

## 1. REHAB MEASURES: ACTION RESEARCH ARM TEST

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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|                        | <a href="#">Available at the Internet Stroke Center (External Link)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Title of Assessment    | Action Research Arm Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Acronym                | ARAT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Instrument Reviewer(s) | Initially reviewed by the Rehabilitation Measures Team in 2011; Updated by Cara Weisbach, PT, DPT and Wendy Romney, PT, DPT, NCS and the SCI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA with references from the chronic stroke population in 2012; Updated by Irene Ward, PT, DPT, NCS and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2012; Updated by Maggie Bland PT,DPT,NCS and Nancy Byl PT,MPH,PhD, FAPTA and the STROKEDGE II Task Force of the Academy of Neurologic Physical Therapy - a component of APTA in 2016.                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Summary Date           | 4/4/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Purpose                | Assesses upper limb functioning using observational methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Description            | <p>The ARAT's is a 19 item measure divided into 4 sub-tests (grasp, grip, pinch, and gross arm movement). Performance on each item is rated on a 4-point ordinal scale ranging from:</p> <p>3: Performs test normally</p> <p>2: Completes test, but takes abnormally long or has great difficulty</p> <p>1: Performs test partially</p> <p>0: Can perform no part of test</p> <p>Lyle's decision rule: Patients who achieve a maximum score on the first (most difficult) item are credited with having scored 3 on all subsequent items on that scale. If the patient scores less than 3 on the first item, then the second item is assessed. This is the easiest item, and if patients score 0 then they are unlikely to achieve a score above 0 for the remainder of the items and are credited with a zero for the other items. The maximum score on the ARTS is 57 points (possible range 0 to 57).</p> <p>Items can also be summed (van der Lee et al, 2002)</p> <p>A standardized scoring protocol has been published by Yozbatiran 2008</p> |

|                           |                                                                                                                            |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Area of Assessment        | Activities of Daily Living; Coordination; Dexterity; Upper Extremity Function                                              |
| Body Part                 | Upper Extremity                                                                                                            |
| ICF Domain                | Activity                                                                                                                   |
| Domain                    | Motor                                                                                                                      |
| Assessment Type           | Observer                                                                                                                   |
| Length of Test            | 06 to 30 Minutes                                                                                                           |
| Time to Administer        | 10 minutes, dependent on number of items performed                                                                         |
| Number of Items           | 19                                                                                                                         |
| Equipment Required        | Various sized wood blocks<br>Cricket ball<br>Stone<br>Jug and glass<br>Tube<br>Washer and bolt<br>Ball bearing<br>A marble |
| Training Required         | None                                                                                                                       |
| Type of training required | No Training                                                                                                                |
| Cost                      | Purchase of the kit ~ \$600                                                                                                |
| Actual Cost               | Free                                                                                                                       |
| Age Range                 | Adolescent: 13-17 years; Adult: 18-64 years; Elderly adult: 65+                                                            |

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |             |                                   |                     |             |  |  |  |                                |  |  |                                   |  |  |  |           |                     |             |           |                     |             |      |    |    |      |    |    |      |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------|-----------------------------------|---------------------|-------------|--|--|--|--------------------------------|--|--|-----------------------------------|--|--|--|-----------|---------------------|-------------|-----------|---------------------|-------------|------|----|----|------|----|----|------|
| Administration Mode                              | Paper/Pencil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |             |                                   |                     |             |  |  |  |                                |  |  |                                   |  |  |  |           |                     |             |           |                     |             |      |    |    |      |    |    |      |
| Diagnosis                                        | Multiple Sclerosis; Stroke; Traumatic Brain Injury                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                     |             |                                   |                     |             |  |  |  |                                |  |  |                                   |  |  |  |           |                     |             |           |                     |             |      |    |    |      |    |    |      |
| Populations Tested                               | Stroke<br><br>Multiple Sclerosis<br><br>Traumatic Brain Injury                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     |             |                                   |                     |             |  |  |  |                                |  |  |                                   |  |  |  |           |                     |             |           |                     |             |      |    |    |      |    |    |      |
| Standard Error of Measurement (SEM)              | (Simpson, 2013) A literature review identifying responsiveness data in patients post stroke (van der Lee, 2004 and Hsueh, 2002). <ul style="list-style-type: none"><li>1.3</li><li>Note: effect size for perceived effect ( e.g. MAL) were 1.66.2 times larger than the functional changes (measured ARAT or Wolf)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |             |                                   |                     |             |  |  |  |                                |  |  |                                   |  |  |  |           |                     |             |           |                     |             |      |    |    |      |    |    |      |
| Minimal Detectable Change (MDC)                  | (Simpson, 2013) <ul style="list-style-type: none"><li>MDC<sub>90</sub> = 3.0</li><li>MDC<sub>95</sub> = 3.5</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                     |             |                                   |                     |             |  |  |  |                                |  |  |                                   |  |  |  |           |                     |             |           |                     |             |      |    |    |      |    |    |      |
| Minimally Clinically Important Difference (MCID) | Chronic Stroke: (van der Lee et al, 2001; n = 20; mean age = 62 (IQR = 52.5–71.8) years; median time since stroke = 3.6 years; mean ARAT score = 29.2 points)<br><br>MCID = 10% of the measures total range (i.e. 5.7 points)<br><br>Chronic Stroke: (van der Lee et al, 2001; n = 22, mean age = 58.5 years; mean time since stroke = 3.6 years; Median baseline ARAT score = 38.0 points)<br><br>MCID = 5.7<br><br>Acute Stroke: (Lang et al, 2008; mean age = 64 (14); time between stroke and first assessment = 9.5 (4.5) days)<br><br><table><tr><td colspan="7">MCID Raw Score:</td></tr><tr><td></td><td colspan="3">MCID if Dominant Side Affected</td><td colspan="3">MCID if Nondominant Side Affected</td></tr><tr><td></td><td>Raw Value</td><td>Percentage of Scale</td><td>Effect Size</td><td>Raw Value</td><td>Percentage of Scale</td><td>Effect Size</td></tr><tr><td>ARAT</td><td>12</td><td>21</td><td>0.78</td><td>17</td><td>30</td><td>1.10</td></tr></table> | MCID Raw Score:     |             |                                   |                     |             |  |  |  | MCID if Dominant Side Affected |  |  | MCID if Nondominant Side Affected |  |  |  | Raw Value | Percentage of Scale | Effect Size | Raw Value | Percentage of Scale | Effect Size | ARAT | 12 | 21 | 0.78 | 17 | 30 | 1.10 |
| MCID Raw Score:                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |             |                                   |                     |             |  |  |  |                                |  |  |                                   |  |  |  |           |                     |             |           |                     |             |      |    |    |      |    |    |      |
|                                                  | MCID if Dominant Side Affected                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     |             | MCID if Nondominant Side Affected |                     |             |  |  |  |                                |  |  |                                   |  |  |  |           |                     |             |           |                     |             |      |    |    |      |    |    |      |
|                                                  | Raw Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Percentage of Scale | Effect Size | Raw Value                         | Percentage of Scale | Effect Size |  |  |  |                                |  |  |                                   |  |  |  |           |                     |             |           |                     |             |      |    |    |      |    |    |      |
| ARAT                                             | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 21                  | 0.78        | 17                                | 30                  | 1.10        |  |  |  |                                |  |  |                                   |  |  |  |           |                     |             |           |                     |             |      |    |    |      |    |    |      |

|                                               | (Simpson, 2013) <ul style="list-style-type: none"><li>6 points total score;1-1.2% of maximum <i>time</i> score</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                               |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--|--|----------|------|----------------|-------|-------------|-----|-----------|-----|-------------|-----|------------|-----|-------|-----|------------|-----|----------|------|----------------|------|-------------|-----|----------|-----|------------------------|---|--------------------------------|-----|----------|------|----------------|-------|-------------------------------------|-----|--------------------------------------|-----|-------------------------------------|-----|
| Cut-Off Scores                                | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                               |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
| Normative Data                                | Chronic Stroke: (van der Lee et al, 2001)<br>Mean (SD) intake ARAT score 29.2 (12.5)<br>Mean (SD) intake Fugl-Meyer Assessment score 49.2 (9.9)<br><table><tr><th colspan="3">Item norms (based on healthy elderly adults):</th></tr><tr><th>Subtest:</th><th>Item</th><th>Time Limit (s)</th></tr><tr><td rowspan="6">Grasp</td><td>Block 2.5cm</td><td>3.6</td></tr><tr><td>Block 5cm</td><td>3.5</td></tr><tr><td>Block 7.5cm</td><td>3.9</td></tr><tr><td>Ball 7.5cm</td><td>3.8</td></tr><tr><td>Stone</td><td>3.6</td></tr><tr><td>Block 10cm</td><td>4.2</td></tr><tr><td>Subtest:</td><td>Item</td><td>Time Limit (s)</td></tr><tr><td rowspan="4">Grip</td><td>Tube 2.25cm</td><td>4.2</td></tr><tr><td>Tube 1cm</td><td>4.3</td></tr><tr><td>Place washer over bolt</td><td>4</td></tr><tr><td>Pour water from glass to glass</td><td>7.9</td></tr><tr><td>Subtest:</td><td>Item</td><td>Time Limit (s)</td></tr><tr><td rowspan="3">Pinch</td><td>Large marble first finger and thumb</td><td>3.8</td></tr><tr><td>Large marble second finger and thumb</td><td>3.8</td></tr><tr><td>Large marble third finger and thumb</td><td>4.1</td></tr></table> | Item norms (based on healthy elderly adults): |  |  | Subtest: | Item | Time Limit (s) | Grasp | Block 2.5cm | 3.6 | Block 5cm | 3.5 | Block 7.5cm | 3.9 | Ball 7.5cm | 3.8 | Stone | 3.6 | Block 10cm | 4.2 | Subtest: | Item | Time Limit (s) | Grip | Tube 2.25cm | 4.2 | Tube 1cm | 4.3 | Place washer over bolt | 4 | Pour water from glass to glass | 7.9 | Subtest: | Item | Time Limit (s) | Pinch | Large marble first finger and thumb | 3.8 | Large marble second finger and thumb | 3.8 | Large marble third finger and thumb | 4.1 |
| Item norms (based on healthy elderly adults): |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                               |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
| Subtest:                                      | Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Time Limit (s)                                |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
| Grasp                                         | Block 2.5cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3.6                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|                                               | Block 5cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3.5                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|                                               | Block 7.5cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3.9                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|                                               | Ball 7.5cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3.8                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|                                               | Stone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3.6                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|                                               | Block 10cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4.2                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
| Subtest:                                      | Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Time Limit (s)                                |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
| Grip                                          | Tube 2.25cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4.2                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|                                               | Tube 1cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4.3                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|                                               | Place washer over bolt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 4                                             |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|                                               | Pour water from glass to glass                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 7.9                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
| Subtest:                                      | Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Time Limit (s)                                |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
| Pinch                                         | Large marble first finger and thumb                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3.8                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|                                               | Large marble second finger and thumb                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3.8                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |
|                                               | Large marble third finger and thumb                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4.1                                           |  |  |          |      |                |       |             |     |           |     |             |     |            |     |       |     |            |     |          |      |                |      |             |     |          |     |                        |   |                                |     |          |      |                |       |                                     |     |                                      |     |                                     |     |

|                                                                                                                                                          |                                      |                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|----------------|
|                                                                                                                                                          | Small marble first finger and thumb  | 4              |
|                                                                                                                                                          | Small marble second finger and thumb | 4.1            |
|                                                                                                                                                          | Small marble third finger and thumb  | 4.4            |
| Subtest:                                                                                                                                                 | Item                                 | Time Limit (s) |
| Gross Movement                                                                                                                                           | Move hand to mouth                   | 2.4            |
|                                                                                                                                                          | Place hand on top of head            | 2.7            |
|                                                                                                                                                          | Place hand behind head               | 2.7            |
| Time limits (mean + 2 SD of the performance times of 20 healthy elderly subjects)                                                                        |                                      |                |
| If performance is slower than the time limit or if the patient loses contact with the back of the chair during performance, the score is 2 instead of 3. |                                      |                |

Acute Stroke: (Beebe and Lang, 2009; mean age = 56.9 (10.2), times since stroke onset = 18.6 (5.6) days)

| Normative Data:                                          |             |             |             |
|----------------------------------------------------------|-------------|-------------|-------------|
|                                                          | 1 month     | 3 months    | 6 months    |
| ARAT                                                     | 26.4 (23.9) | 39.5 (19.7) | 41.3 (20.8) |
| Grip Strength (kg)                                       | 9.2 (9.6)   | 14.0 (10.3) | 15.4 (11.4) |
| 9HPT (sec)                                               | 88.8 (40.2) | 67.8 (41.7) | 60.8 (39.7) |
| SIS: Hand function                                       | 19.9 (28.0) | 48.4 (32.7) | 43.9 (34.2) |
| 9HPT = 9-Hole Peg Test<br>SIS = Stroke Impact Scale-Hand |             |             |             |

Test-retest  
Reliability

Chronic and Acute Stroke, Multiple Sclerosis & Traumatic Brain Injury: (Platz et al, 2005; n = 23)

|                                           |
|-------------------------------------------|
| Interrater Reliability (between 2 raters) |
| Action Research Arm Test:                 |

|                                 | Rating    | ICC   | rho   |
|---------------------------------|-----------|-------|-------|
| Grasp                           | Excellent | 0.949 | 0.965 |
| Grip                            | Excellent | 0.947 | 0.955 |
| Pinch                           | Adequate  | 0.894 | 0.897 |
| Gross movement                  | Excellent | 0.976 | 0.976 |
| Total score                     | Excellent | 0.965 | 0.968 |
| Fugl-Meyer Test, arm section    |           |       |       |
|                                 | Rating    | ICC   | rho   |
| A Shoulder/elbow/forearm        | Excellent | 0.954 | 0.944 |
| B Wrist                         | Excellent | 0.973 | 0.961 |
| C Hand                          | Excellent | 0.958 | 0.941 |
| D Co-ordination/speed           | Excellent | 0.936 | 0.947 |
| Total motor score               | Excellent | 0.965 | 0.951 |
| Sensation                       | Adequate  | 0.806 | 0.672 |
| Passive joint motion/joint pain | Excellent | 0.946 | 0.883 |
| Box and Block Test:             |           |       |       |
|                                 | Rating    | ICC   | rho   |
| Total                           | Excellent | 0.963 | 0.973 |

#### Interrater/Intrater Reliability

Acute Stroke: (Nijland et al, 2010; n = 40; mean age = 60 (13.6) years; median ARAT score = 38; times since stroke onset < 6 months; Dutch sample)

Excellent interrater reliability (ICC = 0.92)

Chronic Stroke: (Van der Lee et al, 2001)

Excellent Interrater Reliability (ICC = 0.995)

Excellent Intrarater Reliability (ICC = 0.989)

Chronic and Acute Stroke, Multiple Sclerosis & Traumatic Brain Injury: (Platz et al, 2005; n = 44)

| Interrater Reliability (between 2 raters) |           |       |       |
|-------------------------------------------|-----------|-------|-------|
| Action Research Arm Test:                 |           |       |       |
|                                           | Rating    | ICC   | rho   |
| Grasp                                     | Excellent | 0.997 | 0.999 |
| Grip                                      | Excellent | 0.964 | 0.958 |
| Pinch                                     | Excellent | 0.999 | 0.999 |
| Gross movement                            | Excellent | 0.984 | 0.984 |
| Total score                               | Excellent | 0.998 | 0.996 |
| Fugl-Meyer Test, arm section              |           |       |       |
|                                           | Rating    | ICC   | rho   |
| A Shoulder/elbow/forearm                  | Excellent | 0.989 | 0.984 |
| B Wrist                                   | Excellent | 0.987 | 0.983 |
| C Hand                                    | Excellent | 0.987 | 0.984 |
| D Co-ordination/speed                     | Excellent | 0.971 | 0.971 |
| Total motor score                         | Excellent | 0.997 | 0.995 |
| Sensation                                 | Excellent | 0.979 | 0.969 |
| Passive joint motion/joint pain           | Excellent | 0.983 | 0.980 |
| Box and Block Test:                       |           |       |       |
|                                           | Rating    | ICC   | rho   |
| Total                                     | Excellent | 0.993 | 0.993 |

Chronic Stroke: (Yozbatrin et al, 2008)

### Interrater Reliability

| Action Research Arm Test |           |        |      |
|--------------------------|-----------|--------|------|
|                          | Rating    | ICC    | rho  |
| Grasp                    | Excellent | 0.9992 | 1.0  |
| Grip                     | Excellent | 0.996  | 0.99 |
| Pinch                    | Excellent | 0.997  | 0.98 |
| Gross Movement           | Excellent | 0.978  | 0.93 |
| Total Score              | Excellent | 0.9986 | 0.96 |

### Intrarater Reliability

| Action Research Arm Test |           |      |      |
|--------------------------|-----------|------|------|
|                          | Rating    | ICC  | rho  |
| Grasp                    | Excellent | 0.98 | 0.93 |
| Grip                     | Excellent | 0.97 | 0.93 |
| Pinch                    | Excellent | 0.99 | 0.98 |
| Gross Movement           | Excellent | 0.93 | 0.91 |
| Total Score              | Excellent | 0.99 | 0.99 |

(Page, 2015) Patients an average of 4.6 years since stroke with moderate upper extremity paresis

- Excellent Intrarater reliability (ICC = 0.99, 95% CI 0.98-0.99)

(Page, 2012) Patients greater than 12 months post-stroke with minimal upper extremity paresis enrolled in trial. Measurements were made before starting the trial, approximately 1 week apart.

- Adequate Intrarater reliability (ICC = 0.71, 95% CI 0.53-0.89)

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Internal Consistency                        | <p>Acute Stroke: (Nijland et al, 2010)</p> <p>Excellent Internal Consistency (alpha = 0.985)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Criterion Validity (Predictive, Concurrent) | <p>Chronic Stroke: (van der Lee et al, 2001)</p> <p>Evidence of concurrent validity confirmed by comparison with the upper limb subtest of the Fugl- Meyer Assessment and the Motor Assessment Scale.</p> <p>Chronic Stroke: (Yozbatiran et al, 2008)</p> <p>Excellent correlation between ARAT and arm motor score of the Fugl-Meyer (<math>r = 0.94</math>, <math>p &lt; 0.01</math>)</p> <p>(Chen, 2012) Patients seen an average of 17.19 (<math>\pm 15.29</math>) months post-stroke</p> <ul style="list-style-type: none"> <li>Adequate predictive validity with the composite physical domain and hand domain of the Stroke Impact Scale (<math>p = 0.45</math> and <math>0.58</math>, <math>p &lt; 0.001</math>, respectively)</li> <li>Excellent predictive validity with the performance time and functional ability scale on the Wolf Motor Function Test (<math>p = -0.66</math> and <math>0.76</math>, <math>p &lt; 0.001</math>, respectively), Motor Activity Log Amount of Use (30) and Quality of Movement (30) (<math>p = 0.62</math> and <math>0.66</math>, <math>p &lt; 0.001</math>, respectively)</li> </ul> <p>(Page, 2015) Patients an average of 4.6 years since stroke with moderate upper extremity paresis</p> <ul style="list-style-type: none"> <li>Excellent concurrent validity with the Wrist Stability and Hand Mobility Subscales of the Fugl-Meyer Assessment (<math>0.67-0.74</math>, <math>p &lt; .001</math>)</li> </ul> <p>(O'Dell, 2014) Community-dwelling volunteers seen an average (mean (SD)) of 4.1 (4.5) years post-stroke for upper extremity robotics training</p> <ul style="list-style-type: none"> <li>Excellent concurrent validity (<math>0.79</math>, <math>p = 0.001</math>) with the 9-item version of the Arm Motor Ability Test.</li> </ul> <p>(Wei, 2011) Twenty-seven stroke participants with moderate motor impairment in their affected upper extremity, an average of <math>4.92 \pm 0.45</math> years post-stroke.</p> <ul style="list-style-type: none"> <li>Excellent concurrent validity (<math>0.81 - 0.96</math>, <math>p &lt; 0.01</math>) with the Fugl-Meyer Assessment and Motor Status Scale.</li> </ul> <p>(Lin, 2010) Fifty-nine stroke participants an average of <math>16.14 \pm 13.95</math> months post-stroke engaging in upper extremity training or placebo.</p> |

- Adequate concurrent validity (0.31 – 0.54,  $p < 0.05$ ) with the Fugl-Meyer Assessment, Motor Activity Log-Amount of Use and Quality of Life, and Stroke Impact Scale Hand Function Domain.

(Chuang, 2012) Sixty-seven participants an average of  $21.12 \pm 13.63$  months post-stroke had functional state of upper extremity skeletal muscle assessed with a Myoton-3 myometer to measure tone, elasticity and stiffness.

#### Pretreatment

- Poor concurrent validity of the ARAT with muscle tone, elasticity and stiffness of the flexor carpi radialis (0.27, [ $p < 0.05$ ], 0.02 [ $P > 0.06$ ], and 0.30 [ $p < 0.05$ ])
- Poor concurrent validity with the ARAT and muscle tone, elasticity and stiffness of the extensor digitorum (-0.01 to -0.03) and the flexor carpi radialis (-0.07 to 0.10).

#### Posttreatment

- Poor to Adequate concurrent validity of the ARAT with muscle tone, elasticity and stiffness of the flexor carpi radialis (0.29 [ $P < 0.05$ ], 0.03 [ $P > 0.05$ ] and 0.36, [ $< 0.01$ ])
- Poor concurrent validity with the ARAT and the muscle tone, elasticity and stiffness of the extensor digitorum (-0.8 to 0.19) and the flexor carpi ulnaris (-0.18 to 0.11)

(Edwards, 2012) Fifty-one subjects as part of the VECTORS (constraint induced movement therapy) study assessed at Day 0 ( $9.5 \pm 4.5$ ), Day 14 ( $24.9 \pm 10.6$ ), Day 90 ( $110.8 \pm 20.7$ ).

- Adequate to Excellent concurrent validity with the Wolf Motor Function Test, Functional Ability Score (WMFT FA)

| (see time frame above) | Day 0  | Day 14 | Day 90 |
|------------------------|--------|--------|--------|
| WMFT FA Function Score | 0.745  | 0.827  | 0.863  |
| WMFT FA Time Score     | -0.641 | -0.825 | -0.772 |
| WMFT FA Grip Score     | 0.702  | 0.631  | 0.553  |

(Lee, J., 2015) Fifteen subjects an average of  $3.1 \pm 2.3$  years post-stroke who wore accelerometers while completing the ARAT

- Poor concurrent validity (0.24) on the affected side, and Excellent concurrent validity on the non-affected side (0.91).

(Lee, G., 2015) Forty-three participants were recruited a mean  $15.21 \pm 3.32$  months post-stroke for assessment.

- An Adequate negative correlation was found ( $-0.41; p < 0.05$ ) with hypertonia (defined as a Modified Ashworth Scale Score of  $> 1+$ )
- Adequate predictive validity (Cut-off  $\leq 15.50/57$  points, AUC .76 (95% CI 0.61-0.90,  $p < 0.01$ ). If a person had an ARAT score of  $\leq 15.50/57$  points, they had a 1.359 increased risk of having a Modified Ashworth Scale score of  $\geq 1+$  ( $p = 0.051$ , 95% CI 1.01-1.82)

(Li et al, 2015) A study with 95 individuals with first time stroke greater than one month post,  $< 2$  on the Modified Ashworth and good mental status (MMST  $> 24$ ) reported significant and adequate concurrent and predictive correlations between arm kinematics (movement time) and the ARAT during reaching (with and without trunk constraint) .

| Regression                                               | Kinematic Variable | Adjusted R2 | P value   |
|----------------------------------------------------------|--------------------|-------------|-----------|
| <b>Concurrent Validity</b><br><i>Before Intervention</i> |                    |             |           |
| Trunk constraint                                         | MT Pre             | 0.29        | $< 0.001$ |
| Trunk Unconstraint                                       | MT Pre             | 0.40        | $< 0.001$ |
| <b>Concurrent validity</b><br><i>After Intervention</i>  |                    |             |           |
| Trunk constraint                                         | MT Pre             | 0.38        | $< 0.001$ |
| Trunk Unconstraint                                       | MT Pre             | 0.34        | $< 0.001$ |
| <b>Predictive Validity</b><br><i>ARAT Post</i>           |                    |             |           |
| Trunk constraint                                         | MT Pre             | 0.33        | $< 0.001$ |
| Trunk Unconstraint                                       | MT Pre             | 0.36        | $< 0.001$ |

(Page, 2012) Patients greater than 12 months post-stroke with minimal upper extremity paresis enrolled in trial.

- Excellent concurrent validity with the Wrist/Hand Subscales of the Fugl-Meyer Assessment.

(Hsieh, 2009) A cohort of 57 stroke participants (an average of 12.98±7.62 months post-stroke) with assessments completed prior to and after treatment in an effectiveness trial examining distributed constraint-induced therapy and bilateral arm training.

- Poor predictive validity (Spearman  $\rho$  (95% CI)) between the ARAT and the Functional Independence Measure-Total Score (0.22 (-0.04, 0.46, not significant)) and the Functional Independence Measure-Motor Score (0.26 (0.00, 0.49, not significant)).

Construct Validity  
(Convergent/Discriminant)

Chronic and Acute Stroke, Multiple Sclerosis & Traumatic Brain Injury: (Platz et al, 2005; n = 56; mean age = 54, range = 13-92 years)

Construct Validity: correlational analysis (Spearman's rho)

|                              | Fugl-Meyer motor | Action Research Arm Test | Box and Block Test |
|------------------------------|------------------|--------------------------|--------------------|
| Action Research Arm Test     | 0.925            | 1                        | 0.951              |
| Fugl-Meyer motor             | 1                | 0.925                    | 0.921              |
| Fugl-Meyer sensation         | 0.239            | 0.298                    | 0.285              |
| Fugl-Meyer joint motion/pain | 0.470            | 0.421                    | 0.433              |
| Box and Block Test           | 0.921            | 0.951                    | 1                  |
| Motricity Index              | 0.861            | 0.811                    | 0.798              |
| Ashworth Scale               | -0.422           | -0.296                   | 0.383              |
| Modified Barthel Index       | 0.086            | 0.049                    | 0.044              |

Correlational analysis were based on the (first) assessment of 56 patients

The above table indicate the ARAT's is strongly related to the:

Fugl-Meyer motor

Box and Block Test

Motricity Index

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  | <p>Negatively related to the Ashworth Scale, moderately related to the Fugl-Meyer sensation and joint motion/pain scales and Not related to the Modified Barthel Index</p> <p>(Awert et al (2015) 50 patients post first stroke (&lt; 5 years), participating in outpatient rehabilitation, capable of completing a self assessment questionnaire Michigan Hand Outcomes Questionnaire (MHOQ) and strength testing (ARAT) .</p> <ul style="list-style-type: none"> <li>Excellent correlations between the MHOQ and the ARAT for all patients (0.64; <math>p &lt; 0.001</math>) and for patients with arm impairments (0.60; <math>P &lt; 0.000</math>).</li> </ul> <p>(Houwink, 2011) Twenty-one participants admitted to rehabilitation, with a stroke diagnosis occurring less than six weeks prior to admission.</p> <ul style="list-style-type: none"> <li>Excellent cross-sectional (0.91, <math>p &lt; 0.001</math>) and longitudinal, 3 months in between assessments, (0.71, <math>p &lt; 0.001</math>) correlations with the Stroke Upper Limb Capacity Scale.</li> </ul> <p>Rabadi and Rabadi 2006) A study of 104 patients in an acute stroke rehabilitation (<math>16 \pm 9</math> days on average post stroke) measured the performance on the ARAT within 72 hours of admission and 24 hours before discharge as well as the FMA National Institutes of Health Stroke Scale, FIM instrumental total score and FIM activities of daily living.</p> <ul style="list-style-type: none"> <li>The Spearman rank correlation of ARAT was excellent with the FMA (<math>\rho = 0.77</math> on admission and 0.87 on discharge, <math>P &lt; 0.001</math>), adequate with the FIM-ADL on admission and discharge (0.32; <math>P &lt; 0.001</math>) and adequate to poor for the FIM (0.33 admission and 0.21 discharge; <math>P &lt; 0.001</math>)</li> </ul> <p>(Hsieh, 2009)</p> <ul style="list-style-type: none"> <li>Excellent construct validity was found between the ARAT and the Fugl-Meyer Assessment (0.73-0.74, <math>p &lt; 0.01</math>) and the Wolf Motor Function Test-Functional Ability Scale (0.68-0.77, <math>p &lt; 0.01</math>).</li> <li>Adequate to Excellent construct validity was found between the ARAT and the Wolf Motor Function Test-Performance Time (0.58-0.63, <math>p &lt; 0.01</math>).</li> <li>Poor construct validity was found between the ARAT and the Functional Independence Measure-Motor Score (0.27-0.39, <math>p &lt; 0.01</math>).</li> </ul> |
| Content Validity | The ARAT is a modified version of the Upper Extremity Function Test (UEFT)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Face Validity    | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## Floor/Ceiling Effects

Acute Stroke: (Lin et al, 2009; n = 53; mean age = 64; Taiwanese sample)

% of Individuals who Experienced Floor and Ceiling Effects:

| Days Post Stroke | Floor | Ceiling |
|------------------|-------|---------|
| 14               | 41.5  | 9.4     |
| 30               | 17.0  | 20.8    |
| 90               | 11.3  | 20.8    |
| 180              | 11.3  | 22.6    |

Acute Stroke: (Nijland et al, 2010)

Floor effects for scores < 3

Ceiling effects for scores > 54

(Edwards, 2012)

% of Individuals who Experienced Floor and Ceiling Effects:

| Days Post Stroke             | Floor | Ceiling |
|------------------------------|-------|---------|
| Day 0 (see time frame above) | 5.9   | 3.9     |
| Day 14                       | 2     | 22      |
| Day 90                       | 2.1   | 33      |

(Hsueh, 2002) Forty-eight participants undergoing rehabilitation. At admission it was a median of 24 days (range 7-53) post-stroke.

% of Individuals who Experienced Floor and Ceiling Effects:

|            | Admission to rehabilitation Floor | Discharge from rehabilitation Ceiling |
|------------|-----------------------------------|---------------------------------------|
| ARAT Total | 52.1%                             | 7%                                    |
| ARAT Grasp | 70.8%                             | 27.1%                                 |

|  |                     |       |       |
|--|---------------------|-------|-------|
|  | ARAT Pinch          | 72.9% | 16.7% |
|  | ARAT Gross Movement | 52.1% | 29.2% |

|                                                                                                                                             |                                                                                                                                |                 |                |             |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|-------------|
| Responsiveness                                                                                                                              | Chronic Stroke: (van der Lee et al, 2002; n = 31 (RIQ = 52–66) years; mean baseline AARAT score = 30.27; > 1 year post stroke) |                 |                |             |
|                                                                                                                                             | 1.2 points (using Lyle’s decision rule)                                                                                        |                 |                |             |
|                                                                                                                                             | 1.7 points (summing items)                                                                                                     |                 |                |             |
|                                                                                                                                             | Acute Stroke: (Lin et al, 2009; n = 53; mean age = 64; Taiwanese sample)                                                       |                 |                |             |
|                                                                                                                                             | Responsiveness:                                                                                                                |                 |                |             |
|                                                                                                                                             | Days Post Stoke                                                                                                                | Effect Rating   | Interpretation | Effect Size |
|                                                                                                                                             | 14–30                                                                                                                          | Small           | Poor           | 0.49        |
|                                                                                                                                             | 14–90                                                                                                                          | Moderate        | Adequate       | 0.70        |
|                                                                                                                                             | 14–180                                                                                                                         | Moderate        | Adequate       | 0.79        |
|                                                                                                                                             | Acute Stroke: (Beebe and Lang, 2009)                                                                                           |                 |                |             |
| Responsiveness:                                                                                                                             |                                                                                                                                |                 |                |             |
| Measure                                                                                                                                     | 1–3 months                                                                                                                     | 1–6 months      |                |             |
| ARAT                                                                                                                                        | 0.55                                                                                                                           | 0.63            |                |             |
| 9HPT                                                                                                                                        | 0.52                                                                                                                           | 0.66            |                |             |
| SIS-Hand                                                                                                                                    | 1.02                                                                                                                           | 0.86            |                |             |
| Acute Stroke (Lang et al, 2006; mean age = 64 (14), Admission NIHSS = 5.3 (1.8); time between stroke and first assessment = 9.5 (4.5) days) |                                                                                                                                |                 |                |             |
| Responsiveness of the ARAT                                                                                                                  |                                                                                                                                |                 |                |             |
| Method                                                                                                                                      | Day 0 to Day 14                                                                                                                | Day 0 to Day 90 |                |             |
| Single population all demonstrated large effect sizes                                                                                       |                                                                                                                                |                 |                |             |
| ARAT total score                                                                                                                            | 1.018                                                                                                                          | 1.390           |                |             |
| ARAT gross subscore                                                                                                                         | 0.729                                                                                                                          | 0.984           |                |             |

|                     |       |       |
|---------------------|-------|-------|
| ARAT grasp subscore | 1.042 | 1.224 |
| ARAT grip subscore  | 1.017 | 1.324 |
| ARAT pinch subscore | 0.854 | 1.494 |

(Edwards, 2012)

|                                                                                                                                                                                                                                               |                                                   |             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------|
| Responsiveness:                                                                                                                                                                                                                               |                                                   |             |
| Measure (see time frame above)                                                                                                                                                                                                                | Day<br>0-14                                       | Day<br>0-90 |
| ARAT Total Score                                                                                                                                                                                                                              | 1.017                                             | 1.390       |
| ARAT Gross Motor Score                                                                                                                                                                                                                        | 0.729                                             | 0.984       |
| ARAT Grasp Score                                                                                                                                                                                                                              | 1.042                                             | 1.224       |
| ARAT Grip Score                                                                                                                                                                                                                               | 1.017                                             | 1.324       |
| ARAT Pinch Score                                                                                                                                                                                                                              | 0.854                                             | 1.494       |
| (Murphy et al, 2013) Kinematic movement analysis and clinically meaningful improvement in the upper extremity were evaluated with kinematic movement analysis of a drinking task and the ARAT in 51 subjects 9 days and 3 months post stroke. |                                                   |             |
| Kinematics                                                                                                                                                                                                                                    | Clinically meaningful improvement in ARAT (95%CI) |             |
| Movement Time                                                                                                                                                                                                                                 | -5.16 (-2.4; -8.4)                                |             |
| Movement Units                                                                                                                                                                                                                                | -6.96 (-2.4; -11.4)                               |             |
| Trunk Displacement                                                                                                                                                                                                                            | -2.58 (-1.2; -4.2)                                |             |

(Wei, Tong and Hu, 2011) Twenty seven patients chronic post stroke (avg.4.92 years) with low level arm function participated in a robotic training paradigm and responsiveness was measured with the FMA, MSS and ARAT using the standardized response mean (SRM) and the Guyatt's Responsiveness Index (GRI) .

- There were no significant gains in the scores on the ARAT after treatment (25.00 [11.25] to 25.86 [10.82])

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          | <ul style="list-style-type: none"> <li>The responsiveness was low with SRM 0.22 and GRI 0.81</li> </ul> <p>The responsiveness was lower for the ARAT than the FMA and MSS. In addition, the responsiveness was lower than 0.85 reported in a previous Hsieh study (2009) The ARAT may not be as responsive in patients with greater upper limb impairments (e.g. baseline ARAT score for the Hsieh study was <math>42.72 \pm 12.11</math> compared to the Wei study with a baseline score of <math>23.48 \pm 11.62</math>).</p> <p>(Rabadi and Rabadi 2006)</p> <ul style="list-style-type: none"> <li>The SRM was 0.68 (admission score of <math>23 \pm 24</math> and discharge score <math>36 \pm 23</math>)</li> <li>This SRM was lower than reported by vanderLee and Roord (2002) which included subjects with a higher level of upper limb function (ARAT score 30.27 at baseline with subjects &gt; 1 year post stroke)</li> </ul> <p>(Hsieh, 2009)</p> <ul style="list-style-type: none"> <li>The standardized response mean (95% CI) of the ARAT was found to be 0.95 (0.75, 1.20, Wilcoxon Z = 4.64, <math>p &lt; 0.01</math>).</li> <li>The ARAT had a smaller standardized response mean (difference in SRM (95%CI) when compared against the Fugl-Meyer Assessment (0.47 (0.09, 0.89, <math>p &lt; 0.05</math>)) and the Wolf-Motor Function Test-Functional Ability Scale (0.35 (-0.01, 0.78, <math>p = \text{not significant}</math>)). However, the ARAT had a greater standardized response mean when compared to the Wolf-Motor Function Test-Performance Time (0.57 (0.28, 0.86, <math>p &lt; 0.05</math>)).</li> </ul> <p>(Lin, 2010)</p> <ul style="list-style-type: none"> <li>The standardized response mean (95% CI) was found to be 0.79 (0.63-1.10, Wilcoxon Z = 5.76, <math>p &lt; 0.001</math>).</li> </ul> |
| Professional Association Recommendations | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StroKEDGE), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

Abbreviations:

|         |                                                                            |
|---------|----------------------------------------------------------------------------|
| HR      | Highly Recommend                                                           |
| R       | Recommend                                                                  |
| LS / UR | Reasonable to use, but limited study in target group / Unable to Recommend |
| NR      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|              | Acute<br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 months post) | Subacute<br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | Chronic<br>(> 6 months) |
|--------------|----------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------|
| SCI EDGE     | LS                                                                                     | LS                                                     | LS                      |
| StrokEDGE II | R                                                                                      | R                                                      | R                       |

Recommendations based on level of care in which the assessment is taken:

|              | Acute Care | Inpatient Rehabilitation | Skilled Nursing Facility | Outpatient Rehabilitation | Home Health |
|--------------|------------|--------------------------|--------------------------|---------------------------|-------------|
| StrokEDGE II | R          | R                        | R                        | R                         | R           |
| TBI EDGE     | LS         | LS                       | R                        | R                         | R           |

Recommendations based on SCI AIS Classification:

|          | AIS A/B | AIS C/D |
|----------|---------|---------|
| SCI EDGE | LS      | LS      |

Recommendations for use based on ambulatory status after brain injury:

|          | Completely Independent | Mildly dependant | Moderately Dependant |
|----------|------------------------|------------------|----------------------|
| TBI EDGE | N/A                    | N/A              | N/A                  |

Recommendations for entry-level physical therapy education and use in research:

|              | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|--------------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| SCI EDGE     | No                                                   | No                                        | No                                                          | Not reported                                         |
| StrokEDGE II | No                                                   | Yes                                       | Yes                                                         | Not reported                                         |
| TBI EDGE     | Yes                                                  | Yes                                       | Yes                                                         | Not reported                                         |

#### Considerations

The ARAT and WMFT are highly correlated and as such may not provide significant levels of incremental validity

(Chen, 2012)

A Rasch Analysis suggested revising the original 4-point scale into a 3-point scale. Tasks of “place hand behind head” and “place hand on top of head” showed poor item fit and item bias relevant to participant’s ages.

(Sivan, 2011)

This study examined outcome measures that are currently being used in robot-assisted exercise trials in stroke. They rated the ARAT as having high/excellent test-retest reliability and inter-rater reliability, moderate construct validity and responsiveness, poor with respect to floor and ceiling effects, and a moderate burden overall. Also, for patients both less than or more than six months post-stroke with Moderate impairment (Fugl-Meyer >25) the ARAT was a recommended measure of activity and participation.

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <p>(Nordin, 2014)</p> <p>This study examined percent intra- and inter-rater reliability across 35 participants a median of 22 months post-stroke. Items 10, 11, 14, and 19 had some systematic disagreement within raters and items 1, 4, 17, and 19 between raters. Item 19 (hand to mouth) had the most disagreements. In general the greatest difficulties were deciding between a score of 2 or 3.</p> <p>(Croarkin, 2004)</p> <p>This evidence-based literature review ranked different tests of upper extremity function based on their psychometric properties. They ranked the ARAT as Level II: Established by evidence for inter-rater reliability and concurrent and convergent validity.</p> <p>(Velstra, 2011)</p> <p>In this systematic review, the authors examined how multiple measures of upper extremity function related to the International Classification of Functioning, Disability, and Health. The ARAT addressed the mobility at several joints category under the Body Functions and Body Structures domain 17 times. Under the Activities and Participation domain 1 time fine hand use was covered, 6 times for grasping, 1 for turning or twisting the hands or arms, and 1 for drinking. One item was found not linked.</p> <p>Do you see an error or have a suggestion for this instrument summary? Please <a href="#">e-mail us!</a></p> |
| Bibliography | <p>Awert ,H.J, Keiser S, Kromme, CH, Vliet, TP, Vlieland, V, Meesters, J.J. (2015) "Validity of the Michigan Hand Outcomes Questionnaire in patients with stroke" Arch of Phys Med and Rehab. <a href="http://www.archives-pmr.org">www.archives-pmr.org</a>. ? details and pub med?</p> <p>Beebe, J. A. and Lang, C. E. (2009). "Relationships and Responsiveness of Six Upper Extremity Function Tests During the First Six Months of Recovery After Stroke." Journal of Neurologic Physical Therapy 33(2): 96-103 <a href="#">Find it on PubMed</a></p> <p>Chen, H., Lin K., Wu, C., Chen, C. (2012). "Rasch validation and predictive validity of the action research arm test in patients receiving stroke rehabilitation." Arch Phys Med Rehabil 93: 1039-1045.</p> <p>Chuang, L., Wu, C., Lin, K. (2012). "Reliability, validity, and responsiveness of myotonometric measurement of muscle tone, elasticity, and stiffness in patients with stroke." Arch Phys Med Rehabil 93: 532-540.</p> <p>Croarkin, E. Danoff, J., Barnes, C. (2004). "Evidence-based rating of upper-extremity motor function tests used for people following stroke." Phys Ther 84(1):62-74.</p>                                                                                                                                                                                            |

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Add pub med link

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|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          | <p>Van der Lee, J. H., De Groot, V., et al. (2001). "The intra- and interrater reliability of the action research arm test: a practical test of upper extremity function in patients with stroke." Arch Phys Med Rehabil 82(1): 14-19. <a href="#">Find it on PubMed</a></p> <p>van der Lee, J. H., Roorda, L. D., et al. (2002). "Improving the Action Research Arm test: a unidimensional hierarchical scale." Clin Rehabil 16(6): 646-653. <a href="#">Find it on PubMed</a></p> <p><a href="#">Velstra, I., Ballert, C.S., Cieza, A. (2011). "A systematic literature review of outcome measures for upper extremity function using the international classification of functioning, disability, and health as reference." American Academy of Physical Medicine and Rehabilitation 3: 846-860.</a></p> <p><a href="#">Wei, X., Tong, K., Hu, X. (2011). "The responsiveness and correlation between Fugl-Meyer Assessment, Motor Status Scale, and the Action Research Arm Test in chronic stroke with upper-extremity rehabilitation robotic training." International J of Rehabilitation Research 34 (4): 349-356.</a></p> <p>Yozbatiran, N., Der-Yeghiaian, L., et al. (2008). "A standardized approach to performing the action research arm test." Neurorehabil Neural Repair 22(1): 78-90. <a href="#">Find it on PubMed</a></p> |
| Year published           | 1981                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Instrument in PDF Format | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Approval Status          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## 2. REHAB MEASURES: ARM MOTOR ABILITY TEST

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Title of Assessment</b>    | Arm Motor Ability Test - 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Acronym</b>                | AMAT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Jane Sullivan PT, DHS, MS and the Stroke EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA. Updated by Michele Sulwer, PT, DPT, NCS and Genevieve Pinto-Zipp, PT, EdD of the StrokEDGE II, Academy of Neurologic Physical Therapy - a component of APTA, in 3/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Summary Date</b>           | 8/30/2013; March 2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Purpose</b>                | To evaluate disabilities in upper extremity function in activities of daily living (ADL) using a quantitative and qualitative measure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>            | <p>The test consists of 13 ADL activities involving one to three component tasks or movement segments. As in the case of most ADL, the components within each compound task either involve differential contributions from the two arms, or of the distal and proximal musculature of an affected arm, or are not of equal difficulty. This, the task components in this assessment are measured separately. However, each compound task is performed continuously, as a unit, without the patient's awareness of component parcellation. One is therefore able to quantify ADL in the manner of a laboratory test without interfering with the natural flow of movement characteristic of everyday activity.</p> <p>Each of tasks is timed and rated according to quality of movement and ability to perform each component part of a compound task. Tasks have either a 1 or 2 minute performance time limit.</p> |
| <b>Area of Assessment</b>     | Activities of Daily Living; Upper Extremity Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Body Part</b>              | Upper Extremity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>ICF Domain</b>             | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Domain</b>                 | ADL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Assessment Type</b>        | Performance Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|                                            |                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Length of Test</b>                      | 31 to 60 Minutes                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Time to Administer</b>                  | 30-40 minutes                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Number of Items</b>                     | 28                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Equipment Required</b>                  | <ul style="list-style-type: none"> <li>• Shoe</li> <li>• Telephone</li> <li>• Shirt</li> </ul> <p>In order to assure a standard placement of test objects, a laminated template is used. This can be constructed according to directions or purchased by contacting: Edward Taub, Ph.D, Department of Psychology, 415 Campbell Hall, University of Alabama at Birmingham, Birmingham, AL 35294</p> |
| <b>Training Required</b>                   | Reading an article/manual                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Type of training required</b>           | Reading an Article/Manual                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Cost</b>                                | Not Free                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Actual Cost</b>                         | <p>\$25; A test template can be obtained from the address below:</p> <p>Edward Taub, Ph.D, Department of Psychology, 415 Campbell Hall, University of Alabama at Birmingham, Birmingham, AL 35294</p>                                                                                                                                                                                              |
| <b>Age Range</b>                           | Adults                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Administration Mode</b>                 | Paper and Pencil                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Diagnosis</b>                           | Stroke                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Populations Tested</b>                  | Stroke                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Standard Error of Measurement (SEM)</b> | Not Established                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Minimal Detectable Change (MDC)</b>     | <u>Stroke:</u>                                                                                                                                                                                                                                                                                                                                                                                     |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <p>(Kopp et al, 1997; <math>n = 33</math> subacute stroke inpatients with moderate to mild upper extremity motor deficit; median age = 66 years; sex = 12 females; median Motricity Index Arm Score = 89; median chronicity = 43 days)</p> <ul style="list-style-type: none"> <li>In individuals with subacute stroke and mild to moderate movement deficits, the AMAT detected the difference in change occurring as a result of the passage of 1 versus 2 weeks.</li> </ul> |
| <b>Minimally Clinically Important Difference (MCID)</b> | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Cut-Off Scores</b>                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Normative Data</b>                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Test-retest Reliability</b>                          | <p><b><u>Stroke:</u></b></p> <p>(Kopp et al, 1997)</p> <ul style="list-style-type: none"> <li><b>Excellent</b> test-retest reliability (ICC = 0.93 - 0.99)</li> </ul>                                                                                                                                                                                                                                                                                                         |
| <b>Interrater/Intrarater Reliability</b>                | <p><b><u>Stroke:</u></b></p> <p>(Kopp et al, 1997)</p> <ul style="list-style-type: none"> <li><b>Excellent</b> interrater reliability (ICC = 0.95 - 0.99)</li> </ul>                                                                                                                                                                                                                                                                                                          |
| <b>Internal Consistency</b>                             | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Criterion Validity (Predictive/Concurrent)</b>       | <p><b><u>Stroke:</u></b></p> <p>(Kopp et al, 1997)</p> <ul style="list-style-type: none"> <li><b>Adequate to excellent</b> concurrent validity with the Motricity-Index-Arm (correlation coefficient = 0.45-0.61)</li> </ul> <p>(Chae et al, 2003)</p> <ul style="list-style-type: none"> <li><b>Excellent</b> concurrent validity with the Fugl-Meyer Assessment (correlation coefficient = 0.92-0.94)</li> </ul>                                                            |
| <b>Construct Validity (Convergent/Discriminant)</b>     | <p><b><u>Stroke:</u></b></p> <p>(Kopp et al, 1997)</p>                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                                                 | <ul style="list-style-type: none"> <li>• <b>Adequate to excellent</b> correlation with Motricity-Index-Arm (<math>r = 0.45 - 0.61</math>)<br/>(Chae et al, 2003; <math>n = 30</math> chronic stroke survivors)</li> <li>• <b>Excellent</b> correlation with Fugl-Meyer Assessment</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |  |           |                  |          |           |                |                                                                            |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--|-----------|------------------|----------|-----------|----------------|----------------------------------------------------------------------------|
| <b>Content Validity</b>                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                |  |           |                  |          |           |                |                                                                            |
| <b>Face Validity</b>                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                |  |           |                  |          |           |                |                                                                            |
| <b>Floor/Ceiling Effects</b>                    | <p><b><u>Stroke:</u></b></p> <p>The AMAT time of performance exhibited significant ceiling and floor effects with respect to the Fugl-Meyer Assessment (Chae et al, 2003).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                |  |           |                  |          |           |                |                                                                            |
| <b>Responsiveness</b>                           | <p><b><u>Stroke:</u></b></p> <p>In individuals with subacute stroke and mild to moderate movement deficits, the AMAT detected the difference in change occurring as a result of the passage of 1 versus 2 weeks (Kopp et al, 1997).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |  |           |                  |          |           |                |                                                                            |
| <b>Professional Association Recommendations</b> | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> <table border="1"> <thead> <tr> <th colspan="2">Abbreviations:</th></tr> </thead> <tbody> <tr> <td><b>HR</b></td><td>Highly Recommend</td></tr> <tr> <td><b>R</b></td><td>Recommend</td></tr> <tr> <td><b>LS / UR</b></td><td>Reasonable to use, but limited study in target group / Unable to Recommend</td></tr> </tbody> </table> | Abbreviations: |  | <b>HR</b> | Highly Recommend | <b>R</b> | Recommend | <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| Abbreviations:                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                |  |           |                  |          |           |                |                                                                            |
| <b>HR</b>                                       | Highly Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |  |           |                  |          |           |                |                                                                            |
| <b>R</b>                                        | Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |  |           |                  |          |           |                |                                                                            |
| <b>LS / UR</b>                                  | Reasonable to use, but limited study in target group / Unable to Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |  |           |                  |          |           |                |                                                                            |

|           |                 |
|-----------|-----------------|
| <b>NR</b> | Not Recommended |
|-----------|-----------------|

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br><br><b>(CVA &lt; 2 months post)</b><br><br><b>(SCI &lt; 1 month post)</b><br><br><b>(Vestibular &lt; 6 months post)</b> | <b>Subacute</b><br><br><b>(CVA 2 to 6 months)</b><br><br><b>(SCI 3 to 6 months)</b> | <b>Chronic</b><br><br><b>(&gt; 6 months)</b> |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------|
| <b>StrokEDGE II</b> | <i>NR</i>                                                                                                                               | <i>R</i>                                                                            | <i>R</i>                                     |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>StrokEDGE II</b> | <i>NR</i>         | <i>R</i>                        | <i>R</i>                        | <i>R</i>                         | <i>R</i>           |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|---------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>StrokEDGE II</b> | <i>No</i>                                                   | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Not reported</i>                                         |

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Considerations</b>           | <ul style="list-style-type: none"> <li>• Limitations: Very lengthy to complete</li> <li>• Client should have some active movement capacity in the involved arm</li> <li>• The AMAT has been used in post stroke UE intervention trials examining constraint induced movement therapy, electrical stimulation, and repetitive task training</li> <li>• Original version of AMAT had 17 items, was created by McCulloch et al, at the University of Alabama for use in the CIMT research.</li> <li>• AMAT-9 version as been proposed by O'Dell, M., et al, (2013) which only includes tasks that are seated, for those patients with more severe deficits limiting mobility and balance in standing.</li> </ul>                                                                                                                    |
| <b>Bibliography</b>             | <p>Chae, J., Labatia, I., et al. (2003). "Upper limb motor function in hemiparesis: concurrent validity of the Arm Motor Ability test." Am J Phys Med Rehabil 82(1): 1-8. <a href="#">Find it on PubMed</a></p> <p>Kopp, B., Kunkel, A., et al. (1997). "The Arm Motor Ability Test: reliability, validity, and sensitivity to change of an instrument for assessing disabilities in activities of daily living." Arch Phys Med Rehabil 78(6): 615-620. <a href="#">Find it on PubMed</a></p> <p><a href="#">McCulloch, K., Cook, E., et al. (1988) "A reliable test of upper extremity ADL function. (abstract)" Arch Phys Med Rehabil (69): 755.</a></p> <p><a href="#">O'Dell, M., Kim, G., et al. (2013) " A psychometric evaluation of the arm motor ability test." J Rehabil Med 45(6): 519-527. Find it on PubMed</a></p> |
| <b>Year published</b>           | 1997                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Instrument in PDF Format</b> | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### 3. REHAB MEASURES DATABASE—ASSESSMENT OF LIFE HABITS

| Link to instrument            | Find Information for the LIFE-H at iNDCP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                     |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--|--|-------|---------------------|--------------------|---|---------------------------------|---------------|---|---------------------------------|--------------------------------|---|------------------------------|---------------|---|------------------------------|--------------------------------|---|---------------------------------|------------------|---|---------------------------------|-----------------------------------------------------|
| Title of Assessment           | Assessment of Life Habits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                     |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| Acronym                       | Life-H                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                     |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| Instrument Reviewer(s)        | Initially reviewed by the Rehabilitation Measures Team; Updated by Sue Saliga, PT, MS, DHSc, Anna de Joya, PT, MS, NCS, and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2012; Updated by Ashley Marrapode, SPT, Taylor McCulloch. SPT, Kristy Samra, SPT in 11/2012.<br><br>Reviewed by Rie Yoshida and Heather Anderson as part of StrokEDGE II task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2016.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                     |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| Summary Date                  | 4/15/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                     |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| Purpose                       | Assesses participants on 77 life habits from daily activities to social participation across 12 domains. It is a self-report based on one's perception of difficulty and assistance required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                     |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| Description                   | <p>The LIFE-H is composed of two scales.</p> <p>The first assesses accomplishments rated across two dimensions:</p> <p style="padding-left: 40px;">The degree of difficulty experienced</p> <p style="padding-left: 40px;">The kind of assistance required (help, technical assistance, physical arrangements)</p> <table><tr><th colspan="3">Life-H Accomplishments Scale:</th></tr><tr><th>Score</th><th>Level of Difficulty</th><th>Type of Assistance</th></tr><tr><td>9</td><td>Accomplished with no difficulty</td><td>No assistance</td></tr><tr><td>8</td><td>Accomplished with no difficulty</td><td>Assistive device or adaptation</td></tr><tr><td>7</td><td>Accomplished with difficulty</td><td>No assistance</td></tr><tr><td>6</td><td>Accomplished with difficulty</td><td>Assistive device or adaptation</td></tr><tr><td>5</td><td>Accomplished with no difficulty</td><td>Human assistance</td></tr><tr><td>4</td><td>Accomplished with no difficulty</td><td>Assistive device or adaptation and human assistance</td></tr></table> | Life-H Accomplishments Scale:                       |  |  | Score | Level of Difficulty | Type of Assistance | 9 | Accomplished with no difficulty | No assistance | 8 | Accomplished with no difficulty | Assistive device or adaptation | 7 | Accomplished with difficulty | No assistance | 6 | Accomplished with difficulty | Assistive device or adaptation | 5 | Accomplished with no difficulty | Human assistance | 4 | Accomplished with no difficulty | Assistive device or adaptation and human assistance |
| Life-H Accomplishments Scale: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                     |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| Score                         | Level of Difficulty                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Type of Assistance                                  |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| 9                             | Accomplished with no difficulty                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | No assistance                                       |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| 8                             | Accomplished with no difficulty                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Assistive device or adaptation                      |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| 7                             | Accomplished with difficulty                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | No assistance                                       |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| 6                             | Accomplished with difficulty                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Assistive device or adaptation                      |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| 5                             | Accomplished with no difficulty                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Human assistance                                    |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |
| 4                             | Accomplished with no difficulty                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Assistive device or adaptation and human assistance |  |  |       |                     |                    |   |                                 |               |   |                                 |                                |   |                              |               |   |                              |                                |   |                                 |                  |   |                                 |                                                     |

|     |                              |                                                     |
|-----|------------------------------|-----------------------------------------------------|
| 3   | Accomplished with difficulty | Human assistance                                    |
| 2   | Accomplished with difficulty | Assistive device or adaptation and human assistance |
| 1   | Accomplished by a proxy      |                                                     |
| 0   | Not accomplished             |                                                     |
| N/A | Not applicable               |                                                     |

The second scale assesses the patient's satisfaction with daily activities or social roles. The satisfaction can range from 1 to 5 (with 5 indicating a high level of satisfaction)

| <b>Life-H Daily Activities Domain:</b> |                                                                         |
|----------------------------------------|-------------------------------------------------------------------------|
| <b>Category</b>                        | <b>Items example</b>                                                    |
| Nutrition                              | Preparing your meal                                                     |
|                                        | Eating in restaurants                                                   |
| Fitness                                | Sleep                                                                   |
|                                        | Participating in physical activities to maintain or improve your health |
| Personal care                          | Attending to your personal hygiene                                      |
|                                        | Using a bathroom or toilet other than those in your home                |
| Communication                          | Communicating with another person at home or in the community           |
|                                        | Written communication                                                   |
| Housing                                | Maintaining your home                                                   |
|                                        | Doing major household tasks                                             |
| Mobility                               | Getting around on slippery or uneven surfaces                           |
|                                        | Driving a vehicle                                                       |
| <b>Social Roles Domain:</b>            |                                                                         |
| <b>Category</b>                        | <b>Items example</b>                                                    |
| Responsibility                         | Making purchases                                                        |
|                                        | Taking care of your children                                            |
| Interpersonal relationships            | Maintaining friendships                                                 |
|                                        | Having a sexual relationship                                            |
| Community life                         | Getting to public buildings in your community                           |
|                                        | Participating in spiritual or religious practices                       |
| Education                              | Participating in educational activities or vocational training          |
|                                        | Undertaking vocational training                                         |
| Work                                   | Holding a paid job                                                      |
|                                        | Carrying out familial or home-making tasks as your main occupation      |

|                                  |                                                                                                                                                      |                                                      |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
|                                  | Recreation                                                                                                                                           | Participating in sporting or recreational activities |
|                                  |                                                                                                                                                      | Taking part in outdoor activities                    |
| <b>Area of Assessment</b>        | Activities of Daily Living; Communication; Eating; Executive Function; Life Participation; Quality of Life                                           |                                                      |
| <b>Body Part</b>                 | Not Applicable                                                                                                                                       |                                                      |
| <b>ICF Domain</b>                | Activity; Participation                                                                                                                              |                                                      |
| <b>Domain</b>                    | ADL                                                                                                                                                  |                                                      |
| <b>Assessment Type</b>           | Performance Measure                                                                                                                                  |                                                      |
| <b>Length of Test</b>            | 06 to 30 Minutes                                                                                                                                     |                                                      |
| <b>Time to Administer</b>        | LIFE-H 3.1 short form: 20-40 minutes; LIFE H 3.0 long form: 20-120 minutes                                                                           |                                                      |
| <b>Number of Items</b>           | General long form 242 items over 12 domains; General short form 77 items over 12 domains; Children long form 240 items; Children short form 62 items |                                                      |
| <b>Equipment Required</b>        | Find a sample of the manual here                                                                                                                     |                                                      |
| <b>Training Required</b>         | None. Test manuals are available from iNDCP.                                                                                                         |                                                      |
| <b>Type of training required</b> | No Training; Reading an Article/Manual                                                                                                               |                                                      |
| <b>Cost</b>                      | Not Free                                                                                                                                             |                                                      |
| <b>Actual Cost</b>               | Information about purchasing the LIFE-H can be found at the iNDCP                                                                                    |                                                      |
| <b>Age Range</b>                 | Infant: birth-23 months; Preschool Child: 2-5 years; Child: 6-12 years; Adolescent: 13-17 years; Adult: 18-64 years; Elderly adult: 65+              |                                                      |
| <b>Administration Mode</b>       | Paper/Pencil                                                                                                                                         |                                                      |
| <b>Diagnosis</b>                 | Cerebral Palsy; Multiple Sclerosis; Spinal Cord Injury; Stroke                                                                                       |                                                      |
| <b>Populations Tested</b>        | Cerebral Palsy<br><br>Geriatrics<br><br>Multiple Sclerosis<br><br>Older adults with disabilities<br><br>Pediatrics                                   |                                                      |



|                                                  | <table><tr><td>Community life</td><td>0.78</td></tr><tr><td>Recreation</td><td>2.15</td></tr><tr><td>Interpersonal relationships</td><td>--</td></tr><tr><td>Education/Employment</td><td>N/A</td></tr><tr><td><b>Social Roles Sub-score</b></td><td>0.49</td></tr><tr><td><b>Total Score</b></td><td>0.25</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Community life             | 0.78       | Recreation    | 2.15      | Interpersonal relationships | --   | Education/Employment | N/A  | <b>Social Roles Sub-score</b> | 0.49      | <b>Total Score</b> | 0.25 |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------|---------------|-----------|-----------------------------|------|----------------------|------|-------------------------------|-----------|--------------------|------|---------|------|-----------------------------------|----------|----------------|-------|----------------|-------|------------|-----------|-----------------------------|-----------|----------------------|-----------|-------------------------------|-----------|--------------------|------|-----------|-----------|-----------|-----------|-----------|---------------|---------|-----------|-----------|-----------|-----------|-----------|---------------|---------|-----------|-----------|-----------|-----------|-----------|---------|-------|-----------|-----------|-----------|-----------|-----------|
| Community life                                   | 0.78                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Recreation                                       | 2.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Interpersonal relationships                      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Education/Employment                             | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| <b>Social Roles Sub-score</b>                    | 0.49                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| <b>Total Score</b>                               | 0.25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Minimal Detectable Change (MDC)                  | <p><b><u>Older Adults with Disabilities:</u></b></p> <p>(Noreau et al, 2004; <i>n</i> = 40; mean age = 76.5 (8.6) years; calculated from standard deviation and ICC values given in Table 4, Older Adults with Disabilities)</p> <table><tr><td><b>LIFE-H</b></td><td><b>MDC</b></td></tr><tr><td>Personal care</td><td>1.30</td></tr><tr><td>Nutrition</td><td>1.93</td></tr><tr><td>Housing</td><td>1.56</td></tr><tr><td>Mobility</td><td>2.85</td></tr><tr><td>Communication</td><td>1.52</td></tr><tr><td>Fitness</td><td>3.71</td></tr><tr><td><b>Daily Activities Sub-score</b></td><td>0.67</td></tr><tr><td>Responsibility</td><td>1.10</td></tr><tr><td>Community life</td><td>2.17</td></tr><tr><td>Recreation</td><td>5.95</td></tr><tr><td>Interpersonal relationships</td><td>--</td></tr><tr><td>Education/Employment</td><td>N/A</td></tr><tr><td><b>Social Roles Sub-score</b></td><td>1.36</td></tr><tr><td><b>Total Score</b></td><td>0.68</td></tr></table>                                                                                                                          | <b>LIFE-H</b>              | <b>MDC</b> | Personal care | 1.30      | Nutrition                   | 1.93 | Housing              | 1.56 | Mobility                      | 2.85      | Communication      | 1.52 | Fitness | 3.71 | <b>Daily Activities Sub-score</b> | 0.67     | Responsibility | 1.10  | Community life | 2.17  | Recreation | 5.95      | Interpersonal relationships | --        | Education/Employment | N/A       | <b>Social Roles Sub-score</b> | 1.36      | <b>Total Score</b> | 0.68 |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| <b>LIFE-H</b>                                    | <b>MDC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Personal care                                    | 1.30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Nutrition                                        | 1.93                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Housing                                          | 1.56                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Mobility                                         | 2.85                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Communication                                    | 1.52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Fitness                                          | 3.71                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| <b>Daily Activities Sub-score</b>                | 0.67                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Responsibility                                   | 1.10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Community life                                   | 2.17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Recreation                                       | 5.95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Interpersonal relationships                      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Education/Employment                             | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| <b>Social Roles Sub-score</b>                    | 1.36                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| <b>Total Score</b>                               | 0.68                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Minimally Clinically Important Difference (MCID) | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Cut-Off Scores                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Normative Data                                   | <p><b><u>Older Adults:</u></b></p> <p>(Desrosiers et al, 2009; <i>n</i> = 350 randomly recruited community-dwelling elderly adults, Older Adults)</p> <table><tr><th colspan="7">Life-H Norms by Age Group:</th></tr><tr><th></th><th></th><th colspan="5">Age Range</th></tr><tr><th>Daily activities</th><th><i>p</i></th><th>65–69</th><th>70–74</th><th>75–79</th><th>80–84</th><th>85+</th></tr><tr><td>Nutrition</td><td>0.97</td><td>8.1 (1.3)</td><td>7.9 (1.2)</td><td>8.0 (1.4)</td><td>8.0 (1.4)</td><td>7.9 (1.1)</td></tr><tr><td>Fitness</td><td>0.06</td><td>8.6 (0.9)</td><td>8.6 (0.5)</td><td>8.7 (0.5)</td><td>8.4 (0.8)</td><td>8.4 (0.8)</td></tr><tr><td>Personal care</td><td>&lt; 0.001</td><td>8.9 (0.2)</td><td>8.8 (0.3)</td><td>8.8 (0.3)</td><td>8.7 (0.3)</td><td>8.6 (0.4)</td></tr><tr><td>Communication</td><td>&lt; 0.001</td><td>8.8 (0.3)</td><td>8.6 (0.6)</td><td>8.7 (0.4)</td><td>8.5 (0.7)</td><td>8.3 (0.9)</td></tr><tr><td>Housing</td><td>0.003</td><td>7.6 (0.9)</td><td>7.3 (0.9)</td><td>7.2 (0.8)</td><td>7.5 (0.9)</td><td>7.1 (0.9)</td></tr></table> | Life-H Norms by Age Group: |            |               |           |                             |      |                      |      |                               | Age Range |                    |      |         |      | Daily activities                  | <i>p</i> | 65–69          | 70–74 | 75–79          | 80–84 | 85+        | Nutrition | 0.97                        | 8.1 (1.3) | 7.9 (1.2)            | 8.0 (1.4) | 8.0 (1.4)                     | 7.9 (1.1) | Fitness            | 0.06 | 8.6 (0.9) | 8.6 (0.5) | 8.7 (0.5) | 8.4 (0.8) | 8.4 (0.8) | Personal care | < 0.001 | 8.9 (0.2) | 8.8 (0.3) | 8.8 (0.3) | 8.7 (0.3) | 8.6 (0.4) | Communication | < 0.001 | 8.8 (0.3) | 8.6 (0.6) | 8.7 (0.4) | 8.5 (0.7) | 8.3 (0.9) | Housing | 0.003 | 7.6 (0.9) | 7.3 (0.9) | 7.2 (0.8) | 7.5 (0.9) | 7.1 (0.9) |
| Life-H Norms by Age Group:                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                            |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Age Range                  |            |               |           |                             |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Daily activities                                 | <i>p</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 65–69                      | 70–74      | 75–79         | 80–84     | 85+                         |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Nutrition                                        | 0.97                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 8.1 (1.3)                  | 7.9 (1.2)  | 8.0 (1.4)     | 8.0 (1.4) | 7.9 (1.1)                   |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Fitness                                          | 0.06                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 8.6 (0.9)                  | 8.6 (0.5)  | 8.7 (0.5)     | 8.4 (0.8) | 8.4 (0.8)                   |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Personal care                                    | < 0.001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 8.9 (0.2)                  | 8.8 (0.3)  | 8.8 (0.3)     | 8.7 (0.3) | 8.6 (0.4)                   |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Communication                                    | < 0.001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 8.8 (0.3)                  | 8.6 (0.6)  | 8.7 (0.4)     | 8.5 (0.7) | 8.3 (0.9)                   |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |
| Housing                                          | 0.003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 7.6 (0.9)                  | 7.3 (0.9)  | 7.2 (0.8)     | 7.5 (0.9) | 7.1 (0.9)                   |      |                      |      |                               |           |                    |      |         |      |                                   |          |                |       |                |       |            |           |                             |           |                      |           |                               |           |                    |      |           |           |           |           |           |               |         |           |           |           |           |           |               |         |           |           |           |           |           |         |       |           |           |           |           |           |

|                             |          |              |              |              |              |            |
|-----------------------------|----------|--------------|--------------|--------------|--------------|------------|
| Mobility                    | < 0.001  | 8.6 (0.7)    | 8.6 (0.6)    | 8.2 (1.1)    | 7.9 (1.2)    | 7.5 (1.7)  |
| Daily activities subscore   | < 0.001  | 8.4 (0.3)    | 8.3 (0.3)    | 8.3 (0.4)    | 8.2 (0.4)    | 8.0 (0.5)  |
| <b>Social roles</b>         | <i>p</i> | <b>65–69</b> | <b>70–74</b> | <b>75–79</b> | <b>80–84</b> | <b>85+</b> |
| Responsibilities            | 0.09     | 8.3 (0.8)    | 8.3 (0.8)    | 8.5 (0.7)    | 8.5 (0.9)    | 8.2 (1.0)  |
| Interpersonal relationships | 0.46     | 8.5 (0.8)    | 8.6 (0.8)    | 8.5 (1.0)    | 8.7 (0.7)    | 8.4 (1.0)  |
| Community life              | < 0.001  | 8.8 (0.7)    | 8.7 (0.6)    | 8.6 (0.8)    | 8.5 (1.0)    | 8.1 (1.6)  |
| Leisure                     | < 0.001  | 7.5 (1.5)    | 7.9 (1.3)    | 7.0 (2.2)    | 7.4 (2.0)    | 6.4 (2.5)  |
| Social roles subscore       | < 0.001  | 8.4 (0.5)    | 8.5 (0.5)    | 8.3 (0.6)    | 8.4 (0.7)    | 7.9 (1.0)  |
| Total score                 | < 0.001  | 8.4 (0.3)    | 8.4 (0.3)    | 8.3 (0.4)    | 8.3 (0.5)    | 8.0 (0.6)  |
|                             |          |              |              |              |              |            |

**Test-retest  
Reliability**

**Children and Adults with impairments:**

(Noreau et al, 2002; Review of studies regarding social participation with various impairments in adults and children;  $n = 24$  children & 25 adults with SCI, Children and Adults with Impairments)

Short form total score

**Adequate** for children (ICC = 0.67)

Excellent for adults (ICC = 0.83)

Long form total score

**Excellent** for children (ICC = 0.80)

**Excellent** for adults (ICC = 0.89)

**Children with Cerebral Palsy:**

(Sakzewski et al, 2007; Review of participation measures for children with CP aged 5 to 13;  $n = 48$ , Children with CP)

Total Score Short Form

**Poor** ICC = 0.67

Total Score Long Form

**Adequate** ICC= 0.73

**Elderly People with Disabilities:**

(Noreau et al, 2004; test-retest study  $n = 40$ ; mean age = 76.5 (8.6); gender = female 29 (72.5); interval between 2 time frames = 5-10 days, Elderly People with Disabilities)

Total Score: ICC = 0.95 (Excellent)

Daily Activities Subscore: ICC = 0.96 (Excellent)

Social Roles Subscore: ICC = 0.76 (Adequate)

|                   |           |      |
|-------------------|-----------|------|
| LIFE-H Categories |           | ICC  |
| Daily Activities  |           |      |
| Personal Care     | Excellent | 0.97 |

|                             |              |      |
|-----------------------------|--------------|------|
| Nutrition                   | Excellent    | 0.90 |
| Housing                     | Excellent    | 0.78 |
| Mobility                    | Excellent    | 0.76 |
| Communication               | Excellent    | 0.75 |
| Fitness                     | Poor         | 0.30 |
| Subscore                    | Excellent    | 0.96 |
| Social Roles                |              |      |
| Responsibility              | Excellent    | 0.89 |
| Community Life              | Excellent    | 0.83 |
| Recreation                  |              | 0.55 |
| Interpersonal Relationships | Limited info | --   |
| Subscore                    | Excellent    | 0.76 |
| Total Score                 | Excellent    | 0.95 |

#### **Myotonic Dystrophy:**

(Gagnon et al, 2006;  $n = 28$ ; mean age of 52.7 (10.01) years; diagnosed with myotonic dystrophy confirmed by DNA; 2 weeks between assessments, Myotonic Dystrophy)

| <b>LIFE-H Test re-test Reliability</b> |                     |                     |                 |            |
|----------------------------------------|---------------------|---------------------|-----------------|------------|
| <b>Category</b>                        | <b>T1 Mean (SD)</b> | <b>T2 Mean (SD)</b> | <b>Strength</b> | <b>ICC</b> |
| Nutrition                              | 8.1 (2.1)           | 8.4 (1.9)           | Excellent       | 0.92       |
| Personal Care                          | 8.8 (1.4)           | 9.0 (1.1)           | Adequate        | 0.86       |
| Mobility                               | 6.2 (3.4)           | 6.5 (2.8)           | Adequate        | 0.79       |
| Housing                                | 6.1 (1.9)           | 6.7* (1.4)          | Poor            | 0.73       |
| Fitness                                | 8.5 (1.5)           | 9.1* (1.2)          | Poor            | 0.20       |
| Communication                          | 9.5 (0.6)           | 9.6 (0.4)           | Poor            | 0.12       |
| Daily Activities Subscore              | 8.0 (1.3)           | 8.3* (1.0)          | Adequate        | 0.80       |
| Interpersonal Relationships            | 8.6 (1.6)           | 8.6 (1.7)           | Adequate        | 0.87       |
| Community Life                         | 6.6 (3.6)           | 6.6 (3.5)           | Adequate        | 0.83       |
| Recreation                             | 6.3 (3.0)           | 7.4* (3.5)          | Adequate        | 0.79       |
| Responsibility                         | 8.1 (2.2)           | 8.5 (1.7)           | Adequate        | 0.76       |

|                       |           |            |           |      |
|-----------------------|-----------|------------|-----------|------|
| Social Roles Subscore | 7.2 (2.2) | 7.4 (1.9)  | Excellent | 0.91 |
| LIFE_ (total score)   | 7.7 (1.6) | 7.9* (1.3) | Adequate  | 0.86 |
| *p < 0.05             |           |            |           |      |

#### **Older Adults with Disabilities:**

(Poulin & Desrosiers, 2009;  $n = 30$ ; mean age 79.4 (7.1); 56.7% female; having significant functional disabilities according to SMAF; recruitment from inpatient rehab unit or short-term geriatric care unit of HSSC-UIGS (Canadian sample) in last 5 years, Older Adults with Disabilities)

**Excellent** test-retest reliability for total score (ICC = 0.88)

Categorical test-retest reliability:

**Excellent** for communication (ICC = 0.88)

**Excellent** for fitness (ICC = 0.76)

**Excellent** for housing (ICC = 0.75)

**Adequate** for personal care (0.73)

**Adequate** for nutrition (ICC = 0.69)

**Adequate** for mobility (ICC = 0.69)

**Excellent** for daily activities (ICC = 0.84)

**Excellent** for leisure (ICC = 0.87)

**Excellent** for interpersonal relationships (ICC = 0.87)

**Excellent** for responsibilities (ICC = 0.80)

**Adequate** for community life (ICC = 0.65)

**Excellent** for social roles (ICC = 0.85)

#### **Older Adults with Stroke :**

(Lemmens, et al, 2007;  $n = 35$ ; mean age = 59 (7.7); gender = male 49%, Older Adults with Stroke)

The Dutch LIFE-H showed excellent test-retest reliability (ICC = 0.80) for the total score

ICC values for subscale scores varied: ranging from 0.21 for social relationships to 0.88 for personal care

| <b>LIFE-H Categories</b> |           | <b>ICC</b> |
|--------------------------|-----------|------------|
| Nutrition                | Adequate  | 0.72       |
| Fitness                  | Adequate  | 0.47       |
| Personal Care            | Excellent | 0.88       |
| Communication            | Excellent | 0.81       |
| Residence                | Adequate  | 0.57       |
| Mobility                 | Adequate  | 0.55       |

|                  |           |      |
|------------------|-----------|------|
| Responsibility   | Adequate  | 0.68 |
| Social Relations | Poor      | 0.21 |
| Community        | Excellent | 0.87 |
| Education        |           | NA   |
| Employment       |           | NA   |
| Recreation       | Adequate  | 0.66 |
| Daily Activities | Excellent | 0.78 |
| Social Roles     | Excellent | 0.78 |
| Total Score      | Excellent | 0.80 |

**Spinal Cord Disorders (Adult and Pediatrics):**

(Fougeyrollas et al. 1998;  $n = 49$ , children  $n = 24$ , adults  $n = 25$ ; mean age years = children: 10.9 (4.7), adults: 42.5 (13.1); duration of injury = children: 10.9 (4.7) years, adults: 12.2 (8.2) years; gender = children: 16 female, 8 male; adults: 3 female, 22 male, Spinal Cord Disorders)

Adequate level of reliability for the children and the adult samples (ICC = 0.73 and 0.74, respectively).

Taken individually, a majority of life habit categories have shown a adequate to excellent reliability level (ICC  $\geq 0.50$ ) while a few life habit categories such as the interpersonal relationship or nutrition showed a poor reliability level

Adults with Spinal Cord Injury: ICC = 0.83-0.95

Interrater / Intrarater Reliability

**Children (Cerebral palsy, myelomeningocele, sensory-motor neuropathy, traumatic brain injury, developmental delay):**

(Noreau et al, 2007;  $n=91$  parents, Children with Disabilities)

| Dimensions          |           | ICC  |           | ICC  |
|---------------------|-----------|------|-----------|------|
| Daily Activities    |           |      |           |      |
| Communication       | Excellent | 0.95 | Excellent | 0.91 |
| Personal Care       | Excellent | 0.94 | Excellent | 0.92 |
| Housing             | Excellent | 0.93 | Excellent | 0.93 |
| Mobility            | Excellent | 0.91 | Excellent | 0.88 |
| Nutrition           | Excellent | 0.86 | Excellent | 0.82 |
| Fitness             | Excellent | 0.83 | Excellent | 0.80 |
| <b>Social Roles</b> |           |      |           |      |
| Recreation          | Excellent | 0.92 | Excellent | 0.87 |
| Responsibility      | Excellent | 0.90 | Excellent | 0.91 |
| Education           | Excellent | 0.90 | Excellent | 0.82 |

|                             |           |      |           |      |
|-----------------------------|-----------|------|-----------|------|
| Community Life              | Excellent | 0.78 | Excellent | 0.78 |
| Interpersonal Relationships | Adequate  | 0.58 | Adequate  | 0.63 |

### **Children with Cerebral Palsy:**

(Sakzewski et al, 2007; Review of participation measures for children with CP aged 5 to 13;  $n = 48$ , Children with CP)

#### **Intrarater ICC**

Daily Activities 0.82-0.96 **Excellent**

Social Roles > 0.90 **Excellent**

Interpersonal relationships 0.64 **Adequate**

#### **Interrater ICC**

0.70-0.91 **Adequate to Excellent**

Interpersonal relationships 0.62 **Adequate**

### **Elderly with Physical Disabilities:**

(Noreau et al, 2004;  $n = 44$ ; mean age = 80.0(7.7) years, Elderly with Physical Disabilities)

#### **Excellent interrater reliability (ICC = 0.89)**

| <b>LIFE-H</b>                     | <b>ICC</b>  | <b>Level of Reliability</b> |
|-----------------------------------|-------------|-----------------------------|
| Nutrition                         | 0.72        | Adequate                    |
| Fitness                           | 0.33        | Poor                        |
| Personal Care                     | 0.95        | Excellent                   |
| Communication                     | --          | ---                         |
| Housing                           | 0.49        | Adequate                    |
| Mobility                          | 0.61        | Adequate                    |
| <b>Daily activities sub-score</b> | <b>0.91</b> | <b>Excellent</b>            |
| Responsibilities                  | 0.72        | Adequate                    |
| Interpersonal relationships       | --          | ---                         |
| Community life                    | 0.70        | Adequate                    |
| Leisure/Recreation                | 0.55        | Adequate                    |
| Education/Employment              | N/A         | N/A                         |
| <b>Social roles sub-score</b>     | <b>0.64</b> | <b>Adequate</b>             |
| <b>Total Score</b>                | <b>0.89</b> | <b>Excellent</b>            |

### **Myotonic Dystrophy:**

(Gagnon et al, 2006;  $n = 26$ ; mean age of 52.7 (10.01) years; diagnosed with myotonic dystrophy confirmed by DNA; 2 weeks between assessments)

| <b>LIFE-H Inter-rater reliability</b> |                     |                     |                 |            |
|---------------------------------------|---------------------|---------------------|-----------------|------------|
| <b>Category</b>                       | <b>T2 Mean (SD)</b> | <b>T3 Mean (SD)</b> | <b>Strength</b> | <b>ICC</b> |
| Personal care                         | 9.0 (1.1)           | 8.7 (1.4)           | Adequate        | 0.87       |
| Mobility                              | 6.2 (2.8)           | 6.3 (2.7)           | Adequate        | 0.84       |
| Housing                               | 6.6 (1.4)           | 6.7 (1.8)           | Adequate        | 0.76       |

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |           |           |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|-----------|------|------|---------------|-----------|-----------|------|------|---------|-----------|------------|------|------|---------------------------|-----------|-----------|----------|------|----------------|-----------|------------|------|------|-----------------------------|-----------|-----------|----------|------|----------------|-----------|-----------|-----------|------|------------|-----------|-----------|----------|------|-----------------------|-----------|-----------|-----------|------|----------------------|-----------|-----------|-----------|------|-----------|--|--|--|--|
|                                              | <table><tr><td>Nutrition</td><td>8.3 (1.9)</td><td>8.5 (1.6)</td><td>Poor</td><td>0.68</td></tr><tr><td>Communication</td><td>9.6 (0.4)</td><td>9.5 (0.6)</td><td>Poor</td><td>0.47</td></tr><tr><td>Fitness</td><td>9.1 (1.2)</td><td>8.4* (1.3)</td><td>Poor</td><td>0.21</td></tr><tr><td>Daily activities subscore</td><td>8.3 (1.0)</td><td>8.0 (1.3)</td><td>Adequate</td><td>0.86</td></tr><tr><td>Responsibility</td><td>8.5 (1.7)</td><td>9.2* (1.0)</td><td>Poor</td><td>0.56</td></tr><tr><td>Interpersonal relationships</td><td>8.6 (1.7)</td><td>8.7 (1.7)</td><td>Adequate</td><td>0.84</td></tr><tr><td>Community life</td><td>6.5 (3.5)</td><td>6.5 (3.7)</td><td>Excellent</td><td>0.93</td></tr><tr><td>Recreation</td><td>7.0 (3.7)</td><td>6.8 (3.4)</td><td>Adequate</td><td>0.75</td></tr><tr><td>Social roles subscore</td><td>7.4 (1.9)</td><td>7.6 (1.9)</td><td>Excellent</td><td>0.92</td></tr><tr><td>LIFE-H (total score)</td><td>7.9 (1.3)</td><td>7.8 (1.5)</td><td>Excellent</td><td>0.90</td></tr><tr><td colspan="5">*p &lt; 0.05</td></tr></table>                                                                                      | Nutrition  | 8.3 (1.9) | 8.5 (1.6) | Poor | 0.68 | Communication | 9.6 (0.4) | 9.5 (0.6) | Poor | 0.47 | Fitness | 9.1 (1.2) | 8.4* (1.3) | Poor | 0.21 | Daily activities subscore | 8.3 (1.0) | 8.0 (1.3) | Adequate | 0.86 | Responsibility | 8.5 (1.7) | 9.2* (1.0) | Poor | 0.56 | Interpersonal relationships | 8.6 (1.7) | 8.7 (1.7) | Adequate | 0.84 | Community life | 6.5 (3.5) | 6.5 (3.7) | Excellent | 0.93 | Recreation | 7.0 (3.7) | 6.8 (3.4) | Adequate | 0.75 | Social roles subscore | 7.4 (1.9) | 7.6 (1.9) | Excellent | 0.92 | LIFE-H (total score) | 7.9 (1.3) | 7.8 (1.5) | Excellent | 0.90 | *p < 0.05 |  |  |  |  |
| Nutrition                                    | 8.3 (1.9)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 8.5 (1.6)  | Poor      | 0.68      |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| Communication                                | 9.6 (0.4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.5 (0.6)  | Poor      | 0.47      |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| Fitness                                      | 9.1 (1.2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 8.4* (1.3) | Poor      | 0.21      |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| Daily activities subscore                    | 8.3 (1.0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 8.0 (1.3)  | Adequate  | 0.86      |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| Responsibility                               | 8.5 (1.7)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 9.2* (1.0) | Poor      | 0.56      |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| Interpersonal relationships                  | 8.6 (1.7)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 8.7 (1.7)  | Adequate  | 0.84      |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| Community life                               | 6.5 (3.5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 6.5 (3.7)  | Excellent | 0.93      |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| Recreation                                   | 7.0 (3.7)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 6.8 (3.4)  | Adequate  | 0.75      |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| Social roles subscore                        | 7.4 (1.9)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7.6 (1.9)  | Excellent | 0.92      |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| LIFE-H (total score)                         | 7.9 (1.3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7.8 (1.5)  | Excellent | 0.90      |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| *p < 0.05                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |           |           |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| Internal Consistency                         | <p><b><u>Children and Adults with Impairments:</u></b><br/>(Noreau et al, 2002; Review of studies regarding social participation with various impairments in adults and children; n= 24 children &amp; 25 adults with SCI, Children and Adults with Impairments)<br/>Short form Cronbach alpha ≥ 0.82<br/><b>Excellent</b><br/>Long form Cronbach alpha ≥ 0.90<br/><b>Excellent</b></p> <p><b><u>Children with Cerebral Palsy:</u></b><br/>(Sakzewski et al, 2007; Review of participation measures for children with CP aged 5 to 13; n = 48, Children with CP)<br/>Daily Activities<br/><b>Excellent</b> alpha 0.97<br/>Social Roles<br/><b>Excellent</b> alpha 0.90<br/>Categories<br/><b>Moderate to Excellent</b> alpha 0.73-0.90<br/>Interpersonal relationships<br/><b>Poor</b> alpha 0.40</p> <p><b><u>SCI:</u></b><br/>(Noonan et al, 2009; Review of SCI instruments, SCI)<br/><b>Excellent:</b> Internal Consistency ( = 0.83)</p> <p><b><u>Stroke:</u></b><br/>(Tse et al, 2013; Systematic review of 36 participation measures for persons with stroke; n = 119 studies)<br/><b>Excellent:</b> Short Form Internal Consistency (Cronbach alpha (α) ≥ 0.80)</p> |            |           |           |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |
| Criterion Validity (Predictive / Concurrent) | <p><b><u>Children with Cerebral Palsy:</u></b><br/><br/>(Sakzewski et al, 2007; Review of participation measures for children with CP aged 5 to 13; n = 48, Children with CP)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |           |           |      |      |               |           |           |      |      |         |           |            |      |      |                           |           |           |          |      |                |           |            |      |      |                             |           |           |          |      |                |           |           |           |      |            |           |           |          |      |                       |           |           |           |      |                      |           |           |           |      |           |  |  |  |  |

|                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |                     |                        |                           |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------|------------------------|---------------------------|
|                                                   | Domains of PEDI, WeeFIM, Life-H                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |                     |                        |                           |
|                                                   | Self-care $r = 0.83-0.94$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                           |                     |                        |                           |
|                                                   | Education/recreation: $0.79-0.91$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                           |                     |                        |                           |
| Construct Validity<br>(Convergent / Discriminant) | <p><b><u>Children and Adults with impairments :</u></b><br/>(Noreau et al, 2002; Review of studies regarding social participation with various impairments in adults and children, Children and Adults with Impairments)<br/>Between Life-H and CHART; N = 482 Adults SCI<br/>Spearman's rho Physical independence:</p> <ul style="list-style-type: none"> <li>o <b>Excellent</b> 0.76<br/>Occupation</li> <li>o <b>Adequate</b> 0.36<br/>Mobility</li> <li>o <b>Adequate</b> 0.33<br/>Social integration</li> <li>o <b>Poor</b> 0.14<br/>Between Life-H and CIQ<br/>N = 30 adults TBI<br/>Home integration</li> <li>o <b>Adequate</b> 0.56<br/>Social integration</li> <li>o <b>Adequate</b> 0.54<br/>Productive activities</li> <li>o <b>Excellent</b> 0.75</li> </ul> <p><b><u>Children with Disabilities (Cerebral palsy, myelomeningocele, sensory-motor neuropathy, traumatic brain injury, developmental delay):</u></b><br/>(Noreau et al, 2007; <math>n = 91</math> parents, Children with Disabilities)<br/>Convergent validity:<br/>Pediatric Evaluation of Disability Inventory (PEDI) Self-care and Mobility dimensions (Functional Skills scale) were strongly associated with LIFE-H Personal care and Housing dimensions (<math>0.79 &lt; r &lt; 0.88</math>) and PEDI Social function was strongly associated with LIFE-H categories, Communication and Responsibility (<math>r = 0.80-0.81</math>)<br/>High correlations between LIFE-H Housing and Personal care with Functional Independence Measure for Children (WeeFIM) Self-care, <math>r = 0.90-0.94</math>; LIFE-H and WeeFIM communication, <math>r = 0.89</math>)<br/>Divergent validity:<br/>Associations of all PEDI dimensions with some LIFE-H dimensions were weaker (Interpersonal relationships and Community life), supporting a distinctiveness between the two constructs: activities of daily living (ADL) and social roles<br/>WeeFIM cognitive dimensions (communication and social cognition) showed a lower association with LIFE-H motor dimensions (i.e. mobility, <math>r = 0.43-0.49</math> respectively).</p> <p><b><u>Children with Disabilities:</u></b><br/>Convergent Validity<br/>(Noreau, 2007; <math>n = 94</math> parents of children with disabilities; children: 36 males, 58 females; mean age 8y 10mo (2y 6), Children with Disabilities)</p> <table border="1"> <tr> <td>LIFE-H for Children</td><td>PEDI Functional Skills</td><td>PEDI Caregiver Assistance</td></tr> </table> |                           | LIFE-H for Children | PEDI Functional Skills | PEDI Caregiver Assistance |
| LIFE-H for Children                               | PEDI Functional Skills                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PEDI Caregiver Assistance |                     |                        |                           |

|                                                                                                                                                                   | Self-Care | Mobility | Social Function | Self-care | Mobility | Social Function |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|-----------------|-----------|----------|-----------------|
| Nutrition                                                                                                                                                         | 0.71      | 0.67     | 0.70            | 0.71      | 0.64     | 0.69            |
| Fitness                                                                                                                                                           | 0.68      | 0.69     | 0.63            | 0.70      | 0.73     | 0.56            |
| Personal care                                                                                                                                                     | 0.79      | 0.82     | 0.61            | 0.88      | 0.80     | 0.57            |
| Communication                                                                                                                                                     | 0.76      | 0.61     | 0.81            | 0.75      | 0.62     | 0.79            |
| Housing                                                                                                                                                           | 0.79      | 0.88     | 0.61            | 0.81      | 0.84     | 0.55            |
| mobility                                                                                                                                                          | 0.56      | 0.68     | 0.40            | 0.63      | 0.65     | 0.32            |
| Responsibility                                                                                                                                                    | 0.70      | 0.67     | 0.80            | 0.71      | 0.66     | 0.76            |
| Interpersonal Relationships                                                                                                                                       | 0.51      | 0.50     | 0.66            | 0.50      | 0.48     | 0.63            |
| Community Life                                                                                                                                                    | 0.54      | 0.53     | 0.47            | 0.58      | 0.52     | 0.44            |
| Education                                                                                                                                                         | 0.69      | 0.69     | 0.60            | 0.74      | 0.65     | 0.56            |
| Recreation                                                                                                                                                        | 0.68      | 0.71     | 0.60            | 0.74      | 0.68     | 0.53            |
| <i>Associations between LIFE-H for children and PEDI (Pediatric Evaluation of Disability Inventory) as measured by Pearson's correlation coefficient; n = 94;</i> |           |          |                 |           |          |                 |

**Multiple diagnosis (Neurologic, amputation, coronary, pulmonary, rheumatic disorder , other):**

**Convergent Validity**

(Lemmens, et al, 2007;  $n = 63$ , mean age = 69 (7.7), chronic illness  $n = 66$  (7.9); gender = male 56%, Multiple Diagnoses)

The correlations between the LIFE-H categories and total scores and the Impact on Participation and Autonomy Questionnaire (0.80-0.82) and London Handicap Scale (0.89-0.92) were excellent.

**Discriminant Validity**

(Lemmens, et al, 2007;  $n = 120$ , healthy older adults  $n = 40$ , patients with chronic illness  $n = 80$ ; mean age healthy adults = 69 (7.7), chronic illness  $n = 66$  (8.3); gender = healthy adults male 60%, chronic illness male 55%, Multiple Diagnoses)

Significant differences between the healthy and ill subjects for the 10 separate categories ( $P < 0.01$ ) and the total score ( $P < 0.001$ )

**Older Adults with Functional Limitations:**

**Convergent Validity**

(Desrosiers et al., 2004;  $n = 87$ ; mean age = 78.0 (8.2), Older Adults with Functional Limitations)

Adequate correlations found between LIFE-H and the Functional Autonomy Measurement System (SMAF) total scores (0.70,  $p < 0.0001$ )

**Discriminant Validity**

(Desrosiers et al., 2004;  $n = 87$ ; mean age = 78.0 (8.2), Older Adults with Functional Limitations)

Participants living in private nursing homes obtained higher scores, followed by those living at home and finally by those living in long-term care units. These variations in scores between the living environments, which are supported by differences in disability levels (SMAF scores), indicate a good level of discriminant validity for the nLIFE-H, particularly in the daily activities.

**Spinal Cord Injury:**

(Dumont et al, 2003;  $n = 1771$ ; current mean age = 44.5 (15); gender=male 81.4%, SCI)

Rasch analysis showed satisfactory measurement properties (person reliability = 0.91), and high agreement with expert opinion (items hierarchy  $r = 0.89$ )

Item difficulty hierarchy from spinal cord injury experts differed from hierarchy from traumatic brain injury experts, suggesting that the construct varies across impairment groups

#### Convergent Validity

(Noreau et al, 1998;  $n = 482$ ; mean age = 42 (12) years; no other information available; information from abstract, SCI)

Convergent validity was demonstrated by correlations between grouped LIFE-H items and corresponding CHART dimensions: 0.14 for social integration, through 0.33 and 0.36 for mobility and occupation, to 0.76 for physical independence

#### Stroke:

(Desrosiers et al, 2003;  $n = 132$ ; mean age = 69.9 (13.5); mean rehab stay = 79.0 (45.5) days; 2-week (T3) and 6 month (T4) post rehabilitation, Acute Stroke)

#### **LIFE-H, SMAF & FIM Correlations:**

|                                    | Time 3 (n = 118)   |                   |                | Time 4 (n = 102)   |                   |                |
|------------------------------------|--------------------|-------------------|----------------|--------------------|-------------------|----------------|
| LIFE-H Domain                      | SMAF (total score) | FIM (total score) | <i>p</i> value | SMAF (total score) | FIM (total score) | <i>p</i> value |
| <b>LIFE-H (total score)</b>        | 0.85*              | 0.79              | 0.001          | 0.89               | 0.85              | 0.006          |
| <b>Personal care</b>               | 0.87               | 0.85              | 0.13           | 0.92               | 0.90              | 0.08           |
| <b>Housing</b>                     | 0.70               | 0.65              | 0.02           | 0.77               | 0.74              | 0.11           |
| <b>Nutrition</b>                   | 0.69               | 0.63              | 0.009          | 0.63               | 0.61              | 0.17           |
| <b>Mobility</b>                    | 0.59               | 0.52              | 0.005          | 0.62               | 0.58              | 0.08           |
| <b>Communication</b>               | 0.52               | 0.52              | 1.00           | 0.56               | 0.56              | 1.00           |
| <b>Fitness</b>                     | 0.38               | 0.38              | 1.00           | 0.58               | 0.58              | 1.00           |
| <b>Daily activities subscore</b>   | 0.89               | 0.85              | 0.007          | 0.91               | 0.88              | 0.03           |
| <b>Responsibility</b>              | 0.68               | 0.63              | 0.03           | 0.72               | 0.64              | 0.001          |
| <b>Community</b>                   | 0.66               | 0.57              | 0.001          | 0.74               | 0.67              | 0.001          |
| <b>Education/employment</b>        | 0.45               | 0.35              | 0.001          | 0.49               | 0.43              | 0.02           |
| <b>Leisure</b>                     | 0.22               | 0.21              | 0.73           | 0.32               | 0.31              | 0.71           |
| <b>Interpersonal relationships</b> | 0.06               | 0.05              | 1.00           | 0.30               | 0.33              | 0.26           |
| <b>Social roles subscore</b>       | 0.66               | 0.57              | 0.001          | 0.77               | 0.71              | 0.006          |

SMAF = système de mesure de l'autonomie fonctionnelle

FIM = functional independence measure

\* Pearson correlation coefficients: at time 3, all significant at the 0.001 level

### **Stroke :**

(Desrosiers et al, 2005;  $n_{\text{stroke}} = 46$ ,  $n_{\text{healthy}} = 46$ ; mean age<sub>stroke</sub> = 72.5 (11.5) years, mean age<sub>healthy</sub> = 73.0 (11.4) years; time post stroke = 4-6 years; French and English sample, Stroke)

| <b><u>LIFE-H- Comparison<br/>between stroke patients and<br/>healthy elderly</u></b> | <b><u>Difference (1-ratio)<br/>and (95% CI)</u></b> |
|--------------------------------------------------------------------------------------|-----------------------------------------------------|
| Nutrition                                                                            | 0.45 (0.35-0.55)                                    |
| Fitness                                                                              | 0.25 (0.18-0.31)                                    |
| Personal Care                                                                        | 0.39 (0.30-0.47)                                    |
| Communication                                                                        | 0.21 (0.09-0.32)                                    |
| Housing                                                                              | 0.31 (0.22-0.39)                                    |
| Mobility                                                                             | 0.33 (0.21-0.44)                                    |
| <b>Daily activities sub-score</b>                                                    | <b>0.33 (0.26-0.39)</b>                             |
| Responsibilities                                                                     | 0.19 (0.09-0.28)                                    |
| Interpersonal relationships                                                          | 0.01 (-0.08-0.06)                                   |
| Community life                                                                       | 0.47 (0.35-0.48)                                    |
| Leisure/Recreation                                                                   | 0.38 (0.12-0.63)                                    |
| Education/Employment                                                                 | 0.69 (0.44-0.95)                                    |
| <b>Social roles sub-score</b>                                                        | <b>0.24 (0.16-0.31)</b>                             |
| <b>Total Score</b>                                                                   | <b>0.29 (0.22-0.36)</b>                             |

### **Content Validity**

Evaluated by an extensive development process involving consultation with 12 international experts including researchers, services providers, and consumer representatives. Experts concluded that the LIFE-H items covered most of a person's life habits (ADL and social roles) and it could be used to determine the appearance of handicap situations. The instrument was refined based on clinical evaluation (Fougeyrollas et al, 1998)

### **LIFE-H for children (Cerebral palsy, myelomeningocele, sensory-motor neuropathy, traumatic brain injury, developmental delay) :**

(Noreau et al, 2007, Children with Disabilities)

Content validity was established with the help of an expert panel ( $n = 29$ ), comprising parents of children with functional limitations ( $n = 11$ ), experienced pediatric clinicians ( $n = 15$ ), and researchers ( $n = 3$ )

The panel reviewed the content of the LIFE-H for its overall relevance for children from 5 to 13 years old

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | <p>They assessed the comprehensiveness and clarity of the wording of the measure</p> <p>According to Tse et al (2012) the LIFE-H has content validity because it is based on the Disability Creation Process Model and was developed and reviewed by experts</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Face Validity           | <p>According to Tse et al (2012) the LIFE-H has face validity because it is based on the Disability Creation Process Model and was developed and reviewed by experts</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Floor / Ceiling Effects | <p><b><u>Children With Congenital Hemiplegia:</u></b><br/>(Sakzewski et al, 2011; <math>n = 64</math>; mean age = 10.2 (2.7) years, Children with Congenital Hemiplegia)<br/>Ceiling effects were observed with LIFE-H categories including community life and interpersonal relationships</p> <p><b><u>SCI:</u></b><br/>(Noreau &amp; Fougereyrollas, 2000; <math>n = 482</math>; mean age = 42.4 (12.1); time since injury = 13 (6.8) years; type of injury = Complete Tetraplegia 24.6%, Incomplete Tetraplegia 19.5%, Complete Paraplegia 38.0%, Incomplete Paraplegia 18.3% Chronic SCI)</p> <p>The LIFE-H has demonstrated low ceiling effects</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Responsiveness          | <p><b><u>Spouses of Individuals with First Time Stroke:</u></b><br/>(Rochette et al, 2007; <math>n = 54</math> spouses; time periods of assessment = before stroke (retrospectively), at 2 weeks, and at 6 months post stroke, Spouses of Individuals with First Time Stroke)<br/>At 2 weeks (T1): moderate effect size for LIFE-H total score (0.53), small for ADL sub core (0.0) and large for social roles subscore (0.90)<br/>At 6 months post stroke (T2): small effect side for LIFE H Total score (0.38), ADL subscore (0.13), and moderate for Social role subscore (0.76)<br/>Changes in participation were larger for personal relationships (T1 = 0.67; T2 = 0.83),, employment (T1 = 0.68; T2 = 0.63), and recreation ( T1 = 1.16; T2 = 0.93) , showing moderate to large effect sizes</p> <p><b><u>Stroke:</u></b><br/>(Rochette et al, 2007 (<math>n = 35</math>; mean age = 72.3 (10.5); gender = male 42.9%; time periods of assessment = before stroke (retrospectively), at 2 weeks, at 3 months, and at 6 months post stroke, Mild Stroke)<br/>At 2 weeks: Large effect size for LIFE-H total score (1.21), ADL (1.15) and Social Roles (1.24) subscores<br/>6 months post stroke and 2 weeks post stroke: moderate effect sizes for LIFE-H total score (0.60), ADL sub sore (0.64) and Social role sub score (0.56)<br/>6 months post-stroke and before the stroke: moderate effect sizes for LIFE-H total score (0.62), ADL sub score (0.58) and Social role sub score (0.70)<br/>(Rochette et al, 2007; <math>n = 35</math>; mean age = 72.3(10.5) years; time post stroke = 2-3 weeks (T1), 3 months (T2), and 6 months (T3); severity &gt; 8.5 on Canadian Neurological Scale; French and English sample, Stroke)</p> |

The LIFE-H is able to detect changes (total score effect size = 0.60)

| <b>LIFE-H</b>                     | <b>Effect Size<br/>T3-T1</b> |
|-----------------------------------|------------------------------|
| Nutrition                         | 0.35                         |
| Fitness                           | 0.54                         |
| Personal Care                     | 0.67                         |
| Communication                     | 0.35                         |
| Housing                           | 0.67                         |
| Mobility                          | 0.44                         |
| <b>Daily activities sub-score</b> | <b>0.64</b>                  |
| Responsibilities                  | 0.29                         |
| Interpersonal relationships       | 0.33                         |
| Community life                    | 0.60                         |
| Leisure/Recreation                | 1.41                         |
| Education/Employment              | 0.14                         |
| <b>Social roles sub-score</b>     | <b>0.56</b>                  |
| <b>Total Score</b>                | <b>0.60</b>                  |

#### Professional Association Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StroKEDGE), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

#### Abbreviations:

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|  | <b>Acute<br/>(CVA &lt; 2 months<br/>post)<br/>(SCI &lt; 1 month post)<br/>(Vestibular &lt; 6<br/>months post)</b> | <b>Subacute<br/>(CVA 2 to 6<br/>months)<br/>(SCI 3 to 6<br/>months)</b> | <b>Chronic<br/>(&gt; 6 months)</b> |
|--|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------|
|  |                                                                                                                   |                                                                         |                                    |

|                     |           |          |          |
|---------------------|-----------|----------|----------|
| <b>StrokEDGE II</b> | <i>NR</i> | <i>R</i> | <i>R</i> |
|---------------------|-----------|----------|----------|

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>StrokEDGE II</b> | <i>NR</i>         | <i>R</i>                        | <i>R</i>                        | <i>R</i>                         | <i>R</i>           |
| <b>TBI EDGE</b>     | <i>NR</i>         | <i>NR</i>                       | <i>NR</i>                       | <i>LS</i>                        | <i>LS</i>          |

Recommendations for use based on ambulatory status after brain injury:

|                 | <b>Completely Independent</b> | <b>Mildly dependant</b> | <b>Moderately Dependant</b> |
|-----------------|-------------------------------|-------------------------|-----------------------------|
| <b>TBI EDGE</b> | <i>N/A</i>                    | <i>N/A</i>              | <i>N/A</i>                  |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|---------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>StrokEDGE II</b> | <i>No</i>                                                   | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Not reported</i>                                         |
| <b>TBI EDGE</b>     | <i>No</i>                                                   | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Not reported</i>                                         |

## Considerations

Evidence Based Review for Research (Magasi et al, 2007). The group identified the following considerations:

Low ceiling effects

The satisfaction scale appears to have little empirical support

Limited use in clinical practice and research

Conceptual foundation not widely known

Translations Available:

Danish

French

German

Italian

Swedish

### **Stroke:**

(Poulin and Desrosiers, 2008;  $n_{\text{stroke}} = 40$ ,  $n_{\text{proxy}} = 40$ ; mean age of stroke patients = 73.6 (8.4) years; mean time post stroke = 43.5 (32.0) months; French sample, Stroke)

**Excellent** level of agreement between stroke patients and their proxies (ICC = 0.82) suggests that proxies are able to complete LIFE-H when stroke patients are unable to respond

| <b><u>LIFE-H</u></b>              | <b><u>ICC</u></b> | <b><u>Level of Reliability</u></b> |
|-----------------------------------|-------------------|------------------------------------|
| Nutrition                         | 0.76              | Excellent                          |
| Fitness                           | 0.61              | Adequate                           |
| Personal Care                     | 0.93              | Excellent                          |
| Communication                     | 0.59              | Adequate                           |
| Housing                           | 0.83              | Excellent                          |
| Mobility                          | 0.86              | Excellent                          |
| <b>Daily activities sub-score</b> | <b>0.87</b>       | <b>Excellent</b>                   |
| Responsibilities                  | 0.63              | Adequate                           |
| Interpersonal relationships       | 0.41              | Adequate                           |
| Community life                    | 0.92              | Excellent                          |
| Leisure                           | 0.82              | Excellent                          |
| Education/Employment              | N/A               | N/A                                |
| <b>Social roles sub-score</b>     | <b>0.73</b>       | <b>Adequate</b>                    |
| <b>Total Score</b>                | <b>0.82</b>       | <b>Excellent</b>                   |

Do you see an error or have a suggestion for this instrument summary? Please e-mail us!

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|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          | <p>Rochette, A., Desrosiers, J., et al. (2007). "Changes in participation after a mild stroke: quantitative and qualitative perspectives." Top Stroke Rehabil 14(3): 59-68. Find it on PubMed</p> <p>Sakzewski, L., Boyd, R., et al. (2007). "Clinimetric properties of participation measures for 5- to 13-year-old children with cerebral palsy: a systematic review." Dev Med Child Neurol 49(3): 232-240. Find it on PubMed</p> <p>Sakzewski, L., Ziviani, J., et al. (2011). "Participation outcomes in a randomized trial of 2 models of upper-limb rehabilitation for children with congenital hemiplegia." Arch Phys Med Rehabil 92(4): 531-539. Find it on PubMed</p> <p>Tse, T., Douglas, J., et al. (2013). "Measuring participation after stroke: a review of frequently used tools." Arch Phys Med Rehabil 94(1): 177-192. Find it on PubMed</p> |
| Year published           | 1997                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Instrument in PDF Format | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Approval Status          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

#### 4. REHAB MEASURES DATABASE: BALANCE EVALUATION SYSTEMS TEST

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | <a href="#">BESTest here (other languages below)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Title of Assessment    | Balance Evaluation Systems Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Acronym                | BESTest                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Instrument Reviewer(s) | Initially reviewed by Kirsten Potter, PT, DPT, MS, NCS and the MS EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 3/2011; Updated with the TBI population by Katie Hays, PT, DPT, and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 5/2012; Updated for PD population by Cathy Harro MS, PT, NCS and the PD EDGE Task Force of Neurology Section, APTA 3/2013. Updated for the Vestibular EDGE task force of the Academy of Neurologic Physical Therapy by Diane Wrisley PT, PhD, NCS and Elizabeth Dannenbaum MScPT 11/2013. Updated by Evan Papa DPT, PhD for the University of North Texas Health |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           | Sciences Center, DPT class of 2015. Updated by StrokEdge II Task Force: Dorian Rose, PhD, PT and Carmen Capo-Lugo, PhD, PT; May 2016.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Summary Date</b>       | 8/25/2015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Purpose</b>            | The Balance Evaluation Systems Test (BESTest) serves as a 36-item clinical balance assessment tool, developed to assess balance impairments across six contexts of postural control: mechanical constraints, limits of stability, APAs, postural response to induced loss of balance, sensory orientation, and gait.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b>        | <ul style="list-style-type: none"> <li>• 36 items</li> <li>• Grouped into 6 systems (biomechanical constraints, stability limits/verticality, anticipatory postural adjustments, postural responses, sensory orientation, stability in gait)</li> <li>• Total score of 108 points total, calculated in to a percentage score (0-100%). Also total sub-scores exist for each above listed system.</li> <li>• Item-level scores range from 0 (severe impairment) to 3 (no impairment).</li> <li>• Subjects are to be tested with flat heeled shoes, or with shoes and socks off.</li> <li>• Subjects who must use an assistive device should be scored one category lower for that item.</li> <li>• Training DVD available for purchase (<a href="http://bestest.us/">http://bestest.us/</a>)</li> <li>• Administration instructions can be found at <a href="http://bestest.us/training/">http://bestest.us/training/</a></li> <li>• Shortened into mini-BESTest and brief BESTest</li> </ul> |
| <b>Area of Assessment</b> | Balance Non-Vestibular; Gait; Strength                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Body Part</b>          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>ICF Domain</b>         | Body Structure; Body Function; Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Domain</b>             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Assessment Type</b>    | Performance Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Length of Test</b>     | 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Time to Administer</b> | <ul style="list-style-type: none"> <li>• 20-30 minutes, 30 minutes if untrained raters</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Number of Items</b>    | 36                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Equipment Required</b> | <ul style="list-style-type: none"> <li>• Stop watch</li> <li>• Measuring tape mounted on wall</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>• Approximately 60 cm x 60 cm block of 4 inch, medium density, Tempur® foam</li> <li>• 10 degree incline ramp (at least 2 x 2 ft)</li> <li>• Stair step, 15 cm (6 inches) in height</li> <li>• 2 stacked shoe boxes (for 9 inch obstacle height)</li> <li>• 2.5 kg (5-lb) free weight</li> <li>• Firm chair with arms with 3 meters in front marked with tape</li> <li>• Masking tape to mark 3 m and 6 m lengths on the floor</li> </ul>                                                                |
| <b>Training Required</b>         | <p>A training DVD is available for purchase. Workshops are available to become skilled in using the BESTest to differentiate complex balance disorders in neurological patients. Workshop participants develop the ability to design a more specific rehabilitation plan of care for balance retraining.</p> <p>A web portal is available through <a href="http://bestest.us/">http://bestest.us/</a> containing instructional videos and scoring samples of each BESTest item, as well as explanations of the six main balance categories.</p> |
| <b>Type of training required</b> | Reading an Article/Manual; Training Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Cost</b>                      | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Actual Cost</b>               | <p>Training DVD is \$200.</p> <p>The BESTest protocol is free, but is subject to copyright.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Age Range</b>                 | Elderly adult: 65+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Administration Mode</b>       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Diagnosis</b>                 | Geriatrics; Parkinson's Disease                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Populations Tested</b>        | <ul style="list-style-type: none"> <li>• Balance deficits</li> <li>• Cerebellar Infarct</li> <li>• Parkinson's Disease (PD)</li> <li>• Peripheral neuropathy</li> <li>• Vestibular dysfunction</li> <li>• Subacute Stroke</li> <li>• Multiple Sclerosis</li> </ul>                                                                                                                                                                                                                                                                              |

**Standard Error of  
Measurement  
(SEM)**

**Community dwelling adults with and without balance dysfunction:  
(Unilateral and bilateral dysfunction, Parkinson's disease, peripheral  
neuropathy, total hip arthroplasty):**

(Horak et al, 2009;  $n = 19$ ; age range 50-88; Session 1  $n = 12$ , mean age = 63 (10); 5 female and 7 male; 3 Parkinsons, 2 unilateral vestibular loss, 3 bilateral vestibular loss, 1 peripheral neuropathy and total hip arthroplasty, 3 controls; Session 2  $n = 11$ , mean age = 75 (7.6); 5 female, 6 male; 2 Parkinsons, 1 unilateral vestibular loss, 1 bilateral vestibular loss, 1 peripheral neuropathy and total hip arthroplasty, 6 controls)

- SEM calculated = 3.21

**Parkinson's Disease:**

(Leddy et al, 2011;  $n = 80$ ; mean age = 68.2 (9.3) time since diagnosis = 8.5 (0.54) years; mean MDS-UPDRS score = 72.6 (25.1); mean Hoehn and Yahr scale stage = 2.45 (0.64), separated into fallers vs. nonfallers; subset of  $n = 15$  used for interrater reliability testing, subset of  $n = 24$  used for test retest reliability testing)

- SEM calculated = 2.35

(Leddy et al, 2011a; subset of subjects  $n = 24$ , MDS-UPDRS = 71 (21.9), disease duration mean 6.9 (3.38), 21% fallers)

- SEM calculated = 5.78

**Subacute Stroke** (Chinsongkram et al., 2014;  $n=70$ ; mean age  $57.0 \pm 12.2$ ; time since stroke:  $1.1 \pm 2.0$  months)

SEM was not provided by this study, but was calculated.

- Standard Deviation = 28.19
- ICC = 0.99
- SEM = 2.819

**Minimal Detectable  
Change (MDC)**

**Community dwelling adults with and without balance dysfunction:**  
(Horak et al, 2009)

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                  | <ul style="list-style-type: none"> <li>MDC calculated = 8.9</li> </ul> <p><b><u>Parkinson's Disease:</u></b></p> <p>(Leddy et al, 2011)</p> <ul style="list-style-type: none"> <li>MDC calculated = 6.5</li> </ul> <p>(Leddy et al, 2011a)</p> <ul style="list-style-type: none"> <li>MDC calculated = 16.02</li> </ul> <p><b><u>Subacute Stroke</u></b> (Chinsongkram et al., 2014; n=70; mean age 57.0±12.2; time since stroke: 1.1±2.0 months))</p> <p>MDC was not provided by this study, but was calculated.</p> <ul style="list-style-type: none"> <li>MDC = 7.81</li> </ul>                                                                                                                                                                                                                                                                     |
| Minimally Clinically Important Difference (MCID) | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Cut-Off Scores                                   | <p><b><u>Balance Deficits:</u></b></p> <p>(Padgett PTJ 2012 ; 1<sup>st</sup> cohort: n = 20 varied Dx (4 PD, 1 CVA, 4 MS, 1 PN, 1 tremor) and 9 healthy; 5 with positive fall history. 2<sup>nd</sup> cohort: n = 13 with MS, mean age 50, EDSS &lt; 6 (range 0-4.5), 7 fallers)</p> <ul style="list-style-type: none"> <li>69% cut off score differentiated fallers from non-fallers, and healthy from those with neurologic diagnoses. <b>Adequate</b> ability to detect fallers (sensitivity = 0.86, specificity = 0.95, LR+ = 17.2, LR- = 0.46, accuracy = 92%)</li> </ul> <p><b><u>Parkinson's disease:</u></b></p> <p>(Leddy et al, 2011)</p> <ul style="list-style-type: none"> <li>69% cut off score (sensitivity = 0.84, specificity = 0.76, LR+ = 3.49, LR- = 0.21, AUC = 0.85) to identify individual as a faller vs. non-faller</li> </ul> |

- Sensitivity higher for BESTest as compared to Functional Gait Assessment and Berg Balance Scale

(Duncan RP 2013 PTJ; Comparative utility of BESTest, Mini BESTest, and Brief BESTest; n = 80 with idiopathic PD, mean age = 68.2 (9.7), mean MDS-UPDRS 41.3 (14.7), H & Y stage [1=4, 2=27, 2.5=30, 3=13, 4=6]; retrospective fallers n = 25 (31%), 6 month prospective fallers n = 14 (27.5%), 12 month prospective fallers n = 13 (32.5%))

- 69% cut off score to detect fallers; **Adequate** for detecting retrospective fallers (sensitivity = 0.84, specificity = 0.76, LR+ = 3.49, LR- = 0.21, AUC = 0.84); **Adequate** for predicting 6 month prospective fallers (sensitivity = 0.93, specificity = 0.84, LR+ = 5.81, LR- = 0.08, AUC = 0.89); **Poor** for predicting 12 month prospective falls (sensitivity = 0.46, specificity = 0.74, LR+ = 1.77, LR- = 0.73, AUC = 0.68)

(Duncan 2012 (Accuracy of fall prediction in PD); Baseline n = 80 PD, six-month evaluation n = 51 {mean age = 67.5 (8.8), years post diagnosis 7.7(3.9), H & Y stage 2.4 (0.6), UPDRS 37.8 (13.1), 27% fallers}; 12-month evaluation n = 40 {mean age 67.3 (9.5), years post diagnosis 7.2 (4.1), H&Y stage 2.3 (0.6), UPDRS 39.3 (13.3), 37% fallers})

- 69% cut off score; **Adequate** prediction of fallers at 6 months (sensitivity = 0.93, specificity = 0.84, LR+ = 5.81, LR- = 0.08, AUC = 0.89 (CI 0.74-0.95)); **Poor** prediction of fallers at 12 months (sensitivity = 0.46, specificity = 0.74, LR+ = 1.77, LR- = 0.73, AUC = 0.68 (CI = 0.45- .83))

**Subacute Stroke** (Chinsongkram et al., 2014; n=70; mean age 57.0±12.2; time since stroke: 1.1±2.0 months))

The following cut off scores help distinguish high functional ability from low functional ability:

- >49% indicates those with high functional ability
- Mini-Best > 9 indicates high functional ability
- BBS > 19 indicates high functional ability

#### Normative Data

**Subacute Stroke** (Chinsongkram et al., 2014; n=70; mean age 57.0±12.2; time since stroke: 1.1±2.0 months))

|                                              | <p>Mean (SD) BESTest score for all participants = 41.7 (28.19)</p> <ul style="list-style-type: none"><li>• Low Functional Ability Mean (SD) = 23.89 (18.87)</li><li>• High Functional Ability Mean (SD) = 59.52 (24.82)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |     |        |                  |      |                  |                                      |      |                 |                      |      |                 |                                              |      |                  |                                 |      |                  |                                |      |                 |                              |      |                 |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----|--------|------------------|------|------------------|--------------------------------------|------|-----------------|----------------------|------|-----------------|----------------------------------------------|------|------------------|---------------------------------|------|------------------|--------------------------------|------|-----------------|------------------------------|------|-----------------|
| Test-retest Reliability                      | <p><b><u>Parkinson's disease:</u></b></p> <p>(Leddy et al, 2011a)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> test-retest reliability for total BEST score (ICC = 0.88) across the group. <b>Adequate</b> test-retest reliability for individuals (ICC = ?)</li><li>• <b>Adequate to Excellent</b> test-retest reliability for sections of the test (ICC = 0.63-0.87 - see table below)<ul style="list-style-type: none"><li>o Biomechanical Constraints (ICC = 0.69)</li><li>o Stability Limits/verticality (ICC = 0.63)</li><li>o Anticipatory Postural Control (ICC = 0.83)</li><li>o Postural Responses (ICC = 0.87)</li><li>o Sensory Orientation (ICC = 0.72)</li><li>o Stability in Gait (ICC = 0.72)</li></ul></li></ul> <table><tr><th>Test Section</th><th>ICC</th><th>Rating</th></tr><tr><td>Total BEST Score</td><td>0.88</td><td><b>Excellent</b></td></tr><tr><td>Section 1: Biomechanical Constraints</td><td>0.69</td><td><b>Adequate</b></td></tr><tr><td>Section 2: Stability</td><td>0.63</td><td><b>Adequate</b></td></tr><tr><td>Section 3: Anticipatory Postural Adjustments</td><td>0.83</td><td><b>Excellent</b></td></tr><tr><td>Section 4: Postural Adjustments</td><td>0.87</td><td><b>Excellent</b></td></tr><tr><td>Section 5: Sensory Orientation</td><td>0.72</td><td><b>Adequate</b></td></tr><tr><td>Section 6; Stability in Gait</td><td>0.72</td><td><b>Adequate</b></td></tr></table> <p>(Leddy et al, 2011)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> test re-test reliability (ICC = 0.91 for PT students, 0.88 for PTs)</li></ul> | Test Section     | ICC | Rating | Total BEST Score | 0.88 | <b>Excellent</b> | Section 1: Biomechanical Constraints | 0.69 | <b>Adequate</b> | Section 2: Stability | 0.63 | <b>Adequate</b> | Section 3: Anticipatory Postural Adjustments | 0.83 | <b>Excellent</b> | Section 4: Postural Adjustments | 0.87 | <b>Excellent</b> | Section 5: Sensory Orientation | 0.72 | <b>Adequate</b> | Section 6; Stability in Gait | 0.72 | <b>Adequate</b> |
| Test Section                                 | ICC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Rating           |     |        |                  |      |                  |                                      |      |                 |                      |      |                 |                                              |      |                  |                                 |      |                  |                                |      |                 |                              |      |                 |
| Total BEST Score                             | 0.88                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Excellent</b> |     |        |                  |      |                  |                                      |      |                 |                      |      |                 |                                              |      |                  |                                 |      |                  |                                |      |                 |                              |      |                 |
| Section 1: Biomechanical Constraints         | 0.69                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Adequate</b>  |     |        |                  |      |                  |                                      |      |                 |                      |      |                 |                                              |      |                  |                                 |      |                  |                                |      |                 |                              |      |                 |
| Section 2: Stability                         | 0.63                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Adequate</b>  |     |        |                  |      |                  |                                      |      |                 |                      |      |                 |                                              |      |                  |                                 |      |                  |                                |      |                 |                              |      |                 |
| Section 3: Anticipatory Postural Adjustments | 0.83                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Excellent</b> |     |        |                  |      |                  |                                      |      |                 |                      |      |                 |                                              |      |                  |                                 |      |                  |                                |      |                 |                              |      |                 |
| Section 4: Postural Adjustments              | 0.87                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Excellent</b> |     |        |                  |      |                  |                                      |      |                 |                      |      |                 |                                              |      |                  |                                 |      |                  |                                |      |                 |                              |      |                 |
| Section 5: Sensory Orientation               | 0.72                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Adequate</b>  |     |        |                  |      |                  |                                      |      |                 |                      |      |                 |                                              |      |                  |                                 |      |                  |                                |      |                 |                              |      |                 |
| Section 6; Stability in Gait                 | 0.72                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Adequate</b>  |     |        |                  |      |                  |                                      |      |                 |                      |      |                 |                                              |      |                  |                                 |      |                  |                                |      |                 |                              |      |                 |
| Interrater / Intrarater Reliability          | <p><b><u>Community dwelling adults with and without balance deficits:</u></b> (Horak et al, 2009)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> interrater reliability for total score (ICC = 0.91)</li><li>• <b>Excellent</b> interrater reliability for test subsections (range of ICC 0.79-0.92)<ul style="list-style-type: none"><li>o Biomechanical constraints (ICC = 0.80)</li></ul></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |     |        |                  |      |                  |                                      |      |                 |                      |      |                 |                                              |      |                  |                                 |      |                  |                                |      |                 |                              |      |                 |

- o Stability limits / vertically (ICC = 0.79)
- o Anticipatory postural adjustments (ICC = 0.92)
- o Postural responses (ICC = 0.92)
- o Sensory orientation (ICC = 0.88)
- o Stability in gait (ICC = 0.91)

(Padgett 2012: 1<sup>st</sup> cohort: n = 20 varied Dx (4 PD, 1 CVA, 4 MS, 1 PN, 1 tremor) and 9 healthy; 5 with positive fall history.)

- **Excellent** inter-rater reliability ICC = 0.985 (CI 0.959-0.994)

**Parkinson's Disease (PD):** (Leddy et al, 2011a, n = 15 people with PD; mean disease duration = 6.8 (3.26) years; MDS-UPDRS mean score = 74.2 (18.6); Hoehn and Yahr scale stage 1 = 2, stage 2 = 7, stage 2.5 = 3, stage 3 = 2, and stage 4 = 1)

- **Excellent** interrater reliability total score (ICC = 0.96, 95% CI = 0.89-0.99)
- **Excellent** Inter-rater reliability of subsections range from ICC= 0.79-0.96:

| Test Section                                | ICC              | Rating           |
|---------------------------------------------|------------------|------------------|
| Total BESTest Score                         | 0.96             | <b>Excellent</b> |
| Section 1 Biomechanical Constraints         | 0.81 (0.61-0.92) | <b>Excellent</b> |
| Section 2 Stability                         | 0.79 (0.58-0.92) | <b>Excellent</b> |
| Section 3 Anticipatory Postural Adjustments | 0.91 (0.81-0.97) | <b>Excellent</b> |
| Section 4 Postural Adjustments              | 0.91 (0.81-0.97) | <b>Excellent</b> |
| Section 5 Sensory Orientation               | 0.96 (0.91-0.95) | <b>Excellent</b> |
| Section 6 Stability in Gait                 | 0.86 (0.62-0.95) | <b>Excellent</b> |

**Parkinson's Disease:**

(Leddy et al, 2011, subset of 15 participants)

- **Excellent** inter-rater reliability ICC = 0.96

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                              | <p><b><u>Subacute Stroke</u></b> (Chinsongkram et al., 2014; n=12; mean age 58.2; time since stroke: 1.1±2.0 months))</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> interrater reliability: ICC= .99 <ul style="list-style-type: none"> <li>o Subsection ICCs = .95 - .99</li> </ul> </li> <li>• <b>Excellent</b> intrarater reliability: ICC= .99 <ul style="list-style-type: none"> <li>o Subsection ICCs = .87 - .98</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Internal Consistency                         | <p><b><u>Balance Deficits:</u></b></p> <p>(Padgett 2012; 1<sup>st</sup> cohort: n = 20 varied Dx (4 PD, 1 CVA, 4 MS, 1 PN, 1 tremor) and 9 healthy; 5 with positive fall history)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> Average Cronbach's Alpha for 5 out of 6 BESTest subsections; poor for stability limits/verticality: <ol style="list-style-type: none"> <li>1. Biomechanical constraints = 0.830</li> <li>2. Stability limits/verticality = 0.621</li> <li>3. Anticipatory Postural adjustments = 0.874</li> <li>4. Postural responses = 0.863</li> <li>5. Sensory orientation = 0.813</li> <li>6. Stability in gait = 0.920</li> </ol> </li> </ul>                                                                                                                                                                                                                                                                                             |
| Criterion Validity (Predictive / Concurrent) | <p>Concurrent Validity:</p> <p><b><u>Community Dwelling with and without Balance Deficits:</u></b></p> <p>(Horak et al, 2009)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> correlation between total BESTest and Activities-specific Balance Confidence Scale (ABC) (<math>r = 0.636</math>, <math>p &lt; 0.01</math>)</li> <li>• <b>Adequate to excellent</b> correlation between BESTest sub-section scores and ABC (<math>r = 0.41-0.78</math>)</li> </ul> <p><b><u>Parkinson's Disease (PD):</u></b></p> <p>(Leddy et al, 2011)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> correlation between total BESTest and ABC (<math>r = 0.757</math>)</li> <li>• <b>Excellent</b> correlation between total BESTest and Berg Balance Scale (<math>r = 0.873</math>)</li> <li>• <b>Excellent</b> correlation between total BESTest and Functional Gait Assessment (<math>r = 0.882</math>)</li> </ul> <p><b><u>Parkinson's Disease:</u></b></p> |

|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                  | <p>(Leddy et al, 2011a)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> correlation with miniBESTest (<math>r = 0.955</math>)</li> </ul> <p><b>Multiple Sclerosis</b> (Jacobs and Kasser, 2012)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> concurrent validity of the EDSS scores (<math>r^2 = 0.85</math>, <math>P &lt; 0.0005</math>)</li> <li>• <b>Adequate</b> concurrent validity for center of pressure displacements during leaning (<math>r^2 = 0.55</math>, <math>P &lt; 0.005</math>)</li> <li>• <b>Adequate</b> concurrent validity of step velocity during step initiation (<math>r^2 = 0.48</math>, <math>P &lt; 0.01</math>)</li> <li>• <b>Excellent</b> concurrent validity for center of pressure displacements during postural response tasks (<math>r^2 = 0.76</math>, <math>P &lt; 0.0001</math>)</li> <li>• Peak anticipatory postural adjustment (APA) amplitudes do not significantly correlate with BESTest total scores (<math>r^2 = 0.17</math>, <math>P = 0.16</math>)</li> <li>• Peak anticipatory postural adjustment (APA) amplitudes do not significantly correlate with BESTest sectional scores (<math>r^2 = 0.26</math>, <math>P = 0.074</math>)</li> </ul> <p><b>Predictive Validity:</b></p> <p><b>Subacute Stroke:</b> (Chinsongkram et al., 2014)</p> <ul style="list-style-type: none"> <li>• <b>Adequate</b> sensitivity (71.4%) in classifying high or low functional ability</li> <li>• <b>High</b> specificity (91.4%) in classifying high or low functional ability</li> <li>• <b>Moderate</b> positive likelihood ratio (LR+) (8.33) in classifying high or low functional ability</li> <li>• <b>Moderate</b> negative likelihood ratio (LR-) (0.31) in classifying high or low functional ability</li> </ul> <p><b>Multiple Sclerosis</b> (Jacobs and Kasser, 2012)</p> <ul style="list-style-type: none"> <li>• <b>High</b> sensitivity (86%) to identify fallers</li> <li>• <b>High</b> specificity (95%) to identify non-fallers</li> </ul> |
| <p><b>Construct Validity</b><br/>(Convergent / Discriminant)</p> | <p><b><u>Community Dwelling Adults with and without Balance deficits:</u></b></p> <p>(Horak et al, 2009)</p> <ul style="list-style-type: none"> <li>• Subjects with balance deficits score significantly lower than healthy controls (<math>p = 0.36</math>)</li> <li>• Discriminated between people with different balance deficits: Poorer performance on Section V: Sensory orientation in subjects with vestibular disorders; Section IV: Postural Responses in those with PD; and Section III: Anticipatory Postural Adjustments in subjects with neuropathy</li> </ul> <p><b><u>Parkinson's Disease:</u></b></p> <p>(Leddy et al, 2011, FGA and BEST):</p> <ul style="list-style-type: none"> <li>• Excellent correlation with: <ul style="list-style-type: none"> <li>o Modified Hoehn and Yahr Scale (<math>r = -0.736</math>)</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  | <ul style="list-style-type: none"> <li>o MDS-UPDRS-3 (<math>r = -0.758</math>)</li> <li>o MDS-UPDRS (<math>r = -0.780</math>)</li> <li>• Discriminates fallers from non-fallers (scores <math>\leq 69\%</math>) sensitivity 84%, Specificity 76%, area under curve 0.84</li> </ul> <p>(Leddy et al, 2011, Utility of the mini-BEST):</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> correlation with mini-BEST (<math>r = 0.955</math>)</li> <li>• Statistically significant difference between BESTest scores in fallers (<math>n = 25</math>, mean score= 57.1% (15.4) and nonfallers (<math>n = 55</math>, mean score= 76.4% (13.6)</li> </ul> <p><b><u>Parkinson's Disease:</u></b></p> <p>(Duncan 2013; excellent correlation between BESTest and Brief BESTest <math>r = 0.95</math>)</p> <p><b><u>Balance deficits:</u></b></p> <p>(Padgett 2012)</p> <ul style="list-style-type: none"> <li>• 1<sup>st</sup> cohort: (<math>n = 20</math> varied Dx (4 PD, 1 CVA, 4 MS, 1 PN, 1 tremor) and 9 healthy; 5 with positive fall history). BESTest scores significantly differentiated between healthy and those with balance deficits;</li> <li>• 2nd cohort: (<math>n = 13</math> with MS, mean age 50, EDSS <math>&lt; 6</math> (range 0-4.5), 7 fallers) BESTest scores differentiated those with self-reported fall history (mean score = 77 and those without fall history (mean score = 96)</li> </ul> <p><b><u>Subacute Stroke:</u></b> (Chinsongkram et al., 2014; <math>n=70</math>; mean age <math>57.0 \pm 12.2</math>; time since stroke: <math>1.1 \pm 2.0</math> months))</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> correlation with the BBS (<math>r = 0.96</math>)</li> <li>• <b>Excellent</b> correlation with the PASS (<math>r = 0.96</math>)</li> <li>• <b>Excellent</b> correlation with the CB&amp;B (<math>r = 0.91</math>)</li> <li>• <b>Excellent</b> correlation with the Mini-BEST (<math>r = 0.96</math>)</li> </ul> |
| Content Validity | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Face Validity    | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**Floor / Ceiling Effects**

Ceiling effects:

**Parkinson's Disease:**

(Leddy et al, 2011; FGA & BESTest)

- Lack of ceiling effect (no perfect score, only 6.4% of subjects scored in top 10%; Specificity = 0.76; Sample BESTest scores were normally distributed representing range of H&Y disease severity)
- No floor effect

**Subacute Stroke:** (Chinsongkram et al., 2014; n=70; mean age 57.0±12.2; time since stroke: 1.1±2.0 months))

- **Excellent**, no floor effects were observed with the BESTest
- **Excellent**, no ceiling effects were observed with the BESTest

**Responsiveness**

Not Established

**Professional Association Recommendations**

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD Edge), Spinal Cord Injury Taskforce (PD Edge), Stroke Taskforce (StrokeEdge, StrokeEdge II), Traumatic Brain Injury Taskforce (TBI Edge), and Vestibular Taskforce (VEDge) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

**Abbreviations:**

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|  | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post) | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months)<br>Vestibular > 6 weeks |
|--|---------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------|
|  |                                                               |                                                               |                                                        |

|                     | (Vestibular < 6 weeks post) |           |           |
|---------------------|-----------------------------|-----------|-----------|
| <b>SCI EDGE</b>     | <i>NR</i>                   | <i>NR</i> | <i>LS</i> |
| <b>StrokEDGE II</b> | <i>UR</i>                   | <i>R</i>  | <i>UR</i> |
| <b>VEDGE</b>        | <i>LS</i>                   | <i>LS</i> | <i>LS</i> |

Recommendations Based on Parkinson Disease Hoehn and Yahr stage:

|                | <b>I</b> | <b>II</b> | <b>III</b> | <b>IV</b> | <b>V</b>  |
|----------------|----------|-----------|------------|-----------|-----------|
| <b>PD EDGE</b> | <i>R</i> | <i>R</i>  | <i>R</i>   | <i>R</i>  | <i>NR</i> |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>MS EDGE</b>      | <i>UR</i>         | <i>UR</i>                       | <i>UR</i>                       | <i>UR</i>                        | <i>UR</i>          |
| <b>StrokEDGE II</b> | <i>UR</i>         | <i>R</i>                        | <i>R</i>                        | <i>R</i>                         | <i>R</i>           |
| <b>TBI EDGE</b>     | <i>NR</i>         | <i>LS</i>                       | <i>LS</i>                       | <i>LS</i>                        | <i>NR</i>          |

Recommendations based on SCI AIS Classification:

|                 | <b>AIS A/B</b> | <b>AIS C/D</b> |
|-----------------|----------------|----------------|
| <b>SCI EDGE</b> | <i>LS</i>      | <i>LS</i>      |

Recommendations for use based on ambulatory status after brain injury:

|                 | <b>Completely Independent</b> | <b>Mildly dependant</b> | <b>Moderately Dependant</b> |
|-----------------|-------------------------------|-------------------------|-----------------------------|
| <b>TBI EDGE</b> | <i>LS</i>                     | <i>LS</i>               | <i>LS</i>                   |

Recommendations based on EDSS Classification:

|                | <b>EDSS 0.0 – 3.5</b> | <b>EDSS 4.0 – 5.5</b> | <b>EDSS 6.0 – 7.5</b> |
|----------------|-----------------------|-----------------------|-----------------------|
| <b>MS EDGE</b> | <i>UR</i>             | <i>UR</i>             | <i>UR</i>             |

Recommendations based on vestibular diagnosis

|              | <b>Peripheral</b> | <b>Central</b> | <b>Benign Paroxysmal Positional Vertigo (BPPV)</b> |
|--------------|-------------------|----------------|----------------------------------------------------|
| <b>VEDGE</b> | <i>LS</i>         | <i>LS</i>      | <i>LS</i>                                          |

Recommendations for entry-level physical therapy education and use in research:

|  | <b>Students should learn to administer</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|--|--------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
|  |                                            |                                                  |                                                                    |                                                             |

|                     | this tool?<br>(Y/N) |     |     |              |
|---------------------|---------------------|-----|-----|--------------|
| <b>MS EDGE</b>      | No                  | No  | No  | Yes          |
| <b>PD EDGE</b>      | No                  | Yes | Yes | Not reported |
| <b>SCI EDGE</b>     | No                  | No  | No  | Not reported |
| <b>StrokEDGE II</b> | No                  | Yes | Yes | Not reported |
| <b>TBI EDGE</b>     | No                  | No  | No  | Not reported |
| <b>VEDGE</b>        | No                  | Yes | Yes | Yes          |

#### Considerations

- The BESTest is suitable for assessing balance in individuals with subacute stroke across many levels of functional ability, demonstrated by the distribution of BESTest scores.
- The BESTest allows the clinician to tailor their intervention to specific postural control systems, due to the instrument's ability to provide information regarding particular balance systems underlying balance impairments.
- The BESTest may be preferred to the BBS and Mini-BESTest for functional classification due to its slightly larger LR+.
- The BESTest may be more preferable than other balance scales due to its lack of floor and ceiling effects.
- Unknown whether or not the BESTest may be generalizable to patients with chronic stroke, cognitive impairment (Mini-Mental State Exam < 24), lesions involving the brainstem or cerebellum, aphasia, or presence of major conditions sufficient to disturb balance.
- Strong psychometric studies in PD population with ability to detect retrospective fallers and predict falls over 6 month period with 68% cut off score
- Limited evidence of its utility in directing treatment
- Time to complete BESTest may not be feasible in all clinical settings, but is a strong tool for more in depth diagnostic assessment of balance impairment in PD

#### Balance Evaluation Systems Test translations:

Danish:

<http://fysio.dk/fafo/Maleredskaber/Maleredskaber-alfabetisk/BESTest/>

Brazilian Portuguese:

Rodrigues LC, Marques AP, Barros PB, Michaelsen SM. Reliability of the Balance Evaluation Systems Test (BESTest) and BESTest sections for adults with hemiparesis. Brazilian journal of physical therapy. 2014;18(3):276-81.

Intra- and inter-rater reliability and concurrent and convergent validity evaluated in the Adult Stroke population

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Do you see an error or have a suggestion for this instrument summary? Please [e-mail us!](#)

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Horak, F. B., Wrisley, D. M., et al. (2009). "The Balance Evaluation Systems Test (BESTest) to differentiate balance deficits." *Phys Ther* 89(5): 484-498. [Find it on PubMed](#)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>Jacobs, JV. &amp; Kasser, SL, (2012). Balance impairment in people with multiple sclerosis: Preliminary evidence for the Balance Evaluation Systems Test. <i>Gait &amp; Posture</i> 36: 414-418.</p> <p>Leddy, A. L., Crowner, B. E., et al. (2011). "Functional gait assessment and balance evaluation system test: reliability, validity, sensitivity, and specificity for identifying individuals with Parkinson disease who fall." <i>Physical Therapy</i> 91(1): 102-113. <a href="#">Find it on PubMed</a></p> <p>Leddy, A. L., Crowner, B. E., et al. (2011). "Functional gait assessment and balance evaluation system test: reliability, validity, sensitivity, and specificity for identifying individuals with Parkinson disease who fall." <i>Phys Ther</i> 91(1): 102-113. <a href="#">Find it on PubMed</a></p> <p>Leddy, A. L., Crowner, B. E., et al. (2011). "Utility of the Mini-BESTest, BESTest, and BESTest sections for balance assessments in individuals with Parkinson disease." <i>J Neurol Phys Ther</i> 35(2): 90-97. <a href="#">Find it on PubMed</a></p> <p>Padgett, P. K., Jacobs, J. V., et al. (2012). "Is the BESTest at its best? A suggested brief version based on interrater reliability, validity, internal consistency, and theoretical construct." <i>Physical therapy</i> 92(9): 1197-1207.</p> |
| <b>Year published</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## 5. REHAB MEASURES DATABASE—BOX AND BLOCK TEST

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | <a href="#">Box and Blocks Test Instructions</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Title of Assessment    | Box and Block Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Acronym                | BBT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Instrument Reviewer(s) | Initially reviewed by Jason Raad, MS of the Rehabilitation Measures Team and Dorian Rose, PT, PhD of the StrokEdge Taskforce of the Academy of Neurologic Physical Therapy - a component of APTA in 9/2011; Updated with references for Stroke and Fibromyalgia populations by Denise Toombs, SPT and Marina Yusupova, SPT in 2011; Reviewed and updated by Michele Sulwer, PT, DPT, NCS and Genevieve Pinto-Zipp, PT, EdD, of the StrokEDGE II Neurology Section, APTA, in 4/2016.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Summary Date           | 4/26/2012                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Purpose                | Assesses unilateral gross manual dexterity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Description            | <ul style="list-style-type: none"> <li>• Individuals are seated at a table, facing a rectangular box that is divided into two square compartments of equal dimension by means of a partition.</li> <li>• One hundred and fifty, 2.5 cm, colored, wooden cubes or blocks are placed in one compartment or the other.</li> <li>• The individual is instructed to move as many blocks as possible, one at a time, from one compartment to the other for a period of 60 seconds.</li> <li>• Standardized dimensions for the test materials and procedures for test administration and scoring have been provided by Mathiowetz et al, 1985.</li> <li>• To administer the test, the examiner is seated opposite the individual in order to observe test performance.</li> <li>• The BBT is scored by counting the number of blocks carried over the partition from one compartment to the other during the one-minute trial period.</li> <li>• Patient's hand must cross over the partition in order for a point to be given, and blocks that drop or bounce out of the second compartment onto the floor are still rewarded with a point.</li> <li>• Multiple blocks carried over at the same time count as a single point.</li> <li>• Higher scores on the test indicate better gross manual dexterity.</li> </ul> |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Area of Assessment</b>        | Activities of Daily Living; Coordination; Dexterity; Upper Extremity Function                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Body Part</b>                 | Not Applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>ICF Domain</b>                | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Domain</b>                    | Motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Assessment Type</b>           | Observer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Length of Test</b>            | 05 Minutes or Less                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Time to Administer</b>        | 2-5 minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Number of Items</b>           | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Equipment Required</b>        | <ul style="list-style-type: none"> <li>• Stopwatch</li> <li>• Wooden box dimensioned in 53.7 cm x 25.4 cm x 8.5 cm</li> <li>• Partition (should be placed at the middle of the box, dividing it in two containers of 25.4 cm each)</li> <li>• 150 wooden cubes (2.5 cm in size)</li> </ul>                                                                                                                                                                                                                                        |
| <b>Training Required</b>         | No Training                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Type of training required</b> | No Training                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Cost</b>                      | Not Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Actual Cost</b>               | <p>Commercially produced versions of the test can be purchased for approximately \$200.00 (as of 2011)</p> <p><a href="http://www.wisdomking.com/product/box-block-test">http://www.wisdomking.com/product/box-block-test</a></p> <p><a href="http://www.pattersonmedical.com/app.aspx?cmd=get_product&amp;id=79848">http://www.pattersonmedical.com/app.aspx?cmd=get_product&amp;id=79848</a></p> <p><a href="http://www.medicalsuppliest.com/box-and-block-test-1">http://www.medicalsuppliest.com/box-and-block-test-1</a></p> |
| <b>Age Range</b>                 | Child: 6-12 years; Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Administration Mode</b>       | Paper/Pencil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Diagnosis</b>                 | Multiple Sclerosis; Stroke; Traumatic Brain Injury                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Populations Tested</b>        | <ul style="list-style-type: none"> <li>• Stroke</li> <li>• Multiple Sclerosis</li> <li>• Traumatic Brain Injury (TBI)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                  |

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                  | <ul style="list-style-type: none"> <li>• Neuromuscular Disorders</li> <li>• Geriatric</li> <li>• Spinal Cord Injury (SCI)</li> <li>• Fibromyalgia</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Standard Error of Measurement (SEM)              | <p><b><u>Acute and Chronic Stroke:</u></b> (calculated from statistics in Chen et al, 2009; <math>n = 62</math> volunteer participants who had sustained a stroke; mean age = 61 (9.9) years; median time post-stroke = 8 months)</p> <p>(**Note: To calculate the Smallest Real Difference (SRD; aka Minimal Detectable Change MDC) the authors averaged the standard deviations from time points 1 &amp; 2 rather than using the baseline standard deviation; thus, to calculate the SEM, an average standard deviation was used).</p> <ul style="list-style-type: none"> <li>• <b>BBT More Affected Hand:</b> SEM= 1.99</li> <li>• <b>BBT Less Affected Hand:</b> SEM= 2.84</li> <li>• <b>BBT Spastic Group:</b> SEM= 2.92</li> <li>• <b>BBT Non-spastic Group:</b> SEM= 2.23</li> </ul> |
| Minimal Detectable Change (MDC)                  | <p><b><u>Acute and Chronic Stroke:</u></b> (Chen et al, 2009)</p> <ul style="list-style-type: none"> <li>• MDC: 5.5 blocks per minute</li> <li>• Percentage change: 18%</li> </ul> <p><b><u>Spastic Hemiplegia:</u></b> (Siebers et al, 2010; <math>n = 17</math> patients with spastic hemiplegia; median age = 54(22-67) years; 2 week training program; 6 month follow-up)</p> <ul style="list-style-type: none"> <li>• MDC for 2 week training program: 4 blocks per minute</li> <li>• MDC for 6 month follow-up: 6 blocks per minute</li> </ul>                                                                                                                                                                                                                                        |
| Minimally Clinically Important Difference (MCID) | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Cut-Off Scores                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Normative Data                                   | <p><b><u>Normal adults:</u></b> (Mathiowetz et al, 1985; <math>n = 310</math> normal adult males, 318 normal adult females; aged 20 and up)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

### Average Number of Cubes Transferred in One Minute

| Age   | Hand | Male |      | Female |      |
|-------|------|------|------|--------|------|
|       |      | Mean | SD   | Mean   | SD   |
| 40-44 | R    | 83.0 | 8.1  | 81.1   | 8.2  |
|       | L    | 80.0 | 8.8  | 79.7   | 8.8  |
| 45-49 | R    | 76.9 | 9.2  | 82.1   | 7.5  |
|       | L    | 75.8 | 7.8  | 78.3   | 7.6  |
| 50-54 | R    | 79.0 | 9.7  | 77.7   | 10.7 |
|       | L    | 77.0 | 9.2  | 74.3   | 9.9  |
| 55-59 | R    | 75.2 | 11.9 | 74.7   | 8.9  |
|       | L    | 73.8 | 10.5 | 73.6   | 7.8  |
| 60-64 | R    | 71.3 | 8.8  | 76.1   | 6.9  |
|       | L    | 70.5 | 8.1  | 73.6   | 6.4  |
| 65-69 | R    | 68.5 | 7.1  | 72.0   | 6.2  |
|       | L    | 67.4 | 7.8  | 71.3   | 7.7  |
| 70-74 | R    | 66.3 | 9.2  | 68.6   | 7.0  |
|       | L    | 64.3 | 9.8  | 68.3   | 7.0  |
| 75+   | R    | 63.0 | 7.1  | 65.0   | 7.1  |
|       | L    | 61.3 | 8.4  | 63.6   |      |

**Normal children:** (Mathiowetz et al, 1985;  $n = 471$  normal children, 231 males, 240 females; age range = 6-19 years)

### Average Number of Cubes Transferred in One Minute

| Age   | Hand | Male |     | Female |     |
|-------|------|------|-----|--------|-----|
|       |      | Mean | SD  | Mean   | SD  |
| 6-7   | R    | 54.4 | 6.6 | 57.9   | 5.3 |
|       | L    | 50.7 | 6.3 | 54.2   | 5.6 |
| 8-9   | R    | 63.4 | 4.3 | 62.8   | 5.1 |
|       | L    | 60.1 | 4.9 | 60.4   | 5.2 |
| 10-11 | R    | 68.4 | 6.9 | 70.0   | 7.6 |
|       | L    | 65.9 | 6.8 | 67.6   | 8.6 |
| 12-13 | R    | 74.6 | 8.3 | 73.6   | 8.1 |
|       | L    | 72.4 | 8.2 | 70.5   | 6.2 |
| 14-15 | R    | 76.6 | 8.7 | 75.4   | 8.5 |
|       | L    | 74.6 | 7.9 | 72.1   | 7.6 |
| 16-17 | R    | 80.3 | 8.7 | 77.0   | 9.0 |
|       | L    | 77.6 | 5.1 | 74.3   | 9.1 |

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |     |      |     |      |     |  |   |      |     |      |     |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|------|-----|------|-----|--|---|------|-----|------|-----|
|                                      | <table><tr><td>18-19</td><td>R</td><td>79.9</td><td>8.9</td><td>77.9</td><td>9.4</td></tr><tr><td></td><td>L</td><td>79.2</td><td>8.8</td><td>76.0</td><td>8.5</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 18-19 | R   | 79.9 | 8.9 | 77.9 | 9.4 |  | L | 79.2 | 8.8 | 76.0 | 8.5 |
| 18-19                                | R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 79.9  | 8.9 | 77.9 | 9.4 |      |     |  |   |      |     |      |     |
|                                      | L                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 79.2  | 8.8 | 76.0 | 8.5 |      |     |  |   |      |     |      |     |
| Test-retest Reliability              | <p><b><u>Acute and Chronic Stroke:</u></b> (Chen et al, 2009)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> test-retest reliability when tested on more affected (<math>r = 0.98</math>) and less affected hand (<math>r = 0.93</math>)</li></ul> <p><b><u>Upper Limb Impairment:</u></b> (Desrosiers et al, 1994; <math>n = 35</math> able bodied subjects; mean age = 71.7(60-89) years; <math>n = 34</math> subjects with impairment; mean age = 74.5(65-87) years)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> test-retest reliability of the right hand for able bodied subjects (ICC= 0.97)</li><li>• <b>Excellent</b> test-retest reliability of the left hand for able bodied subjects (ICC= 0.96)</li><li>• <b>Excellent</b> test-retest reliability of the right hand for subjects with impairment (ICC= 0.90)</li><li>• <b>Excellent</b> test-retest reliability of the left hand for subjects with impairment (ICC= 0.89)</li></ul> <p><b><u>Upper Extremity Paresis:</u></b> (Platz et al, 2005; <math>n = 56</math> people with upper limb paresis as a result of stroke, Multiple Sclerosis (MS), and traumatic brain injury (TBI); median age = 54(13-92) years; <math>n = 37</math> for stroke; median age = 62(22-92) years; <math>n = 14</math> for MS; median age = 43(28-60) years; <math>n = 5</math> for TBI; median age = 34(13-50) years)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> test-retest reliability (ICC = 0.96)</li></ul> <p><b><u>Spastic Hemiplegia:</u></b> (Siebers et al, 2010)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> test-retest reliability (ICC = 0.95)</li></ul> |       |     |      |     |      |     |  |   |      |     |      |     |
| Interrater / Intratester Reliability | <p><b><u>Normal Adults:</u></b> (Mathiowetz et al, 1985)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> interrater reliability for the right hand (<math>r = 1.00</math>)</li><li>• <b>Excellent</b> interrater reliability for the left hand (<math>r = 0.99</math>)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |       |     |      |     |      |     |  |   |      |     |      |     |

|                                                | <p><b><u>Upper Extremity Paresis:</u></b> (Platz et al, 2005)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> interrater reliability (ICC = 0.99)</li></ul> <p><b><u>Spastic Hemiplegia:</u></b> (Siebers et al, 2010)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> interrater reliability (<math>r = 0.95</math>)</li></ul> <p><b><u>Fibromyalgia:</u></b> (Canny et al, 2009; <math>n = 30</math> participants with fibromyalgia; mean age = 46.9(range 20-68) years; <math>n = 30</math> healthy participants; mean age= 41.2(29-52) years)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> intrarater reliability for participants with fibromyalgia (ICC = 0.90)</li><li>• <b>Excellent</b> intrarater reliability for healthy participants (ICC = 0.98)</li><li>• <b>Excellent</b> interrater reliability for participants with fibromyalgia (ICC = 0.85)</li><li>• <b>Excellent</b> interrater reliability for healthy participants (ICC = 0.80)</li></ul>                                                                                                                                                       |                                              |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|--|--|---------|----------------------|-----------------------|------|----------------------------|----------------------------|------|---------------------------|---------------------------|-----|--------------------------|--------------------------|---------|---------------------------|--------------------------|---------|--------------------------|--------------------------|-----|--------------------------|--------------------------|
| Internal Consistency                           | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                              |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |
| Criterion Validity (Predictive / Concurrent)   | <p><b><u>Stroke:</u></b> (Lin et al, 2010; <math>n = 59</math> patients with stroke; sex = 47 males, 12 females; mean age = 55.5(11.66) years)</p> <table><tr><th colspan="3">Concurrent Validity Pre- and Post- Treatment</th></tr><tr><th>Measure</th><th>Pretreatment (<math>r</math>)</th><th>Posttreatment (<math>r</math>)</th></tr><tr><td>NHPT</td><td>-0.80 (<b>Excellent</b>)</td><td>-0.71 (<b>Excellent</b>)</td></tr><tr><td>ARAT</td><td>0.63 (<b>Excellent</b>)</td><td>0.64 (<b>Excellent</b>)</td></tr><tr><td>FMA</td><td>0.44 (<b>Adequate</b>)</td><td>0.35 (<b>Adequate</b>)</td></tr><tr><td>MAL-AOU</td><td>-0.37 (<b>Adequate</b>)</td><td>0.49 (<b>Adequate</b>)</td></tr><tr><td>MAL-QOM</td><td>0.52 (<b>Adequate</b>)</td><td>0.52 (<b>Adequate</b>)</td></tr><tr><td>SIS</td><td>0.59 (<b>Adequate</b>)</td><td>0.52 (<b>Adequate</b>)</td></tr></table> <p>ARAT = Action Research Arm Test, BBT = Box and Block Test, CI = confidence interval, FMA = Fugl-Meyer Assessment, MAL-AOU = Motor Activity Log-Amount of Use, MAL-QOM = Motor Activity Log-Quality of Movement, NHPT = Nine-Hole Peg Test, SIS = Stroke Impact Scale</p> | Concurrent Validity Pre- and Post- Treatment |  |  | Measure | Pretreatment ( $r$ ) | Posttreatment ( $r$ ) | NHPT | -0.80 ( <b>Excellent</b> ) | -0.71 ( <b>Excellent</b> ) | ARAT | 0.63 ( <b>Excellent</b> ) | 0.64 ( <b>Excellent</b> ) | FMA | 0.44 ( <b>Adequate</b> ) | 0.35 ( <b>Adequate</b> ) | MAL-AOU | -0.37 ( <b>Adequate</b> ) | 0.49 ( <b>Adequate</b> ) | MAL-QOM | 0.52 ( <b>Adequate</b> ) | 0.52 ( <b>Adequate</b> ) | SIS | 0.59 ( <b>Adequate</b> ) | 0.52 ( <b>Adequate</b> ) |
| Concurrent Validity Pre- and Post- Treatment   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                              |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |
| Measure                                        | Pretreatment ( $r$ )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Posttreatment ( $r$ )                        |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |
| NHPT                                           | -0.80 ( <b>Excellent</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -0.71 ( <b>Excellent</b> )                   |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |
| ARAT                                           | 0.63 ( <b>Excellent</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.64 ( <b>Excellent</b> )                    |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |
| FMA                                            | 0.44 ( <b>Adequate</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.35 ( <b>Adequate</b> )                     |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |
| MAL-AOU                                        | -0.37 ( <b>Adequate</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.49 ( <b>Adequate</b> )                     |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |
| MAL-QOM                                        | 0.52 ( <b>Adequate</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.52 ( <b>Adequate</b> )                     |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |
| SIS                                            | 0.59 ( <b>Adequate</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.52 ( <b>Adequate</b> )                     |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |
| Construct Validity (Convergent / Discriminant) | <p><b><u>Upper Limb Impairment:</u></b> (Desrosiers et al, 1994)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> convergent validity with the Action Research Arm Test (<math>r = 0.80</math>)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                              |  |  |         |                      |                       |      |                            |                            |      |                           |                           |     |                          |                          |         |                           |                          |         |                          |                          |     |                          |                          |

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          | <ul style="list-style-type: none"> <li>• <b>Adequate</b> convergent validity with Functional Autonomy Measurement System (<math>r</math> (right hand) = 0.47; <math>r</math> (left hand) = 0.51)</li> </ul> <p><b>Upper Extremity Paresis:</b> (Platz et al, 2005)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> convergent validity with the Action Research Arm Test (<math>r</math> = 0.95)</li> <li>• <b>Excellent</b> convergent validity with the Fugl-Meyer Test (<math>r</math> = 0.92)</li> <li>• <b>Excellent</b> convergent validity with the Hemispheric Stroke Scale (<math>r</math> = -0.67)</li> <li>• <b>Adequate</b> convergent validity with the Passive Joint motion/Joint pain sub-scale of Fugl-Meyer Test (<math>r</math> = 0.43)</li> <li>• <b>Poor</b> convergent validity with the Modified Barthel Index (<math>r</math> = 0.04)</li> </ul> <p><b>Central Paresis:</b> (Platz et al, 2008; <math>n</math> = 33 neurological patients with central paresis due to stroke, ischemic/anoxic brain damage, traumatic brain injury, or spinal cord injury; <math>n=3</math> patients with SCI(C3,C4,T8), 6 patients with TBI, and 23 patients with stroke; sex = 20 males, 13 females; mean duration of disease = 19.4 months; mean age = 49.7(17.3) years)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> convergent validity with Resistance to Passive Movement (<math>r</math> = -0.680)</li> </ul> |
| Content Validity                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Face Validity                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Floor / Ceiling Effects                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Responsiveness                           | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Professional Association Recommendations | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StroKEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

**Abbreviations:**

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|                         | <b>Acute<br/>(CVA &lt; 2 months<br/>post)<br/>(SCI &lt; 1 month post)<br/>(Vestibular &lt; 6<br/>months post)</b> | <b>Subacute<br/>(CVA 2 to 6<br/>months)<br/>(SCI 3 to 6<br/>months)</b> | <b>Chronic<br/>(&gt; 6 months)</b> |
|-------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------|
| <b>StrokEDGE<br/>II</b> | <i>R</i>                                                                                                          | <i>R</i>                                                                | <i>R</i>                           |

Recommendations based on level of care in which the assessment is taken:

|                         | <b>Acute<br/>Care</b> | <b>Inpatient<br/>Rehabilitation</b> | <b>Skilled<br/>Nursing<br/>Facility</b> | <b>Outpatient<br/>Rehabilitation</b> | <b>Home<br/>Health</b> |
|-------------------------|-----------------------|-------------------------------------|-----------------------------------------|--------------------------------------|------------------------|
| <b>MS EDGE</b>          | <i>R</i>              | <i>R</i>                            | <i>R</i>                                | <i>R</i>                             | <i>R</i>               |
| <b>StrokEDGE<br/>II</b> | <i>R</i>              | <i>R</i>                            | <i>R</i>                                | <i>R</i>                             | <i>R</i>               |

Recommendations based on EDSS Classification:

|                | <b>EDSS 0.0 – 3.5</b> | <b>EDSS 4.0 – 5.5</b> | <b>EDSS 6.0 – 7.5</b> |
|----------------|-----------------------|-----------------------|-----------------------|
| <b>MS EDGE</b> | <i>R</i>              | <i>R</i>              | <i>R</i>              |

Recommendations for entry-level physical therapy education and use in research:

|                         | <b>Students<br/>should learn<br/>to<br/>administer<br/>this tool?<br/>(Y/N)</b> | <b>Students<br/>should be<br/>exposed to<br/>tool? (Y/N)</b> | <b>Appropriate<br/>for use in<br/>intervention<br/>research<br/>studies? (Y/N)</b> | <b>Is additional<br/>research<br/>warranted<br/>for this tool<br/>(Y/N)</b> |
|-------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| <b>MS EDGE</b>          | <i>No</i>                                                                       | <i>Yes</i>                                                   | <i>Yes</i>                                                                         | <i>No</i>                                                                   |
| <b>StrokEDGE<br/>II</b> | <i>No</i>                                                                       | <i>Yes</i>                                                   | <i>Yes</i>                                                                         | <i>Yes</i>                                                                  |

**Considerations**

- Changing block surfaces to rubber, improved BBT scores 8% for controls and stroke survivors (both paretic and non-paretic hands), by reducing movement time for “finger closing” and “contact-to-lift”. This study suggests the need to modify daily objects with rubber and indicate need for therapy to focus on goal directed reaching and object grasping/releasing. (Slota et al, 2013)

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | Do you see an error or have a suggestion for this instrument summary? Please <a href="#">e-mail us!</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Bibliography</b> | <p>Canny, M. L., Thompson, J. M., et al. (2009). "Reliability of the box and block test of manual dexterity for use with patients with fibromyalgia." <i>Am J Occup Ther</i> 63(4): 506-510. <a href="#">Find it on PubMed</a></p> <p>Chen, H. M., Chen, C. C., et al. (2009). "Test-retest reproducibility and smallest real difference of 5 hand function tests in patients with stroke." <i>Neurorehabil Neural Repair</i> 23(5): 435-440. <a href="#">Find it on PubMed</a></p> <p>Desrosiers, J., Bravo, G., et al. (1994). "Validation of the Box and Block Test as a measure of dexterity of elderly people: reliability, validity, and norms studies." <i>Arch Phys Med Rehabil</i> 75: 751-755. <a href="#">Find it on PubMed</a></p> <p>Lin, K. C., Chuang, L. L., et al. (2010). "Responsiveness and validity of three dexterous function measures in stroke rehabilitation." <i>J Rehabil Res Dev</i> 47(6): 563-571. <a href="#">Find it on PubMed</a></p> <p>Mathiowetz, V., Ferderman, S., et al. (1985). "Box and Block Test of Manual Dexterity: Norms for 6-19 Year Olds." <i>Canadian Journal of Occupational Therapy. Revue Canadienne d'ergothérapie</i> 52(5): 241-246. <a href="#">Find it on PubMed</a></p> <p>Mathiowetz, V., Volland, G., et al. (1985). "Adult norms for the Box and Block Test of manual dexterity." <i>Am J Occup Ther</i> 39(3160243): 386-391. <a href="#">Find it on PubMed</a></p> <p>Platz, T., Pinkowski, C., et al. (2005). "Reliability and validity of arm function assessment with standardized guidelines for the Fugl-Meyer Test, Action Research Arm Test and Box and Block Test: a multicentre study." <i>Clin Rehabil</i> 19(4): 404-411. <a href="#">Find it on PubMed</a></p> <p>Platz, T., Vuadens, P., et al. (2008). "REPAS, a summary rating scale for resistance to passive movement: item selection, reliability and validity." <i>Disabil Rehabil</i> 30(1): 44-53. <a href="#">Find it on PubMed</a></p> <p>Siebers, A., Oberg, U., et al. (2010). "The effect of modified constraint-induced movement therapy on spasticity and motor function of the affected arm in patients with chronic stroke." <i>Physiother Can</i> 62(4): 388-396. <a href="#">Find it on PubMed</a></p> |

|                                 |                                                                                                                                                                                                                                 |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | Slota, G., Enders, L., et al. (2013). "Improvement of hand function using different surfaces and identification of difficult movement post stroke in the Box and Block Test." Applied Ergonomics 45: 833-838. Find it on PubMed |
| <b>Year published</b>           | 1957                                                                                                                                                                                                                            |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                             |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                        |

## 6. REHAB MEASURES DATABASE—CANADIAN OCCUPATIONAL PERFORMANCE MEASURE

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | <a href="#">Available for purchase at the Canadian Association of Occupational Therapists (external link)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Title of Assessment    | Canadian Occupational Performance Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Acronym                | COPM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Instrument Reviewer(s) | Initially reviewed by the Rehabilitation Measures Team; Updated with references from the TBI population by Anna de Joya, PT, DSc, NCS, Coby Nirider, PT, DPT, and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2012; Updated with references for Arthritis, Pediatrics, and Ankylosing Spondylitis by Brianna DeBois, SPT, Samantha Dillon, SPT, and Jennifer Kick, SPT in 11/2012. Updated by Maggie Bland PT,DPT,NCS and Nancy Byl PT,MPH,PhD, FAPTA and the StrokEdge II task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2016.                                                                                                                                                                                                                                                                                                                                                                       |
| Summary Date           | 4-19-2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Purpose                | Assesses an individual's perceived occupational performance in the areas of self-care, productivity, and leisure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Description            | <p>The assessment involves a 5-step process nested within a semi-structured interview, typically conducted by an Occupational Therapist.</p> <ul style="list-style-type: none"> <li>• Interview focuses on identifying activities within each performance domain that the client wants, needs, or is expected to perform.</li> <li>• Following Step 3, the patient and therapist create goals for therapeutic interventions.</li> <li>• The interviewer may need to supplement information gathered during the COPM interview through other techniques including direct observation, administration of standardized tests, or an assessment of the patient's environment (Law et al, 1990).</li> <li>• Has been translated into 24 languages and is used in over 35 countries. Also available in Pediatric, French, Hebrew, Icelandic, Japanese, German, Danish, Swedish, Greek, Spanish, Mandarin Chinese, Korean, Russian, Slavic, Italian, Portuguese and Norwegian versions.</li> </ul> |

|                                  |                                                                                                                                                                                                                                                                        |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>Caregiver/proxy may respond on the patient's behalf, but they may not identify the same deficits or problems as the patient would and there may be differences in opinion in regard to the importance of activities.</li> </ul> |
| <b>Area of Assessment</b>        | Activities of Daily Living; Functional Mobility; Life Participation; Occupational Performance                                                                                                                                                                          |
| <b>Body Part</b>                 | Not Applicable                                                                                                                                                                                                                                                         |
| <b>ICF Domain</b>                | Participation                                                                                                                                                                                                                                                          |
| <b>Domain</b>                    | ADL; General Health; Motor                                                                                                                                                                                                                                             |
| <b>Assessment Type</b>           | Patient Reported Outcomes                                                                                                                                                                                                                                              |
| <b>Length of Test</b>            | 06 to 30 Minutes                                                                                                                                                                                                                                                       |
| <b>Time to Administer</b>        | 10-20 minutes                                                                                                                                                                                                                                                          |
| <b>Number of Items</b>           | Not applicable                                                                                                                                                                                                                                                         |
| <b>Equipment Required</b>        | None necessary                                                                                                                                                                                                                                                         |
| <b>Training Required</b>         | None necessary                                                                                                                                                                                                                                                         |
| <b>Type of training required</b> | Reading an Article/Manual                                                                                                                                                                                                                                              |
| <b>Cost</b>                      | Not Free                                                                                                                                                                                                                                                               |
| <b>Actual Cost</b>               | A 45-minute DVD and Workbook with COPM manual and 100 Forms is \$225.45 (Canadian) or a Manual/Form Kit for \$52.45 (Canadian) can be purchased from the Canadian Association of Occupational Therapists (cost determined in November, 2012)                           |
| <b>Age Range</b>                 | Child: 6-12 years; Adolescent: 13-17 years; Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                     |
| <b>Administration Mode</b>       | Paper/Pencil                                                                                                                                                                                                                                                           |
| <b>Diagnosis</b>                 | Arthritis; Cerebral Palsy; Chronic Obstructive Pulmonary Disease; Pain; Parkinson's Disease; Spinal Cord Injury; Stroke; Traumatic Brain Injury                                                                                                                        |
| <b>Populations Tested</b>        | <p>The COPM was designed for use with all clients regardless of diagnosis (Law et al, 2004). The COPM has been validated with patients drawn from the following populations:</p> <ul style="list-style-type: none"> <li>Stroke</li> </ul>                              |

|                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            | <ul style="list-style-type: none"> <li>• COPD</li> <li>• Pain</li> <li>• Cerebral Palsy</li> <li>• Traumatic Brain Injury</li> <li>• Parkinson's Disease</li> <li>• Arthritis</li> <li>• Pediatrics</li> <li>• Ankylosing Spondylitis</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Standard Error of Measurement (SEM)</b> | <p><b><u>Ankylosing Spondylitis:</u></b><br/>(calculated from statistics in Kjenken et al, 2005; Rescore by personal interview, <math>n=17</math>, mean age 46.4 (12.8) years; Rescore by telephone, <math>n=25</math>, mean age 48.7 (13.3) years; Rescore by mail, <math>n=24</math>, mean age 46.6 (12.5) years; 2 weeks between assessments, Ankylosing Spondylitis)</p> <ul style="list-style-type: none"> <li>• Personal interview <ul style="list-style-type: none"> <li>◦ SEM for performance=0.66</li> <li>◦ SEM for satisfaction=0.84</li> </ul> </li> <li>• Telephone interview <ul style="list-style-type: none"> <li>◦ SEM for performance=1.41</li> <li>◦ SEM for satisfaction=1.86</li> </ul> </li> <li>• Mail <ul style="list-style-type: none"> <li>◦ SEM for performance=0.99</li> <li>◦ SEM for satisfaction=1.13</li> </ul> </li> </ul> <p><b><u>Stroke:</u></b><br/>(calculated from statistics in Cup et al, 2003, Acute Stroke) 2 to 6 months post onset</p> <ul style="list-style-type: none"> <li>• SEM for performance=1.2 points</li> <li>• SEM for satisfaction=1.9 points</li> </ul> |
| <b>Minimal Detectable Change (MDC)</b>     | <p><b><u>Ankylosing Spondylitis:</u></b><br/>(calculated from statistics in Kjenken et al, 2005)</p> <ul style="list-style-type: none"> <li>• Personal interview <ul style="list-style-type: none"> <li>◦ MDC for performance=1.59</li> <li>◦ MDC for satisfaction - 1.80</li> </ul> </li> <li>• Telephone interview <ul style="list-style-type: none"> <li>◦ MDC for performance=2.33</li> <li>◦ MDC for satisfaction=2.63</li> </ul> </li> <li>• Mail <ul style="list-style-type: none"> <li>◦ MDC for performance=1.95</li> <li>◦ MDC for satisfaction=2.08</li> </ul> </li> </ul> <p><b><u>Osteoarthritis:</u></b><br/>(calculated by MacDermid et al, 2009 from Kjenken et al, 2005; <math>n=87</math>, women, mean age=62.7 (5.4) years, Hand Osteoarthritis)</p> <ul style="list-style-type: none"> <li>• MDC= 5</li> </ul> <p><b><u>Stroke:</u></b><br/>(calculated from statistics in Cup et al, 2003, Acute Stroke) 2 to 6 months post onset</p> <ul style="list-style-type: none"> <li>• MDC for performance=1.7 points</li> <li>• MDC for satisfaction=2.7 points</li> </ul>                          |

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Minimally Clinically Important Difference (MCID) | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Cut-Off Scores                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Normative Data                                   | <p><b><u>Acute Stroke:</u></b><br/>(Cup et al, 2003; <math>n=26</math>; mean age=68 (15) years; mean time between assessments=8 days (2.5) days, range 5–16 days, Acute Stroke)<br/>Mean performance and satisfaction scores Mode number of problems identified over two assessments 3 to 5</p> <ul style="list-style-type: none"> <li>• <b>Interview 1:</b> mean <u>performance</u> score 3.5 (SD 1.8, range 1.0–7.0)</li> <li>• <b>Interview 2:</b> mean <u>performance</u> score 3.7 (SD 1.9, range 1.0–6.8)</li> <li>• <b>Interview 1:</b> mean <u>satisfaction</u> score 3.3 (SD 1.9, range 1.0–7.5)</li> <li>• <b>Interview 2:</b> mean <u>satisfaction</u> score 3.5 (SD 2.1, range 1.0–7.4)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Test-retest Reliability                          | <p><b><u>Adults with impairment in 1 or more ADL:</u></b><br/>(Eyssen et al, 2005; <math>n=95</math>; mean age 47 (15) years; various diagnoses; COPM administered twice, 7 days between assessments)</p> <ul style="list-style-type: none"> <li>• <b>Adequate</b> test-retest reliability (ICC=0.67 performance and 0.69 satisfaction)</li> </ul> <p><b><u>Ankylosing Spondylitis:</u></b><br/>(Kjenken et al, 2005)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> test-retest reliability by personal interview (ICC=0.92 performance and ICC=0.93 satisfaction)</li> <li>• <b>Adequate</b> test-retest reliability by telephone (ICC=0.73 performance and ICC=0.73 satisfaction)</li> <li>• <b>Excellent</b> test-retest reliability by mail (ICC=0.90 performance and ICC=0.90 satisfaction)</li> </ul> <p><b><u>COPD:</u></b><br/>(Sewell &amp; Singh, 2001, COPD)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> test-retest reliability (ICC=0.81 performance and ICC=0.76 satisfaction)</li> </ul> <p><b><u>Stroke:</u></b><br/>(Cup et al, 2003; 2 to 6 months post onset, Acute Stroke)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> test-retest reliability <ul style="list-style-type: none"> <li>o <math>r=0.87</math> performance</li> <li>o <math>r=0.88</math> satisfaction</li> </ul> </li> </ul> |
| Interrater / Intrarater Reliability              | <p><b><u>Acquired Brain Injury:</u></b><br/>(Jenkinson et al, 2007; Community dwelling individuals; <math>n=34</math> (TBI=21; CVA=11; Others=2); total of 15 patients with ABI were involved in the stability study, ABI)</p> <p><b><u>Consistency of self- and relative ratings for no intervention group:</u></b></p> <ul style="list-style-type: none"> <li>• No significant difference in COPM performance ratings for participants (<math>M=4.62</math> (1.72)) and relatives (<math>M=4.49</math> (1.86)); <math>t=0.30</math>, <math>p=0.77</math>)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                               | <ul style="list-style-type: none"> <li>No significant difference in COPM satisfaction ratings for participants (<math>M=4.24(1.89)</math>) and relatives (<math>M=5.01(1.57)</math>); <math>t=-1.79</math>, <math>p=0.078</math>)</li> <li>Participants rated their functional abilities on the Patient Competency Rating Scale (PCRS) (<math>M=111.92(17.58)</math>) at a higher level than their relatives (<math>M=105.75(20.46)</math>); however, no significant difference (<math>t(62)=1.29</math>, <math>p=0.20</math>)</li> <li>Participants' self-ratings relatively consistent with their relatives' ratings</li> </ul> <p>Test-re-test reliability coefficients for the COPM ratings over the 8-week interval were all significant</p> <ul style="list-style-type: none"> <li><b>Excellent</b> (<math>r=0.75-0.86</math>) for relative ratings; <b>Adequate</b> (<math>r=0.53-0.67</math>) for self-ratings</li> </ul> <p><b>Stroke:</b><br/>(Cup et al, 2003; <math>n=26</math>; mean age=68 (15); gender; 11 males, 15 females; time post stroke: 24 patients 6 months post stroke, 2 patients 2 months post stroke, Stroke)<br/>Test retest reliability: interval=8 days</p> <ul style="list-style-type: none"> <li>Spearman's rho correlation coefficient for the performance scores=0.89 (<math>p&lt;0.001</math>) and for the satisfaction scores 0.88 (<math>p&lt;0.001</math>)</li> </ul> |
| Internal Consistency                          | <p><b>Cerebral Palsy:</b><br/>(Cusik et al, 2007; <math>n=42</math>; mean age=3.9 years; time post diagnosis unknown; GMFCS Level 1, Spastic Hemiplegic Cerebral Palsy)</p> <ul style="list-style-type: none"> <li>Using an adapted form of the COPM completed by a parent proxy (deleted the categories of "paid/unpaid work" and "household management"), internal consistency reliability was found to be acceptable for Performance (Cronbach's <math>\alpha=0.73</math>) and Satisfaction (Cronbach's <math>\alpha=0.83</math>).</li> </ul> <p><b>Stroke:</b><br/>(Cup et al, 2003, Acute Stroke)<br/>26 participants were asked to identify problems over the course of two interviews. During the initial COPM interview 115 problems were identified. In the second interview 112 problems were identified. 64 problems (56%) mentioned in the first interview were also mentioned in the second interview.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Criterion Validity<br>(Predictive/Concurrent) | <p><b>Arthritis:</b><br/>(Ripat et al, 2001; <math>n=13</math>, stage 2 or stage 3 RA, Rheumatoid Arthritis)</p> <ul style="list-style-type: none"> <li>Total Performance Scores on the COPM were not significantly correlated to total scores on the disability index of the Health Assessment Questionnaire (HAQ) <ul style="list-style-type: none"> <li><math>r=-0.37^*</math>, <math>p=0.22</math></li> </ul> </li> <li>36 out of 50 activities identified on the COPM exactly matched activities included in the disability dimension of the HAQ. Individual performance scores on the COPM were significantly related to scores on the matched HAQ components and matched HAQ activities <ul style="list-style-type: none"> <li><math>r=-0.52^*</math>, <math>p&lt;0.01</math></li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

◦  $r = -0.67^*$ ,  $p < 0.01$

\*Pearson product-moment correlation coefficient

### **Community Dwelling Disabled Individuals:**

(McColl et al, 2000;  $n=61$ ; disability unspecified, Community Dwelling Disabled Individuals)

- Participants identified 481 problems on the COPM and the Perceived Problem Check List (PPCL)
- 54 similar problems were identified on both measures:
  - 24% of PPCL problems were similar to COPM
  - 21% of COPM problems were similar to PPCL
- Problems mentioned on both measures include:
  - Transportation and errands
  - Dressing
  - Toileting
  - Climbing stairs
  - Cooking
  - Cleaning
  - Socializing

(Martini et al 2014) Adults post stroke (6 community dwelling, > one year post stroke) and children post stroke (8 children performing below the 15<sup>th</sup>% on the Movement Assessment Battery for Children) were videotaped and rated twice (separated by two weeks) by 3 different raters (research assistant, Occupational Therapist [OT] and OT student). The objective was to determine responsiveness, inter rater and test retest (2 weeks) reliability for the PQRS (Operational Definitions [OD] and Generic systems-[G]) as well as convergent validity between the PQRS-OD, the PQRS-G and the COPM Performance Scores. In terms of convergent validity there was:

- PreTest
  - Poor, virtually no convergent validity between PQRS-G or PQRS-OD with COPM Performance (-0.37 to 0.10) and COPM Satisfaction (-0.23 to -0.07)
- Post test:
  - Poor to Adequate convergent validity based on multiple raters for PQRS-G and PQRS-OD and COPM Performance (0.20 to 0.53)
  - Poor convergent validity for PQRS-G and PQRS-OD and COPM Satisfaction (0.04 to 0.29)

- Change scores
  - Poor to Adequate correlations between PQRS-G and PQRS-OD and COPM Performance (-0.12 to 0.35) and COPM Satisfaction (0.17-0.58)
  - Correlations between change scores on the PQRS and the COPM were higher for research assistant raters (-0.14 to 0.58) and OT student raters (-0.20 to -0.47) compared to licensed OT's (-0.12 to -0.21)

(Hill et al, 2014). This study evaluated 49 community dwelling individuals (mean age of 59.67 (14.14), 72 (58.8) months post stroke to determine if there was a correlation between sensory discrimination (Touch-Test, similar to Semmes Weinstein Monofilaments) and valued activities (functional performance on the COMP).

- Good to excellent correlations were found between individuals who scored high on the COPM (5.9-9.6) and low on the Touch-Test ( $X^2=9.80$  ( $P<0.05$ );
- No significant relationships were reported between the COPM scores below the median (1.2-5.8) and overall hand sensation ( $(X^2=.523$ ;  $P=0.97$ )
- Little to no correlations were reported between touch sensation of the hand and performance of *valued* activities for those who scored low on the COPM
- No significant relationships were reported for subjects scoring above or below the median for specific hand testing locations and COPM scores
- Subjects with minimal to moderate sensation impairments did not report speech or communication as a *valued* activity
- Subjects with severe impaired sensation did not report exercise as a *valued* activity.

Construct Validity  
(Convergent / Discriminant)

**Discriminant Validity:**

**Acquired Brain Injury:**

(Jenkinson et al, 2007; Community dwelling individuals;  $n=34$  (TBI=21; CVA=11; Others=2) , ABI)

|  |                     |                    |                 |                                    |
|--|---------------------|--------------------|-----------------|------------------------------------|
|  | PCRS<br>Discrepancy | HADS<br>Depression | HADS<br>Anxiety | Health and<br>Safety<br>Subtest of |
|--|---------------------|--------------------|-----------------|------------------------------------|

|                   |      |       |        | the Independent Living Scale |
|-------------------|------|-------|--------|------------------------------|
| COPM Performance  | 0.21 | -0.23 | -0.30  | 0.18                         |
| COPM Satisfaction | 0.20 | -0.33 | -0.42* | -0.02                        |

\* $p < 0.05$ , two-tailed (PCRS: Patient Competency Rating Scale; HADS: Hospital Anxiety Depression Scale)

- Lower self-ratings of satisfaction were associated with higher levels of anxiety
- No significant difference between self-ratings of satisfaction with measures of awareness, depression and cognitive function
- No significant difference between self-ratings of performance with awareness of deficit, mood state, and cognitive function

**Mixed Population (Disorders of wrist, hand and arm, Central neurological disorder, neuromuscular diseases, other diagnosis):**  
(Eyssen et al, 2011; Dutch version;  $n=138$ ; mean age=51 (13), Mixed Population)

- Significant positive correlations between the COPM scores and the Sickness Impact Profile (SIP68), Disability and Impact Profile (DIP), and Impact on Participation and Autonomy (IPA) scores

**Pediatrics:**

(Cusick et al, 2006, Pediatrics)

**Stroke:**

(Cup et al, 2003, Acute Stroke)

COPM performance scores:

- **Poor** correlation with Barthel Index  $r = -0.225^*$
- **Poor** correlation with Frenchay Activities Index  $r = -0.115^*$
- **Poor** correlation with the Stroke Adapted Sickness Impact Profile (SA-SIP30)  $r = 0.102^*$
- **Poor** correlation with the Euroqol 5D (EQ-5D)  $r = 0.143^*$
- **Poor** correlation with the Rankin Scale  $r = 0.209^*$

In other words, standardized performance measures **did not correlate with the COPM** indicating strong evidence of discriminate validity.

\*(Spearman rho)

- Poor correlation with the Goal Attainment Scaling (GAS) measure compared to COPM Performance score,  $r = -0.16$  and COPM Satisfaction score,  $r = -0.13$
- COPM performance and satisfaction scores are highly correlated,  $r = 0.5$ ,  $p = 0.0012$

**Content Validity**

The COPM assessment focuses on measuring a mismatch between a person's abilities and the demands of a task leading to functional impairment. (Macedo et al, 2009)

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Face Validity           | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Floor / Ceiling Effects | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Responsiveness          | <p>Research (Law et al 2004) suggests:</p> <ul style="list-style-type: none"> <li>• A change of 2 or more points is clinically significant</li> <li>• Changes in scores from assessment to re-assessment tend to be meaningful</li> </ul> <p><b><u>Acquired Brain Injury:</u></b><br/>(Phipps et al, 2007; <math>n=155</math> (TBI=38, CVA=117); Time from admission to discharge (TBI=141.26 (85.10); Right CVA=97.45 (72.99); Left CVA=96.47 (65.97), ABI)</p> <ul style="list-style-type: none"> <li>• Significant change in performance ratings and satisfaction ratings from admission to discharge for entire sample and also for each diagnostic group</li> </ul> <p>(Jenkinson et al, 2007; Community dwelling individuals; <math>n=34</math> (TBI=21; CVA=11; Others=2); total of 10 patients involved in an 8-week intervention group, ABI)</p> <ul style="list-style-type: none"> <li>• Significant improvement in COPM performance self-ratings (<math>p=0.018</math>) and satisfaction self-ratings (<math>p=0.013</math>) between the pre- and post-assessment</li> <li>• Significant improvement in relatives' ratings of performance between the pre- and post-assessment (<math>p=0.008</math>)</li> <li>• Improvement for relatives' ratings of satisfaction between the pre- and post-assessment was not significant (<math>p&gt;0.05</math>)</li> </ul> <p><b><u>Arthritis:</u></b><br/>(Macedo et al, 2009, Rheumatoid Arthritis)</p> <ul style="list-style-type: none"> <li>• Means Changes in Satisfaction and Performance were found to be both clinically and statistically significant</li> </ul> <p><b><u>Cerebral Palsy:</u></b><br/>(Cusick et al, 2007, Spastic Hemiplegic Cerebral Palsy)</p> <ul style="list-style-type: none"> <li>• The adapted COPM demonstrates an ability to detect change above the published minimum clinically important difference of 2 points</li> </ul> <p><b><u>Mixed neurologic sample:</u></b><br/>(Bodium, 1999; in-patient rehabilitation; <math>n=17</math>; admission to discharge=10 weeks, Mixed Neurologic Sample)</p> <ul style="list-style-type: none"> <li>• significant differences in improvement in self-ratings of performance and satisfaction</li> </ul> <p><b><u>Mixed neurological, orthopedic and cardiology sample:</u></b></p> |

(Wressle et al, 2002; n=155 experiment group and 55 in control group within geriatric, stroke and home rehabilitation; median age=80 experiment group and 79 control group; assessment after discharge=2-4 weeks with 88 patients in control group; 30 in control group, Mixed patients)

- Significant differences between groups: more patients in the experiment group perceived that treatment goals were identified, were able to recall the goals, felt that they were active participants in the goal formulation process, and perceived themselves better able to manage after completed rehabilitation compared with patients in the control group

**Mixed Population (Disorders of wrist, hand and arm, Central neurological disorder, neuromuscular diseases, other diagnosis):**

(Eyssen et al, 2011; Dutch version; n=138; mean age=51 (13), Mixed Population)

- Significant differences between assessment and reassessment scores ( $p<0.001$ )
- The AUC ranged from 0.79 to 0.85, and the optimal cut-off values for the performance scores and satisfaction scores ranged from 0.9 to 1.9

**Neuro Rehabilitation:**

(Chenq et al, 2002; n=12, 7=cerebrovascular accident, 2=spinal cord injuries, & 3=TBI; mean age 42.5; Taiwanese sample, Neuro Rehabilitation)

- Mean changes in Satisfaction and Performance were found to be both clinically and statistically significant

**Pain:**

(Carpenter et al, 2001; n=87 completed the COPM at baseline, end of program and 3 month post intervention; mean age=44, range=19 to 72 years, Pain)

- Changes in satisfaction and performance scores were found to be statistically and clinically significant

**Traumatic Brain Injury:**

(Trombly et al, 1998; Outpatient therapy services; n=16; gender=7 female and 9 male; mean age=43 (12.6); time since injury=22 (5.4), TBI)

- Performance self-ratings were significantly better ( $p<0.001$ ), and satisfaction self-ratings were significant as well ( $p=0.001$ ) after treatment than before (discharge: 4-23 weeks after admission; mean=12.3 weeks)
- No significant difference from discharge to follow up (4-8 weeks after discharge)

## Professional Association Recommendations

(Trombly et al, 2002; outpatient rehabilitation;  $n=31$ ; mean age=37.03 (12.16); gender=75% male; onset more than equal to 12 months=55%; onset less than equal to 3 months=19%; mixed level of severity, TBI)

- Performance self-ratings: significantly greater gain  $t(10)=5.029$ ,  $p<0.001$ ,  $r=0.84$ , during the treatment versus no treatment periods
- Satisfaction self-ratings: significantly greater gain  $t(10)=6.325$ ,  $p<0.001$ ,  $r=0.89$  during the treatment versus no-treatment periods

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE, StrokEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

### Abbreviations:

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute<br/>(CVA &lt; 2 months post)<br/>(SCI &lt; 1 month post)<br/>(Vestibular &lt; 6 months post)</b> | <b>Subacute<br/>(CVA 2 to 6 months)<br/>(SCI 3 to 6 months)</b> | <b>Chronic<br/>(&gt; 6 months)</b> |
|---------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------|
| <b>StrokEDGE II</b> | <i>UR</i>                                                                                                 | <i>R</i>                                                        | <i>R</i>                           |

Recommendations based on level of care in which the assessment is taken:

|                | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|----------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>MS EDGE</b> | <i>UR</i>         | <i>UR</i>                       | <i>UR</i>                       | <i>UR</i>                        | <i>UR</i>          |

|                     |           |           |           |           |           |
|---------------------|-----------|-----------|-----------|-----------|-----------|
| <b>StrokEDGE II</b> | <i>NR</i> | <i>UR</i> | <i>UR</i> | <i>UR</i> | <i>UR</i> |
| <b>TBI EDGE</b>     | <i>NR</i> | <i>NR</i> | <i>NR</i> | <i>LS</i> | <i>LS</i> |

Recommendations for use based on ambulatory status after brain injury:

|                 | <b>Completely Independent</b> | <b>Mildly Dependent</b> | <b>Moderately Dependent</b> | <b>Severely Dependent</b> |
|-----------------|-------------------------------|-------------------------|-----------------------------|---------------------------|
| <b>TBI EDGE</b> | <i>N/A</i>                    | <i>N/A</i>              | <i>N/A</i>                  | <i>N/A</i>                |

Recommendations based on EDSS Classification:

|                | <b>EDSS 0.0 – 3.5</b> | <b>EDSS 4.0 – 5.5</b> | <b>EDSS 6.0 – 7.5</b> | <b>EDSS 8.0 – 9.5</b> |
|----------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <b>MS EDGE</b> | <i>UR</i>             | <i>UR</i>             | <i>UR</i>             | <i>UR</i>             |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|---------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>MS EDGE</b>      | <i>No</i>                                                   | <i>No</i>                                        | <i>No</i>                                                          | <i>Yes</i>                                                  |
| <b>StrokEDGE II</b> | <i>No</i>                                                   | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Not reported</i>                                         |
| <b>TBI EDGE</b>     | <i>No</i>                                                   | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Not reported</i>                                         |

#### Considerations

- The COPM can be time consuming and difficult to administer (Toomey et al, 1995)
- Requires that the therapist using the tool be comfortable with a client-centered approach to both assessment and practice (Law et al, 1994)
- The interview process is of critical importance both in eliciting relevant information and devising patient-centered therapeutic interventions. However, the interview process is not standardized and both the quality and adequacy of information obtained from interviews may vary considerably between interviewers
- Initially was not considered appropriate for children under 8 years of age, but more recent research supports its use with children (Galvin et al 2010). Twenty six children with ischemic or hemorrhagic stroke ( 5-16 years of age) participated in this study to identify the functional tasks of concern and identify the

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | <p>most valued functional activities as measured by the COPM when completed by the children and by the parents). The satisfaction and performance parts of the COPM were not administered. A total of 103 goals were identified.</p> <ul style="list-style-type: none"> <li>• Preschool aged children had the most concerns about self care (45%) and productivity (36% ) with less concern about leisure (19%)</li> <li>• School aged children had the most concerns about self care (46%) and leisure activities (36%)</li> <li>• Parents had concerns about their children's self care (47%), productivity (27%) and leisure activities (26%)</li> </ul> <p>Do you see an error or have a suggestion for this instrument summary?<br/>Please <a href="#">e-mail us!</a></p>                                                                                                                                                                                                                                                                   |
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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>Trombly, C. A., Radomski, M. V., et al. (2002). "Occupational therapy and achievement of self-identified goals by adults with acquired brain injury: phase II." Am J Occup Ther 56(5): 489-498. <a href="#">Find it on PubMed</a></p> <p>Wressle, E., Eeg-Olofsson, A. M., et al. (2002). "Improved client participation in the rehabilitation process using a client-centred goal formulation structure." Journal of Rehabilitation Medicine 34(1): 5-11.</p> |
| <b>Year published</b>           | 1991                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## 7. REHAB MEASURES: CHEDOKE ARM AND HAND ACTIVITY INVENTORY

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     | <a href="#">Chedoke Arm and Hand Activity Inventory - 13</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Title of Assessment</b>    | Chedoke Arm and Hand Activity Inventory - 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Acronym</b>                | CAHAI – 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Dorian Rose, PhD, PT and the Stroke Edge Taskforce of the Academy of Neurologic Physical Therapy - a component of APTA, Updated by Maggie Bland PT,DPT,NCS and Nancy Byl, PT, MPH, PhD, FAPTA and the StrokEdge II Task Force of the Academy of Neurologic Physical Therapy - a component of APTA in 2016.                                                                                                                                                                                                                                                                                                                                     |
| <b>Summary Date</b>           | 2/29/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Purpose</b>                | The purpose of this measure is to evaluate the functional ability of the paretic arm and hand to perform tasks.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b>            | <p>The CAHAI is a performance test using functional items. It is not designed to measure the client's ability to complete the task using only their unaffected hand, but rather to encourage bilateral function.</p> <p>The original test consists of 13 functional tasks to complete (open jar of coffee, call 911, draw a line with a ruler, put toothpaste on toothbrush, cut medium consistency putty, pour a glass of water, wring out washcloth, clean pair of eyeglasses, zip up a zipper, do up 5 buttons, dry back with towel, place container on table, carry bag upstairs). Additional shorter versions exist as well: CAHAI-7, CAHAI-8, and CAHAI-9.</p> |
| <b>Area of Assessment</b>     | Activities of Daily Living; Upper Extremity Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Body Part</b>              | Upper Extremity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>ICF Domain</b>             | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Domain</b>                 | ADL; Motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Assessment Type</b>        | Performance Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Length of Test</b>         | 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Time to Administer</b>        | 30 minutes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Number of Items</b>           | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Equipment Required</b>        | <ul style="list-style-type: none"> <li>• Jar of coffee</li> <li>• Phone</li> <li>• Ruler and pen</li> <li>• Toothpaste and toothbrush</li> <li>• Knife</li> <li>• Fork</li> <li>• Putty</li> <li>• Glass of water</li> <li>• Wet washcloth</li> <li>• Eyeglasses</li> <li>• Jacket and zipper</li> <li>• Shirt with 5 buttons</li> <li>• Towel</li> <li>• Rubbermaid 38 liter container (50x37x27cm) with 10 lb. weight</li> <li>• Plastic grocery bag with 4 lb. weight</li> </ul> |
| <b>Training Required</b>         | Read the administration and scoring manual                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Type of training required</b> | reading an article/manual                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Cost</b>                      | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Actual Cost</b>               | \$0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Age Range</b>                 | Not specified                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Administration Mode</b>       | Paper/Pencil                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Diagnosis</b>                 | Movement Disorders                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                                                         |                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Populations Tested</b>                               | Upper Extremity Paralysis                                                                                                                                                                                                                                                                                                                       |
| <b>Standard Error of Measurement (SEM)</b>              | Not Established.                                                                                                                                                                                                                                                                                                                                |
| <b>Minimal Detectable Change (MDC)</b>                  | <u><b>Upper Extremity Paralysis</b></u><br>(Barreca et al, 2005) <ul style="list-style-type: none"> <li>MDC (90) = 6.3 points</li> </ul>                                                                                                                                                                                                        |
| <b>Minimally Clinically Important Difference (MCID)</b> | <u><b>Upper Extremity Paralysis</b></u><br>(Siven et al, 2011) Systematic Review <ul style="list-style-type: none"> <li>MCID (chronic) = 6.3 points</li> </ul>                                                                                                                                                                                  |
| <b>Cut-Off Scores</b>                                   | Not Established.                                                                                                                                                                                                                                                                                                                                |
| <b>Normative Data</b>                                   | Not Established.                                                                                                                                                                                                                                                                                                                                |
| <b>Test-retest Reliability</b>                          | <u><b>Upper Extremity Paralysis:</b></u><br>(Barreca et al, 2005) <ul style="list-style-type: none"> <li><b>Excellent</b> reliability (ICC = 0.96)</li> </ul>                                                                                                                                                                                   |
| <b>Interrater/Intrarater Reliability</b>                | <u><b>Upper Extremity Paralysis:</b></u><br>(Barreca et al, 2005) <ul style="list-style-type: none"> <li><b>Excellent</b> reliability (ICC = 0.98)</li> </ul>                                                                                                                                                                                   |
| <b>Internal Consistency</b>                             | <u><b>Upper Extremity Paralysis:</b></u><br>(Barreca et al, 2006) Comparison of the CAHAI-13 to other measures in people 20-108 days post-stroke<br>("Psychometric properties: Reliability") <ul style="list-style-type: none"> <li><b>Excellent</b> reliability (ICC = 0.98)</li> <li><b>Excellent</b> Internal consistency: r=0.98</li> </ul> |
| <b>Criterion Validity (Predictive/Concurrent)</b>       | Not Established.                                                                                                                                                                                                                                                                                                                                |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |  |           |                  |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--|-----------|------------------|
| <b>Construct Validity<br/>(Convergent/Discriminant)</b> | <p><b>Stroke:</b></p> <p>(Barreca et al. , 2006)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> correlation with Action Reach Arm Test: <math>r=0.93</math></li> <li>• <b>Excellent</b> correlation with Chedoke-McMaster Stroke</li> </ul> <p>(Baker, et al 2011) Systematic review of key assessment of hand/arm outcome tools to measure change following robotic therapy in stroke rehabilitation (45 measures identified)</p> <ul style="list-style-type: none"> <li>• Chedoke Arm and Hand Inventory was one of 3 measures that met all domains of the ICF framework and incorporated a mixture of clinical-rated and patient reported outcome measures</li> <li>• None of the scales were considered to be sufficient on their own to capture all important outcome domains</li> </ul>                                                                                                                                                                      |                       |  |           |                  |
| <b>Content Validity</b>                                 | Not Established.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |  |           |                  |
| <b>Face Validity</b>                                    | Not Established.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |  |           |                  |
| <b>Floor/Ceiling Effects</b>                            | Not Established.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |  |           |                  |
| <b>Responsiveness</b>                                   | Not Established.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |  |           |                  |
| <b>Professional Association Recommendations</b>         | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE, StrokEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> <table border="1"> <tr> <td colspan="2"><b>Abbreviations:</b></td></tr> <tr> <td><b>HR</b></td><td>Highly Recommend</td></tr> </table> | <b>Abbreviations:</b> |  | <b>HR</b> | Highly Recommend |
| <b>Abbreviations:</b>                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |  |           |                  |
| <b>HR</b>                                               | Highly Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |  |           |                  |

|                |                                                                               |
|----------------|-------------------------------------------------------------------------------|
| <b>R</b>       | Recommend                                                                     |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group /<br>Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                               |

Recommendations for use based on acuity level of the patient:

|                         | <b>Acute</b><br><br>(CVA < 2 months<br>post)<br><br>(SCI < 1 month<br>post)<br><br>(Vestibular < 6<br>months post) | <b>Subacute</b><br><br>(CVA 2 to 6<br>months)<br><br>(SCI 3 to 6<br>months) | <b>Chronic</b><br><br>(> 6 months) |
|-------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------|
| <b>StrokEDGE<br/>II</b> | <i>NR</i>                                                                                                          | <i>LS / UR</i>                                                              | <i>NR</i>                          |

Recommendations based on level of care in which the assessment is taken:

|                         | <b>Acute<br/>Care</b> | <b>Inpatient<br/>Rehabilitation</b> | <b>Skilled<br/>Nursing<br/>Facility</b> | <b>Outpatient<br/>Rehabilitation</b> | <b>Home<br/>Health</b> |
|-------------------------|-----------------------|-------------------------------------|-----------------------------------------|--------------------------------------|------------------------|
| <b>StrokEDGE<br/>II</b> | <i>NR</i>             | <i>NR</i>                           | <i>NR</i>                               | <i>NR</i>                            | <i>NR</i>              |

Recommendations for entry-level physical therapy education and use in research:

|  | <b>Students<br/>should<br/>learn to<br/>administer<br/>this tool?<br/>(Y/N)</b> | <b>Students<br/>should be<br/>exposed<br/>to tool?<br/>(Y/N)</b> | <b>Appropriate<br/>for use in<br/>intervention<br/>research<br/>studies? (Y/N)</b> | <b>Is additional<br/>research<br/>warranted<br/>for this tool<br/>(Y/N)</b> |
|--|---------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
|  |                                                                                 |                                                                  |                                                                                    |                                                                             |

|                       | StrokEDGE II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | No | Yes | No | Not reported |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|----|--------------|
| <b>Considerations</b> | <p>Stroke:</p> <p>(Schuster et al, 2010; n = 23 post stroke patients with minimal motor function in the upper extremity, 26 days to 8 years post-stroke, validation of the CAHAI in German; CAHAI-G)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> correlation between the Chedoke-McMaster Stroke Assessment subscale hand and CAHAI-G 13 (<math>r = .74</math>)</li> <li>• <b>Excellent</b> correlation between the Chedoke-McMaster Stroke Assessment subscale arm and CAHAI-G 13 (<math>r = .67</math>)</li> <li>• <b>Excellent</b> reliability (ICC = 0.99) for CAHAI-G 13</li> </ul> <p>These translations, and links to them, are subject to the <a href="#">Terms and Conditions</a> of Use of the Rehab Measures Database. RIC is not responsible for and does not endorse the content, products or services of any third-party website, and does not make any representations regarding its quality, content or accuracy. If you would like to contribute a language translation to the RMD, please contact us at <a href="mailto:rehabmeasures@ric.org">rehabmeasures@ric.org</a></p>                                                                                                                                       |    |     |    |              |
| <b>Bibliography</b>   | <p>Baker K, Cano SJ, Playford D. Outcome measurement in stroke: A scale selection strategy (2011) Stroke ; 42:1787-1794. <a href="#">Find it on PubMed</a></p> <p>Barreca, S., Gowland, C. K., et al. (2004). "Development of the Chedoke Arm and Hand Activity Inventory: theoretical constructs, item generation, and selection." Top Stroke Rehabil 11(4): 31-42. <a href="#">Find it on PubMed</a></p> <p>Barreca, S. R., Stratford, P. W., et al. (2005). "Test-retest reliability, validity, and sensitivity of the Chedoke arm and hand activity inventory: a new measure of upper-limb function for survivors of stroke." Arch Phys Med Rehabil 86(8): 1616-1622. <a href="#">Find it on PubMed</a></p> <p>Barreca SR, Stratford PW, Masters LM, Lambert CL, Griffiths J (2006). Comparing 2 versions of the Chedoke Arm and Hand Activity Inventory with the Action Research Arm Test. Phys Ther; 86:245-253. <a href="#">Find it on PubMed</a></p> <p>Schuster, C., Hahn, S., Ettlin, T. (2010). "Objectively-assessed outcome measures: a translation and cross-cultural adaptation procedure applied to the Chedoke McMaster Arm and Hand Activity inventory (CAHAI)." BMC Med Res Methodol 10: 106. <a href="#">Find it on PubMed</a></p> |    |     |    |              |

|                                 |                                                                                                                                                                                                                        |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | Sivan, M., O'Connor, R.J., et al. (2011). "Systematic review of outcome measures used in the evaluation of robot-assisted upper limb exercise in stroke." J Rehabil Med 43: 181-189. <a href="#">Find it on PubMed</a> |
| <b>Year published</b>           | 2004                                                                                                                                                                                                                   |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                    |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                               |

## 8. REHAB MEASURES: CHEDOKE MCMASTER STROKE ASSESSMENT MEASURE

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | <a href="#">Chedoke-McMaster Stroke Assessment Measure Manual and Scoring Form (other languages available below)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Title of Assessment    | Chedoke-McMaster Stroke Assessment Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Acronym                | CMSA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Instrument Reviewer(s) | Reviewed by Michele Sulwer, PT, DPT, NCS and Genevieve Pinto-Zipp, PT, EdD of the StrokEDGE II, Neurology Section, APTA in 3/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Summary Date           | March 2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Purpose                | Assesses physical impairment and disability in clients with stroke and other neurological impairment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Description            | <p>The CMSA is composed of two inventories:</p> <p><b>1. <u>Impairment Inventory</u>:</b> Used to determine the presence and severity of common physical impairments. It has six dimensions:</p> <ol style="list-style-type: none"> <li>1) Recovery stage of the arm</li> <li>2) Hand</li> <li>3) Leg</li> <li>4) Foot</li> <li>5) Postural control</li> <li>6) Shoulder pain</li> </ol> <p>Each dimension is measured on a 7-point scale, each point corresponds to seven stages of motor recovery. The 7-point scale for shoulder pain is based on pain severity.</p> <p><b>2. <u>Activity Inventory</u></b> measures clinically important changes in the client's functional ability. This Activity Inventory is made up of a gross motor function and walking subscale.</p> <ul style="list-style-type: none"> <li>• <b><u>The Gross Motor Function</u></b> index consists of the 10 following items: <ol style="list-style-type: none"> <li>1. Supine to side lying on strong side</li> <li>2. Supine to side lying on weak side</li> <li>3. Side lying to long sitting through strong side</li> <li>4. Side lying to sitting on side of the bed through strong side</li> </ol> </li> </ul> |

5. Side lying to sitting on side of the bed through weak side
  6. Standing
  7. Transfer to and from bed toward strong side
  8. Transfer to and from bed toward weak side
  9. Transfer up and down from floor to chair
  10. Transfer up and down from floor and standing.
- **The Walking Index** consists of the 5 following items:
    1. Walking indoors
    2. Walking outdoors, over rough ground, ramps, and curbs
    3. Walking outdoors several blocks
    4. Stairs
    5. Age and sex appropriate walking distance in meters for 2 minutes.
  - Impairment Inventory is scored on a 7-point scale, where:
    - o 1 = Flaccid paralysis
    - o 2 = Spasticity is present and felt as a resistance to passive movement
    - o 3 = Marked spasticity but voluntary movement present within synergistic patterns
    - o 4 = Spasticity decreases
    - o 5 = Spasticity wanes but is evident with rapid movement at the extremes of range
    - o 6 = Coordination and patterns of movement are near normal
    - o 7 = Normal movement.
  - The 7-point scale corresponds to seven stages of motor recovery. The 7-point scale for shoulder pain is based on pain severity.
  - The minimum score for the Impairment Inventory is 6 and the maximum score is 42 (Gowland et al, 1993).

- The Activity Inventory is also scored on a 7-point scale, based on the amount of assistance the individual with stroke requires. It is categorized by:
  - o The need for assistance from another person
  - o The need for equipment, or
  - o The need for extra time to accomplish a task.
- For the Activity Inventory, the scoring key from the Functional Independence Measure is used, where:
  - o 1 = The client needs total assistance
  - o 2 = Maximal assistance
  - o 3 = Moderate assistance
  - o 4 = Minimal assistance
  - o 5 = Clients needs supervision
  - o 6 = Client is modified independent (needs assistance from devices)
  - o 7 = Client is timely and safely independent.
- The maximum score is 100, where higher scores reflect normal function (Finch et al, 2002; Gowland et al, 1993).
- The maximum score for the gross motor function index is 70
- The maximum score for the walking index is 30 (Gowland et al, 1993).
- A 2-point bonus should be assigned for those who walk appropriate distances in meters based on norms for the patient's age and sex, on item 15 (the 2-Minute Walk Test) (Huijbregts at al, 2000)

|                           |                         |
|---------------------------|-------------------------|
| <b>Area of Assessment</b> | Functional Mobility     |
| <b>Body Part</b>          | Not Applicable          |
| <b>ICF Domain</b>         | Body Function; Activity |
| <b>Domain</b>             | Motor                   |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Assessment Type</b>           | Observer                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Length of Test</b>            | 31 to 60 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Time to Administer</b>        | 45-60 minutes                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Number of Items</b>           | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Equipment Required</b>        | <ul style="list-style-type: none"> <li>• An adjustable table</li> <li>• Chair with armrests</li> <li>• Floor mat</li> <li>• Pillows</li> <li>• A pitcher with water</li> <li>• A measuring cup</li> <li>• A ball 2.5 inches in diameter</li> <li>• A footstool</li> <li>• A 2m line marked on the floor</li> <li>• Stopwatch</li> </ul>                                                                                                                 |
| <b>Training Required</b>         | <p>The administrative guidelines can be used to learn how to administer the test. However, a training workshop is recommended to increase confidence in the ability to administer and score the measure accurately.</p> <p>A training workshop is also recommended if the measure is intended to be used to collect data for research purposes.</p> <p>Further information about training can be found at the <a href="#">instrument's website</a>.</p> |
| <b>Type of training required</b> | Reading an Article/Manual                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Cost</b>                      | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Actual Cost</b>               | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                                                         |                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Age Range</b>                                        | Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                                                                                                                                                    |
| <b>Administration Mode</b>                              | Paper/Pencil                                                                                                                                                                                                                                                                                                                                              |
| <b>Diagnosis</b>                                        | Stroke                                                                                                                                                                                                                                                                                                                                                    |
| <b>Populations Tested</b>                               | <ul style="list-style-type: none"> <li>• Stroke</li> <li>• Brain Injury</li> <li>• Other Neurological Disorders</li> </ul>                                                                                                                                                                                                                                |
| <b>Standard Error of Measurement (SEM)</b>              | Not Established                                                                                                                                                                                                                                                                                                                                           |
| <b>Minimal Detectable Change (MDC)</b>                  | Not Established                                                                                                                                                                                                                                                                                                                                           |
| <b>Minimally Clinically Important Difference (MCID)</b> | <p><b>Acute Stroke:</b> (Gowland et al 1993; <math>n = 32</math>; mean age = 64; mean time since stroke onset = 9 months)</p> <ul style="list-style-type: none"> <li>• MCID = 8 points (total CMSA via stroke patients) and 7 points (total CMSA via caregivers of stroke patients).</li> </ul>                                                           |
| <b>Cut-Off Scores</b>                                   | > 9 on the leg and postural control scores indicates that the individual is able to ambulate independently. (Stevenson, 1999)                                                                                                                                                                                                                             |
| <b>Normative Data</b>                                   | Not Established                                                                                                                                                                                                                                                                                                                                           |
| <b>Test-retest Reliability</b>                          | <p><b>Acute Stroke:</b> (Gowland et al, 1993)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> test-retest reliability, Disability Inventory (ICC = 0.98)</li> </ul>                                                                                                                                                                         |
| <b>Interrater/Intrarater Reliability</b>                | <p><b>Acute Stroke:</b> (Gowland et al, 1993)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> inter-rater reliability, Impairment inventory ICC = 0.97</li> <li>• <b>Excellent</b> inter-rater reliability, Disability inventory ICC = 0.99</li> <li>• <b>Excellent</b> intra-rater reliability, Impairment inventory ICC = 0.98</li> </ul> |
| <b>Internal Consistency</b>                             | <p><b>Acute Stroke:</b> (Gowland et al, 1993)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> internal consistency, Total scale ICC = 0.98</li> </ul>                                                                                                                                                                                       |

**Criterion Validity  
(Predictive/Concurrent)**

**Acute Stroke:** (Gowland et al, 1993)

- **Excellent** concurrent validity: Fugl-Meyer ( $r = 0.95$ )
- **Excellent** concurrent validity: FIM ( $r = 0.79$ )
- **Excellent** concurrent validity: Barthel Index of ADLs ( $r = 0.75 - 0.87$  \*Disability Index)
- **Poor** concurrent validity with, Barthel Index: areas of shoulder pain & eating and bowel incontinence ( $r < 0.30$ )
- **Excellent** predictive validity, Physical Impairment Scale Leg postural control scores of  $>9$  showed 100% sensitivity and 80% specificity in prediction of independent ambulation.
- **Excellent** predictive validity, Total outcome of CMSA stroke assessment could be predicted by 7 items on the Barthel Index ( $R^2 = 0.75$ )

**Predictive Equations:**

Predicting Clinical Outcomes following Stroke Rehabilitation (Gowland et al, 1995):

| Outcome Variables       | R squared | Equation                                                                                                   | CI         |
|-------------------------|-----------|------------------------------------------------------------------------------------------------------------|------------|
| Discharge Destination   | 0.38      | $5.97 - (0.06 \times \text{Gross Motor Function}) - (0.21 \times \text{Bladder})$                          | $\pm 3.5$  |
| Length of Stay          | 0.38      | $22.03 - (1.18 \times \text{Leg}) - (0.05 \times \text{Adult FIM}^{\text{SM}}) - (0.06 \times \text{Age})$ | $\pm 6.9$  |
| Adult FIM <sup>SM</sup> | 0.65      | $39.23 + (0.73 \times \text{Adult FIM}^{\text{SM}})$                                                       | $\pm 29.6$ |
| Activity Inventory      | 0.73      | $17.45 + (0.88 \times \text{Gross Motor Function}) + (4.30 \times \text{Leg})$                             | $\pm 23.3$ |
| Gross Motor Function    | 0.7       | $24.94 + (0.76 \times \text{Gross Motor Function}) - (0.30 \times \text{Weeks})$                           | $\pm 16.1$ |
| Walking                 | 0.71      | $(\text{Gross Motor Function} \times 0.28) + (\text{Postural Control} + \text{Leg} \times 1.23) - 4.55$    | $\pm 9.2$  |
| Shoulder Pain           | 0.55      | $2.33 + (0.44 \times \text{Shoulder Pain}) + (0.28 \times \text{Arm})$                                     | $\pm 1.6$  |

|                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                |      |                                                |      |            |      |                                  |      |             |      |                    |      |            |      |                                  |      |             |      |                                   |      |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------|------------------------------------------------|------|------------|------|----------------------------------|------|-------------|------|--------------------|------|------------|------|----------------------------------|------|-------------|------|-----------------------------------|------|
|                                                      | <table><tr><td><b>Postural Control</b></td><td>0.60</td><td>2.23 + (0.35 x Postural Control) + (0.3 x Leg)</td><td>±1.3</td></tr><tr><td><b>Arm</b></td><td>0.80</td><td>0.82+(1.03 x Arm)-(0.03 x Weeks)</td><td>±1.5</td></tr><tr><td><b>Hand</b></td><td>0.78</td><td>0.53+(0.98 x Hand)</td><td>±1.5</td></tr><tr><td><b>Leg</b></td><td>0.69</td><td>1.83+(0.77 x Leg)-(0.02 x Weeks)</td><td>±1.5</td></tr><tr><td><b>Foot</b></td><td>0.73</td><td>1.11+(0.90 x Foot)-(0.03 x Weeks)</td><td>±1.3</td></tr></table> <p>Predictive Equations for Stroke Acute Care can be found <a href="#">HERE</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Postural Control</b>                        | 0.60 | 2.23 + (0.35 x Postural Control) + (0.3 x Leg) | ±1.3 | <b>Arm</b> | 0.80 | 0.82+(1.03 x Arm)-(0.03 x Weeks) | ±1.5 | <b>Hand</b> | 0.78 | 0.53+(0.98 x Hand) | ±1.5 | <b>Leg</b> | 0.69 | 1.83+(0.77 x Leg)-(0.02 x Weeks) | ±1.5 | <b>Foot</b> | 0.73 | 1.11+(0.90 x Foot)-(0.03 x Weeks) | ±1.3 |
| <b>Postural Control</b>                              | 0.60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2.23 + (0.35 x Postural Control) + (0.3 x Leg) | ±1.3 |                                                |      |            |      |                                  |      |             |      |                    |      |            |      |                                  |      |             |      |                                   |      |
| <b>Arm</b>                                           | 0.80                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.82+(1.03 x Arm)-(0.03 x Weeks)               | ±1.5 |                                                |      |            |      |                                  |      |             |      |                    |      |            |      |                                  |      |             |      |                                   |      |
| <b>Hand</b>                                          | 0.78                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.53+(0.98 x Hand)                             | ±1.5 |                                                |      |            |      |                                  |      |             |      |                    |      |            |      |                                  |      |             |      |                                   |      |
| <b>Leg</b>                                           | 0.69                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.83+(0.77 x Leg)-(0.02 x Weeks)               | ±1.5 |                                                |      |            |      |                                  |      |             |      |                    |      |            |      |                                  |      |             |      |                                   |      |
| <b>Foot</b>                                          | 0.73                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.11+(0.90 x Foot)-(0.03 x Weeks)              | ±1.3 |                                                |      |            |      |                                  |      |             |      |                    |      |            |      |                                  |      |             |      |                                   |      |
| <b>Construct Validity (Convergent/Discriminant )</b> | <p><b>Acute Stroke:</b> (Gowland et al, 1993)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> convergent validity with subscales of the Fugl-Meyer Assessment (FMA)</li><li>• <b>Excellent</b> convergent validity with the CMSA Arm and hand Impairment Inventory and FMA shoulder, elbow, forearm, wrist and hand scale (<i>r</i> = 0.95)</li><li>• <b>Excellent</b> convergent validity with the CMSA Leg and foot Impairment Inventory and FMA hip, knee, foot and ankle scale (<i>r</i> = 0.93)</li><li>• <b>Excellent</b> convergent validity with the CMSA Postural control and FMA balance scale (<i>r</i> = 0.84)</li><li>• <b>Excellent</b> convergent validity with the CMSA Shoulder pain Impairment Inventory and FMA upper limb joint pain scale (<i>r</i> = 0.76)</li></ul> <p>CMSA Activity Inventory and the Functional Independence Measure (FIM) convergent validity evidence:</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> convergent validity with the CMSA gross motor function index and the FIM Mobility subscale (<i>r</i> = 0.90)</li><li>• <b>Excellent</b> convergent validity with the CMSA walking index and the FIM Locomotion subscale (<i>r</i> = 0.85)</li></ul> |                                                |      |                                                |      |            |      |                                  |      |             |      |                    |      |            |      |                                  |      |             |      |                                   |      |
| <b>Content Validity</b>                              | Moreland, Gowland, Van Hullenar, and Huijbregts (1993) performed a literature review to gather evidence for a theoretical basis of the Chedoke-McMaster Stroke Assessment. All items from both inventories had enough scientific evidence supporting its assumptions. Thus, the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                |      |                                                |      |            |      |                                  |      |             |      |                    |      |            |      |                                  |      |             |      |                                   |      |

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                 | authors were able to establish a theoretical basis underlying the content of the Chedoke-McMaster Stroke Assessment.                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Face Validity</b>                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Floor/Ceiling Effects</b>                    | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Responsiveness</b>                           | The CMSA Disability Inventory is more sensitive to the FIM at detecting clinically important change. (Gowland et al, 1993)                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Professional Association Recommendations</b> | Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD Edge), Spinal Cord Injury Taskforce (PD Edge), Stroke Taskforce (StrokeEdge II), Traumatic Brain Injury Taskforce (TBI Edge), and Vestibular Taskforce (VEEdge) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process. |

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

**Abbreviations:**

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|  | <b>Acute</b><br>(CVA < 2 months post) | <b>Subacute</b><br>(CVA 2 to 6 months) | <b>Chronic</b><br>(> 6 months) |
|--|---------------------------------------|----------------------------------------|--------------------------------|
|  |                                       |                                        |                                |

|                     | (SCI < 1 month post)<br><br>(Vestibular < 6 months post) | (SCI 3 to 6 months) |          |
|---------------------|----------------------------------------------------------|---------------------|----------|
| <b>StrokEDGE II</b> | <i>R</i>                                                 | <i>R</i>            | <i>R</i> |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>StrokEDGE II</b> | <i>R</i>          | <i>R</i>                        | <i>UR</i>                       | <i>R</i>                         | <i>R</i>           |

Recommendations for entry-level physical therapy education and use in research:

|                  | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>StrokEDGE</b> | <i>No</i>                                                   | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Not reported</i>                                         |

## Considerations

### Chedoke-McMaster Stroke Assessment Measure translations:

French:

<http://www.physiotherapy.ca/Practice-Resources/Orders>

These translations, and links to them, are subject to the [Terms and Conditions of Use](#) of the Rehab Measures Database. RIC is not responsible for and does not endorse the content, products or services of any third-party website, and does not make any representations regarding its

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>quality, content or accuracy. If you would like to contribute a language translation to the RMD, please contact us at <a href="mailto:rehabmeasures@ric.org">rehabmeasures@ric.org</a>.</p> <p>Do you see an error or have a suggestion for this instrument summary? Please <a href="#">e-mail us</a>!</p>                                                                                                                                                                                                                                                                  |
| <b>Bibliography</b>             | <p>Gowland, C., Stratford, P., et al. (1993). "Measuring physical impairment and disability with the Chedoke-McMaster Stroke Assessment." <i>Stroke</i> 24(1): 58. <a href="#">Find it on PubMed</a></p> <p>Huijbregts, M., Gowland, C., et al. (2000). "Measuring clinically-important change with the activity inventory of the Chedoke McMaster Stroke Assessment." <i>Physiotherapy Canada</i> 52(4): 295-304.</p> <p>Morland, J., Gowland, C., et al. (1993). "Theoretical basis of the Chedoke-McMaster Stroke Assessment." <i>Physiotherapy Canada</i> 45: 231-231.</p> |
| <b>Year published</b>           | 1993                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## 9. REHAB MEASURES DATABASE—DASH

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | <a href="#">DASH Website</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Title of Assessment    | Disabilities of the Arm, Shoulder, and Hand Questionnaire                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Acronym                | DASH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Instrument Reviewer(s) | Initially reviewed by Jill Smiley, MPH and Allison Todd in 5/2012; Updated by Franco Calabrese, SPT, Adam Fagan, SPT, and Patrick Galvin, SPT in 11/2012. Updated by Melissa M. Eden PT, DPT, OCS. Reviewed by Dorian Rose, PhD, PT StrokEDGE II Task Force November 2017.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Summary Date           | 8/7/2014                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Purpose                | The DASH is designed to evaluate disorders and measure disability of the upper extremities, and monitor change or function over time.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Description            | <p>Developed jointly by the Institute for Work &amp; Health and the American Academy of Orthopaedic Surgeons (AAOS).</p> <p>The DASH was first published in 1996. It has 2 shortened versions, the QuickDASH and the QuickDASH-9. The DASH has been formally translated into 41 versions. There are 18 translations in progress.</p> <p>The DASH is a 30-item self-report questionnaire designed to assess musculoskeletal disorders of the upper limbs. It has two, 4-item, optional modules used to measure symptoms and function in athletes, artists, and workers who require a high level of function.</p> <p>Scoring the DASH:</p> <ul style="list-style-type: none"> <li>• The 30-item disability/symptom section (item responses range from 1 (e.g. no difficulty, not at all, not limited, none, strongly disagree) to 5 (e.g. unable, extremely, unable, strongly agree))</li> <li>• Scoring: <math>[(\text{sum of } n / n) - 1] \times 25</math>; <math>n</math> = number of completed responses (see test sheet for more information) <ul style="list-style-type: none"> <li>o The DASH should not be scored if more than three items are missing</li> </ul> </li> <li>• Optional 4-item high performance section <ul style="list-style-type: none"> <li>o Add values of each response, then divide by 4, subtract 1 and multiply by 25: <math>[(\text{sum of values}/4) - 1] \times 25</math></li> <li>o Optional modules should not be scored if items are missing</li> </ul> </li> </ul> |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>More information, including a PDF of the DASH, can be found on the <a href="#">DASH website</a></li> </ul>                                                                                                                                                                                                                                                                                                                   |
| <b>Area of Assessment</b>        | Upper Extremity Function                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Body Part</b>                 | Upper Extremity                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>ICF Domain</b>                | Body Structure; Body Function; Activity; Participation                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Domain</b>                    | ADL; Motor                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Assessment Type</b>           | Patient Reported Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Length of Test</b>            | 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Time to Administer</b>        | 05 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Number of Items</b>           | 30 (34, if option high performance section is needed)                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Equipment Required</b>        | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Training Required</b>         | No Training                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Type of training required</b> | No Training                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Cost</b>                      | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Actual Cost</b>               | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Age Range</b>                 | Adult: 18-64 years                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Administration Mode</b>       | Paper/Pencil                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Diagnosis</b>                 | Arthritis; Geriatrics; Movement Disorders; Multiple Sclerosis; Pain; Stroke                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Populations Tested</b>        | <ul style="list-style-type: none"> <li>Adults with wrist, hand, elbow and shoulder disorders</li> <li>Rheumatoid Arthritis</li> <li>Psoriatic Arthritis and Inflammatory Disease</li> <li>Athletes</li> <li>Carpal Tunnel Syndrome</li> <li>Elbow Arthroplasty</li> <li>Neck Pain</li> <li>Proximal Humeral Fractures</li> <li>Trauma Disorders</li> <li>Post-Operative Upper Extremity Surgery</li> <li>Multiple Sclerosis</li> <li>Adhesive Capsulitis</li> </ul> |

- Non-traumatic neck complaints with Upper Extremity symptoms
- Shoulder Impingement
- Stroke

**Standard Error of Measurement (SEM)**

**Intercollegiate Athletes:**

(Hsu et al, 2010;  $n = 321$ ; mean age 19.4 (17.6-22.6) years; Pre-competition physical, Intercollegiate Athletes)

- 3.61 (Calculated from  $MDC = 1.96 \times SEM \times \text{square root of } 2$ ;  $10 = 1.96 \times SEM \times \text{square root of } 2$ )

**Osteoarthritis:**

(Vermeulen et al, 2009;  $n = 19$ , Primary Thumb Carpometacarpal Osteoarthritis; evaluated at 0, 3, 6 and 12 months, Osteoarthritis)

Analysis of the Change in DASH Score From Preoperative Clinical Evaluations

|                          | Mean   | SD    | SEM  | Lower  | Upper  |
|--------------------------|--------|-------|------|--------|--------|
| <b>DASH 0 to DASH 3</b>  | -14.93 | 9.63  | 2.27 | -10.14 | -19.72 |
| <b>DASH 0 to DASH 6</b>  | -20.54 | 14.58 | 3.26 | -13.71 | -27.36 |
| <b>DASH 0 to DASH 12</b> | -20.83 | 20.09 | 4.49 | -11.42 | -30.23 |

\*Paired differences of the DASH scores. DASH 0 is mean DASH score preoperative, DASH 3 is mean DASH score at 3 months, DASH 6 is mean DASH score at 6 months, and DASH 12 is mean DASH score at 12 months.

**Proximal Humeral Fractures:**

(Slobogean et al, 2010;  $n = 61$ , mean age = 69, Proximal Humeral Fractures)

- Calculated using  $SEM = \text{Standard Deviation of first outcome} \times \text{square root } (1 - ICC)$
- $SEM = 21.7 \times \text{square root } (1 - 0.928) = 5.82$

**Adults with musculoskeletal upper extremity problems:**

(Schmitt J.S., Di Fabio R.P., 2004)

- $SEM = 5.22$

(Beaton D.E., Katz J.N., Fossel A.H., Wright J.G., Tarasuk V., Bombardier C., 2001)

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                  | <ul style="list-style-type: none"> <li>SEM = 4.6</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Minimal Detectable Change (MDC)                  | <p><b><u>Intercollegiate Athletes:</u></b></p> <p>(Hsu et al, 2010; <math>n = 321</math>; mean age 19.4 (17.6-22.6) years; Pre-competition physical, Intercollegiate Athletes)</p> <ul style="list-style-type: none"> <li>MDC = 10</li> </ul> <p><b><u>Proximal Humeral Fractures:</u></b></p> <p>(Slobogean et al., 2010; <math>n = 61</math>, mean age = 69, Proximal Humeral Fractures)</p> <ul style="list-style-type: none"> <li>Calculated from <math>MDC = 1.96 * SEM * (\text{square root of } 2)</math></li> <li><math>MDC = 1.96 * 5.82 * (\text{square root of } 2) = 16.1</math></li> </ul> <p><b><u>Adults with musculoskeletal upper extremity problems:</u></b></p> <p>(Schmitt J.S., Di Fabio R.P., 2004)</p> <ul style="list-style-type: none"> <li>MDC90 = 12.2</li> </ul> <p>(Beaton D.E., Katz J.N., Fossel A.H., Wright J.G., Tarasuk V., Bombardier C., 2001)</p> <ul style="list-style-type: none"> <li>MDC90 = 10.7</li> <li>MDC95 = 12.75</li> </ul> |
| Minimally Clinically Important Difference (MCID) | <p><b><u>Intercollegiate Athletes:</u></b></p> <p>(Hsu et al, 2010; <math>n = 321</math>; mean age 19.4 (17.6-22.6) years; Pre-competition physical, Intercollegiate Athletes)</p> <ul style="list-style-type: none"> <li>MCID = 10</li> </ul> <p><b><u>Pre-operative and Post-operative change in UE Function:</u></b></p> <p>(Gummesson, Atroshi and Ekdah; 2003; <math>n = 109</math>; patients had surgery for a variety of upper extremity conditions; assessed prior to surgery then again 6 to 21 months later; Swiss sample)</p> <ul style="list-style-type: none"> <li>Patients (<math>n = 53</math>) reporting "<b>much better</b>" or "<b>much worse</b>" <ul style="list-style-type: none"> <li>Mean Change = 19 (15 to 23) points</li> </ul> </li> <li>Patients (<math>n = 21</math>) reporting "<b>somewhat better</b>" or "<b>somewhat worse</b>" <ul style="list-style-type: none"> <li>Mean Change = 10 (7 to 14) points</li> </ul> </li> </ul>              |

- Patients ( $n = 9$ ) reporting "no change"
  - Mean change = -3 (-3 to 3.0) points

**Total Elbow Arthroplasty:**

(Angst et al, 2012;  $n = 65$ ; 61.9 (13.0), Total Elbow Arthroplasty)

- Standard Response Mean = 0.55, Effect Size = 0.20)

**Adults with upper extremity musculoskeletal complaints undergoing surgery:**

(Angst F., Schwyzer H.K., Aeschlimann A., Simmen B.R., Goldhahn J., 2011)

- MCID = 10.2

**Adults with musculoskeletal upper extremity problems:**

(Schmitt J.S., Di Fabio R.P., 2004)

- MCID = 10.2

**Cut-Off Scores**

Not Established

**Normative Data**

**Elbow Disorders:**

(Angst et al, 2005;  $n = 79$ ; mean age = 64.1 (13.3) years; time since surgery = 11.2 (3.0) years; Function following total elbow arthroplasty; Swiss sample, Elbow Disorders)

| Instrument                       | Mean (SD)   | $n$ |
|----------------------------------|-------------|-----|
| DASH                             | 55.3 (23.2) | 77  |
| DASH function                    | 51.1 (25.2) | 77  |
| DASH symptoms                    | 66.1 (22.8) | 79  |
| SF-36 physical functioning       | 48.7 (28.4) | 79  |
| SF-36 role physical              | 45.1 (44.7) | 76  |
| SF-36 bodily pain                | 59.1 (27.5) | 79  |
| SF-36 general health             | 56.0 (25.7) | 78  |
| SF-36 vitality                   | 48.4 (22.4) | 78  |
| SF-36 social functioning         | 80.7 (22.8) | 79  |
| SF-36 role emotional             | 74.8 (41.9) | 72  |
| SF-36 mental health              | 71.4 (20.6) | 78  |
| SF-36 physical component summary | 37.2 (12.0) | 75  |
| SF-36 mental component summary   | 52.3 (11.5) | 69  |
| SF-36: Short Form 36             |             |     |

DASH: Disabilities of the Arm, Shoulder, and Hand Questionnaire

### **Osteoarthritis:**

(MacDermid et al, 2007;  $n = 122$ ; mean age = 65.4 (8.1) years; time since surgery = 54.2 (23.1) months, Osteoarthritis)

#### **Arthroplasty of the carpometacarpal joint for osteoarthritis**

|                                         | Minimum | Maximum | Mean | SD    |
|-----------------------------------------|---------|---------|------|-------|
| <b>DASH</b>                             | 0       | 90.8    | 36.7 | 24.03 |
| <b>PRWHE</b>                            | 0       | 92      | 41.5 | 28.33 |
| <b>SF-36 Mental Component Summary</b>   | 21.9    | 66.7    | 47.9 | 11.67 |
| <b>SF-36 Physical Component Summary</b> | 12.0    | 61.5    | 34.6 | 11.38 |

PRWHE: Patient-Rated Wrist Hand Evaluation  
DASH: Disabilities of Arm, Shoulder, and Hand Questionnaire  
SF-36: Short Form 36

### **Rheumatoid Arthritis:**

(Chiari-Grisar et al, 2006;  $n = 37$ ; Function following finger joint arthroplasty in patients with rheumatoid arthritis; study performed in Austria; grip strength scores measured with a Martin vigorimeter, Rheumatoid Arthritis)

| Instrument                  | Mean (SD)     | Median | Min | Max  |
|-----------------------------|---------------|--------|-----|------|
| DASH (German version) score | 44.52 (19.14) | 44.2   | 5   | 82.5 |
| HAQ score                   | 1.12 (0.76)   | 1.06   | 0   | 2.88 |

DASH: Disabilities of Arm, Shoulder, and Hand Questionnaire  
HAQ: Health Assessment Questionnaire

### **Wrist Disorders:**

(Imaeda et al, 2010;  $n = 117$ ; adapted by the Japanese Society for Surgery of the Hand, Japanese sample, Wrist Disorders)

#### **Score for PRWE, DASH-JSSH, and VAS:**

| Instrumental Scale | No. | Mean | SD   | Median | Minimum | Maximum |
|--------------------|-----|------|------|--------|---------|---------|
| <b>DASH-JSSH</b>   | 116 | 44.2 | 28.2 | 39.5   | 0(a)    | 100(b)  |

|             |     |      |      |      |   |        |
|-------------|-----|------|------|------|---|--------|
| <b>PRWE</b> | 112 | 58.7 | 24.3 | 61.5 | 5 | 99     |
| <b>VAS</b>  | 111 | 59.3 | 24.3 | 60   | 6 | 100(b) |

PRWE: Patient-Related Wrist Evaluation  
DASH-JSSH: Disability/Symptom scale of the Japanese version of the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire  
VAS: Visual Analogue Scale for Pain (0-10 Scale)  
Maximum Health Status Scores (Ceiling)

#### Test-retest Reliability

##### **Overhead Athletes:**

(Alberta et al, 2010;  $n = 252$  mean age = 23.7, Overhead Athletes)

- **Adequate** test-retest reliability (ICC = 0.536)

##### **Proximal Humeral Fractures:**

(Slobogean et al, 2010;  $n = 61$ , mean age = 69, Proximal Humeral Fractures)

- **Excellent** test-retest reliability (ICC 2,1 = 0.928)

| Instrument   | ICC (95% CI)           | Mean Difference      | Limits of Agreement |
|--------------|------------------------|----------------------|---------------------|
| <b>EQ-5D</b> | 0.773 (0.604 to 0.875) | 0.03 (0.00 to 0.06)  | -0.18 to 0.24       |
| <b>HUI3</b>  | 0.471 (0.184 to 0.686) | 0.04 (-0.03 to 0.11) | -0.37 to 0.45       |
| <b>SF-6D</b> | 0.794 (0.634 to 0.889) | 0.01 (-0.02 to 0.04) | -0.17 to 0.19       |
| <b>DASH</b>  | 0.928 (0.860 to 0.963) | 0.4 (-2.3 to 3.1)    | -15.2 to 15.9       |

##### **Total Elbow Arthroplasty:**

(Angst et al, 2012;  $n = 65$ ; 61.9 (13.0), Total Elbow Arthroplasty)

- **Excellent** test-retest reliability (ICC = 0.96)

##### **Rheumatoid Arthritis:**

(Raven E.E.J., Haverkamp D., Siervelt I.N., et al., 2008)

- ICC = 0.97

##### **Swedish Patients with Rheumatoid Arthritis:**

(Bilberg A., Bremell T., Mannerkorpi K., 2012;  $n = 67$ )

- ICC = 0.99 (95% CI, 0.98-0.99)

##### **Adults with musculoskeletal upper extremity problems:**

(Schmitt J.S., Di Fabio R.P., 2004)

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                     | <ul style="list-style-type: none"> <li>• ICC = 0.91</li> </ul> <p>(Beaton D.E., Katz J.N., Fossel A.H., Wright J.G., Tarasuk V., Bombardier C., 2001)</p> <ul style="list-style-type: none"> <li>• ICC = 0.96 (95% CI, 0.93-0.98)</li> </ul> <p><b><u>Patients Post-Stroke (n=32; 27.9±14.4 days post-stroke)</u></b></p> <p>(Dalton E, Lannin NA, Laver K, Ross L, Ashford S, McCluskey A, Cusick A., 2016)</p> <ul style="list-style-type: none"> <li>• ICC=0.56 (95% CI 0.05-0.79)</li> </ul>                                                                                                                                                                                                                                                                                                                                  |
| Interrater / Intrarater Reliability | <p><b><u>Proximal Humeral Fractures:</u></b></p> <p>(Slobogean et al, 2010; n = 61, mean age = 69, Proximal Humeral Fractures)</p> <ul style="list-style-type: none"> <li>• See Test-retest reliability in Proximal Humeral Fractures for format</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Internal Consistency                | <p><b><u>Rheumatoid Arthritis:</u></b></p> <p>(Raven E.E.J., Haverkamp D., Siervelt I.N., et al., 2008)</p> <ul style="list-style-type: none"> <li>• Cronbach's alpha = 0.97</li> </ul> <p><b><u>Adults with upper extremity musculoskeletal complaints undergoing surgery:</u></b></p> <p>(Gummesson C., Atroshi I., Ekdahl C., 2003)</p> <ul style="list-style-type: none"> <li>• Cronbach's alpha = 0.92-0.97</li> </ul> <p><b><u>Adults with Multiple Sclerosis:</u></b></p> <p>(Cano S., Barrett L., Zajicek J., Hobart J., 2011)</p> <ul style="list-style-type: none"> <li>• Cronbach's alpha = 0.98</li> </ul> <p><b><u>General Population:</u></b></p> <p>(Hunsaker F.G., Cioffi D.A., Amadio P.C., Wright J.G., Caughlin B., 2002)</p> <ul style="list-style-type: none"> <li>• Cronbach's alpha = 0.94-0.98</li> </ul> |

|                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |                          |                            |                             |                            |                             |             |             |       |       |       |       |       |       |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|-------------|-------------|-------|-------|-------|-------|-------|-------|
|                                                   | <p><b><u>Patients Post-Stroke (n=61; 43.1±69.8 days post-stroke)</u></b></p> <p>(Dalton E, Lannin NA, Laver K, Ross L, Ashford S, McCluskey A, Cusick A., 2016)</p> <ul style="list-style-type: none"><li>Cronbach's alpha = 0.92, SEM = 6.65</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                            |                          |                            |                             |                            |                             |             |             |       |       |       |       |       |       |
| Criterion Validity<br>(Predictive / Concurrent)   | <p><b><u>Neck Pain:</u></b></p> <p>(Mehta et al., 2010; <i>n</i> = 66, mean age= 40.6 (14.2), Neck Pain)</p> <ul style="list-style-type: none"><li>Both versions of the DASH showed high correlation (0.82-0.84) with the NDI and moderate correlation with the CSOQ and VAS.</li></ul> <p><b>Correlation Between Self-Report Measures</b></p> <table><tr><td></td><td>CSOQ Neck Pain</td><td>CSOQ Shoulder and Arm Pain</td><td>CSOQ Physical Symptom</td><td>CSOQ Functional Disability</td><td>CSOQ Psychological Distress</td><td>VAS</td></tr><tr><td>DASH</td><td>0.61*</td><td>0.55*</td><td>0.67*</td><td>0.58*</td><td>0.56*</td><td>0.55*</td></tr></table> <p>*Correlation is significant at the 0.01 level (2-tailed);<br/>CSOQ= Cervical spine outcome questionnaire;<br/>VAS= Visual Analog Scale</p> |                            | CSOQ Neck Pain           | CSOQ Shoulder and Arm Pain | CSOQ Physical Symptom       | CSOQ Functional Disability | CSOQ Psychological Distress | VAS         | DASH        | 0.61* | 0.55* | 0.67* | 0.58* | 0.56* | 0.55* |
|                                                   | CSOQ Neck Pain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CSOQ Shoulder and Arm Pain | CSOQ Physical Symptom    | CSOQ Functional Disability | CSOQ Psychological Distress | VAS                        |                             |             |             |       |       |       |       |       |       |
| DASH                                              | 0.61*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.55*                      | 0.67*                    | 0.58*                      | 0.56*                       | 0.55*                      |                             |             |             |       |       |       |       |       |       |
|                                                   | <p><b><u>Patients Post-Stroke (n=32; 27.9±14.4 days post-stroke)</u></b></p> <p>(Dalton E, Lannin NA, Laver K, Ross L, Ashford S, McCluskey A, Cusick A., 2016)</p> <p>Spearman's rho between DASH and Patient Rated Wrist Evaluation (PRWE)</p> <p><i>r</i><sub>s</sub>=0.4 (<i>p</i>=0.023)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |                          |                            |                             |                            |                             |             |             |       |       |       |       |       |       |
| Construct Validity<br>(Convergent / Discriminant) | <p><b><u>Neck Pain:</u></b></p> <p>(Huisstede et al., 2009; <i>n</i> = 679; 41.0 (23.0), Neck Pain)</p> <table><tr><td></td><td>SF-12 Physical Component</td><td>SF-12 Mental Component</td><td>Severity</td></tr><tr><td></td><td>Correlation</td><td>Correlation</td><td>Correlation</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                            | SF-12 Physical Component | SF-12 Mental Component     | Severity                    |                            | Correlation                 | Correlation | Correlation |       |       |       |       |       |       |
|                                                   | SF-12 Physical Component                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | SF-12 Mental Component     | Severity                 |                            |                             |                            |                             |             |             |       |       |       |       |       |       |
|                                                   | Correlation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Correlation                | Correlation              |                            |                             |                            |                             |             |             |       |       |       |       |       |       |

|            |      |      |      |
|------------|------|------|------|
| S-A-H      | 0.62 | 0.15 | 0.55 |
| N-S-A-H    | 0.61 | 0.16 | 0.52 |
| N-S-A-H    | 0.63 | 0.19 | 0.5  |
| N          | 0.62 | 0.27 | 0.44 |
| S-A-H-only | 0.61 | 0.1  | 0.56 |
| N-only     | 0.57 | 0.33 | 0.44 |

#### **Osteoarthritis:**

(MacDermid et al, 2007;  $n = 122$ ; function following arthroplasty of the carpometacarpal joint of the hand for osteoarthritis; Osteoarthritis)

#### **Correlations of the SF-36 component summary scores with PRWHE and DASH Scores**

| SF-36 Subscale                                            | PRWHE | DASH  |
|-----------------------------------------------------------|-------|-------|
| Physical Component Summary                                | -0.35 | -0.49 |
| Mental Component Summary                                  | -0.45 | -0.49 |
| All correlations significant at the 0.01 level (2-tailed) |       |       |
| SF-36: Short Form 36                                      |       |       |
| PRWHE: Patient-Rated Wrist Hand Evaluation                |       |       |

#### **Correlation between self-report function scores and measured impairments\***

|                        | PRWHE total | DASH    |
|------------------------|-------------|---------|
| <b>Strength</b>        |             |         |
| Grip                   | -0.45**     | -0.43** |
| Tripod pinch           | -0.45**     | -0.44** |
| Key pinch              | -0.36**     | -0.40** |
| Wrist flexion          | -0.39**     | -0.44** |
| Wrist extension        | -0.39**     | -0.37** |
| <b>Dexterity</b>       |             |         |
| NK small objects       | 0.32**      | 0.30**  |
| NK medium objects      | 0.39**      | 0.48**  |
| NK large objects       | 0.44**      | 0.48**  |
| <b>Range of Motion</b> |             |         |
| Wrist flexion          | -0.26**     | -0.23*  |
| Wrist extension        | -0.05       | -0.07   |

|                                                                                            |         |         |
|--------------------------------------------------------------------------------------------|---------|---------|
| Radial deviation                                                                           | -0.15   | -0.12   |
| Ulnar deviation                                                                            | -0.23*  | -0.12   |
| Pronation                                                                                  | -0.05   | -0.03   |
| Supination                                                                                 | 0.00    | -0.01   |
| Thumb IP flexion                                                                           | 0.03    | -0.08   |
| Thumb MCP flexion                                                                          | 0.03    | 0.05    |
| Thumb IP extension                                                                         | 0.12    | 0.06    |
| Thumb MCP extension                                                                        | -0.10   | -0.02   |
| Thumb CMC extension                                                                        | -0.12   | -0.11   |
| Thumb abduction                                                                            | 0.01    | 0.03    |
| Thumb opposition                                                                           | 0.11    | 0.10    |
| Hand Span                                                                                  | -0.34** | -0.25** |
| *Impairments measured using the NK Hand Assessment System                                  |         |         |
| ** Correlation significant at 0.01 (2-tailed). *Correlation significant at 0.05 (2-tailed) |         |         |
| PRWHE: Patient-Rated Wrist Hand Evaluation                                                 |         |         |
| DASH: Disabilities of Arm, Shoulder, Hand                                                  |         |         |

### **Proximal Humeral Fractures:**

(Slobogean et al, 2010;  $n = 61$ , mean age = 69, Proximal Humeral Fractures)

| <b>Spearman Correlations between Study Instruments</b>                                         |       |      |       |      |      |   |
|------------------------------------------------------------------------------------------------|-------|------|-------|------|------|---|
| Self Function                                                                                  | 1     |      |       |      |      |   |
| SF-12 PCS                                                                                      | 0.49  | 1    |       |      |      |   |
| DASH                                                                                           | -0.76 |      | 1     |      |      |   |
| EQ-5D                                                                                          | 0.53  | 0.73 | -0.75 | 1    |      |   |
| HUI3                                                                                           | 0.38* | 0.63 | -0.58 | 0.63 | 1    |   |
| SF-6D                                                                                          | 0.45  | 0.83 | -0.73 | 0.74 | 0.59 | 1 |
| All correlations are significant to $P < 0.01$ , except Self Function, HUI3 where $P < 0.02$ . |       |      |       |      |      |   |

### **Rheumatoid Arthritis:**

(Chiari-Grisar et al, 2006;  $n = 37$ ; Function following finger joint arthroplasty in patients with rheumatoid arthritis; study performed in Austria, Rheumatoid Arthritis)

| <b>SF-36 Subscale</b> | <b>Mean (SD)</b> | <b>Correlation to DASH (German version)</b> |
|-----------------------|------------------|---------------------------------------------|
|-----------------------|------------------|---------------------------------------------|

|                      |                  |                       |
|----------------------|------------------|-----------------------|
| Physical functioning | 47.16<br>(24.17) | -0.73 ( $P < 0.01$ )  |
| Role-physical        | 32.43<br>(44.04) | -0.53 ( $P < 0.01$ )  |
| Bodily pain          | 43.92<br>(22.37) | -0.53 ( $P < 0.01$ )  |
| General health       | 51.41<br>(18.62) | -0.43 ( $P < 0.01$ )  |
| Vitality             | 46.08<br>(22.36) | -0.51 ( $P < 0.001$ ) |
| Social functioning   | 81.42<br>(21.77) | -0.35 ( $P < 0.03$ )  |
| Role-emotional       | 72.97<br>(41.45) | -0.31 ( $P < 0.05$ )  |
| Mental health        | 71.24<br>(18.66) | -0.57 ( $P < 0.001$ ) |

SF-36: Short Form 36

DASH: Disabilities of Arm, Shoulder, Hand

(Raven E.E.J., Haverkamp D., Siervelt I.N., et al., 2008)

- Correlation of DASH and other outcome measures: (Pearson correlation)
  - o Health Assessment Questionnaire –  $r = 0.88$
  - o SF-36 –  $r = 0.70$
  - o Arthritis Impact Measurement Scale –  $r = 0.85$
  - o Disease Activity Score –  $r = 0.42$
  - o Grip Strength –  $r = 0.41-0.48$
  - o Visual Analog Scale –  $r = 0.60-0.65$

#### **Swedish Patients with Rheumatoid Arthritis:**

(Bilberg A., Bremell T., Mannerkorpi K., 2012;  $n = 67$ )

- Correlation of DASH and other outcome measures: (Spearman correlation)
  - o Health Assessment Questionnaire –  $r = 0.80$
  - o Active shoulder-arm motion –  $r = -0.38$  to  $-0.50$
  - o Handgrip force –  $r = -0.46$  to  $-0.59$
  - o Activity-Induced pain –  $r = 0.66$
  - o Disease Activity Score in 28 joints –  $r = 0.63$

**Adults with musculoskeletal upper extremity problems:**

(Schmitt J.S., Di Fabio R.P., 2004)

- Global Disability Rating – Spearman  $r = 0.67-0.71$

(Beaton D.E., Katz J.N., Fossel A.H., Wright J.G., Tarasuk V., Bombardier C., 2001)

- SPADI pain – Pearson  $r = 0.79$ , Spearman  $r = 0.76$
- SPADI function – Pearson  $r = 0.85$ , Spearman  $r = 0.83$

**Adhesive Capsulitis:**

(Staples M.P., Forbes A., Green S., Buchbinder R., 2010)

- SPADI –  $r = 0.55$
- Croft Index –  $r = 0.65$
- Visual Analog Scale –  $r = 0.31$
- Health Assessment Questionnaire –  $r = 0.54$

**Shoulder Arthroplasty (Switzerland, German-language):**

(Angst F., Pap G., Mannion A.F., et al., 2004;  $n = 43$ )

- SF-36 (PCS) –  $r = 0.67$
- SF-36 (MCS) –  $r = 0.06$
- SPADI –  $r = 0.93$
- pASES –  $r = 0.79$
- cASES –  $r = 0.59$
- Constant Shoulder –  $r = 0.82$

Discriminative Validity:

**Adults with musculoskeletal upper extremity problems:**

(Beaton D.E., Katz J.N., Fossel A.H., Wright J.G., Tarasuk V., Bombardier C., 2001)

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <ul style="list-style-type: none"> <li>Participants who were working with their upper limb condition and were able to continue to work had a significantly lower disability than those unable to work (26.8 vs. 50.7, <math>t=-7.51</math>, <math>p&lt;0.0001</math>).</li> <li>Similarly, the DASH was able to discriminate between those who could do everything they wanted to vs. those who could not (23.6 vs. 47.1, <math>t=-5.81</math>, <math>p&lt;0.0001</math>).</li> </ul> |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                         |                 |
|-------------------------|-----------------|
| <b>Content Validity</b> | Not Established |
|-------------------------|-----------------|

|                      |                 |
|----------------------|-----------------|
| <b>Face Validity</b> | Not Established |
|----------------------|-----------------|

**Professional Association Recommendations** Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Stroke Taskforce (StrokEDGE II). These recommendations were developed by a panel of research and clinical experts.

**Abbreviations:**

|                |                                                                      |
|----------------|----------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                     |
| <b>R</b>       | Recommend                                                            |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Rec |
| <b>NR</b>      | Not Recommended                                                      |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br>(CVA < 2 months post) | <b>Subacute</b><br>(CVA 2 to 6 months) | <b>Chronic</b><br>(> 6 months) |
|---------------------|---------------------------------------|----------------------------------------|--------------------------------|
| <b>StrokEDGE II</b> | NR                                    | LS                                     | LS                             |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>StrokEDGE II</b> | NR                | NR                              | NR                              | LS                               | LS                 |

Recommendations for entry-level physical therapy education and use in research:

|  | <b>Students should learn to administer</b> | <b>Students should be exposed</b> | <b>Appropriate for use in intervention</b> | <b>Is additional research warranted for</b> |
|--|--------------------------------------------|-----------------------------------|--------------------------------------------|---------------------------------------------|
|  |                                            |                                   |                                            |                                             |

|                         | this tool?<br>(Y/N) | to tool?<br>(Y/N) | research<br>studies? (Y/N) | this tool (Y/N) |
|-------------------------|---------------------|-------------------|----------------------------|-----------------|
| <b>StrokEDGE<br/>II</b> | N                   | Y                 | Y                          | Y               |

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## 10. REHAB MEASURES DATABASE—DYNAMOMETRY

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Title of Assessment    | Hand-held Dynamometry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Acronym                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Instrument Reviewer(s) | Originally reviewed by StrokEDGE task force<br><br>Re-reviewed by Heather Anderson and Rie Yoshida of the StrokEDGE II task force.                                                                                                                                                                                                                                                                                                                                                                                      |
| Summary Date           | 4/28/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Purpose                | A quantitative and objective measure of isometric muscular strength                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Description            | <ul style="list-style-type: none"> <li>• Clients are asked to maintain an isometric contraction (for either a “make” or “break test”) for 2-5 seconds. During a “make” test the client pushes the body segment into the dynamometer. During a “break” test, the examiner asks the client to maintain a static position while the examiner applies resistance.</li> <li>• This instrument is scored using force production: kilograms, Newtons or pounds of force</li> <li>• Kilograms (0-90), Pounds (0-200)</li> </ul> |
| Area of Assessment     | Muscle strength                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Body Part              | UE, LE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| ICF Domain             | Body Structure; Body Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Domain                 | Motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Assessment Type        | Performance based                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Length of Test         | 05 Minutes or Less                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Time to Administer     | Variable depending on the number of muscles being tested and the number of trials performed. Standard is up to 5 seconds per muscle tested.                                                                                                                                                                                                                                                                                                                                                                             |
| Number of Items        | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Equipment Required     | Requires purchase of a hand-held dynamometer                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Training Required      | Reading of the instruction manual, familiarizing oneself to the dynamometer features                                                                                                                                                                                                                                                                                                                                                                                                                                    |

| Type of training required                        | Reading an Article/Manual                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------|-----------------|-----|-------------|------------|-----|-------------|------------|-----|-------------|------------|-----|-------------|------------|
| Cost                                             | Approximately \$1000 or more for each dynamometer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Actual Cost                                      | Cost of instrument varies depending on the manufacture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Age Range                                        | Pediatric-adult                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Administration Mode                              | Therapist conducts motor strength testing with dynamometer instrument                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Diagnosis                                        | Geriatrics; Stroke                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Populations Tested                               | <ul style="list-style-type: none"><li>• Geriatrics</li><li>• Healthy Adults</li><li>• Stroke</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Standard Error of Measurement (SEM)              | <p><b><u>Chronic Stroke:</u></b></p> <p>(Bertrand, et al, 2007; <i>n</i> = 17; mean age 53.7(13.0); paresis of the arm as a result of a unilateral stroke that occurred &gt; one year earlier; three trials with time intervals between two sessions as well as the time of day not fixed; participants were not involved in a rehabilitation program)</p> <table><tr><th>Session/Trial</th><th>Paretic SEM</th><th>Non-paretic SEM</th></tr><tr><td>1,1</td><td>28.78 (20%)</td><td>22.27 (8%)</td></tr><tr><td>1,3</td><td>26.15 (18%)</td><td>17.10 (6%)</td></tr><tr><td>2,1</td><td>20.35 (14%)</td><td>16.07 (6%)</td></tr><tr><td>2,3</td><td>18.49 (13%)</td><td>12.23 (4%)</td></tr></table> <ul style="list-style-type: none"><li>• SEM = 0.10 (19%) session 1</li><li>• SEM = 0.07 (13%) session 2</li></ul> | Session/Trial   | Paretic SEM | Non-paretic SEM | 1,1 | 28.78 (20%) | 22.27 (8%) | 1,3 | 26.15 (18%) | 17.10 (6%) | 2,1 | 20.35 (14%) | 16.07 (6%) | 2,3 | 18.49 (13%) | 12.23 (4%) |
| Session/Trial                                    | Paretic SEM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Non-paretic SEM |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| 1,1                                              | 28.78 (20%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 22.27 (8%)      |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| 1,3                                              | 26.15 (18%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 17.10 (6%)      |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| 2,1                                              | 20.35 (14%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 16.07 (6%)      |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| 2,3                                              | 18.49 (13%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 12.23 (4%)      |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Minimal Detectable Change (MDC)                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Minimally Clinically Important Difference (MCID) | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Cut-Off Scores                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Normative Data                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |
| Test-retest Reliability                          | <b><u>Stroke:</u></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |             |                 |     |             |            |     |             |            |     |             |            |     |             |            |

(Bertrand et al, 2007, Chronic Stroke)

- **Excellent** test-retest reliability (ICC 0.80 to 0.89)

**Community Dwelling Older Adults:** (Abizanda, et al., 2012, n=281; mean age = 74.3 (4.9) years, healthy older adults)

- **Excellent** test-retest reliability (ICC = 0.9874)

### **Stroke and TBI:**

(Riddle et al 1989; measurements at wrist, elbow, shoulder, hip, knee and ankle)

- **Excellent** test-retest reliability (ICC = 0.79-0.97)

### **Stroke, TBI, SCI and peripheral neuropathy**

(Bohannon 1986; measurements at wrist, elbow, shoulder, hip, knee and ankle)

- **Excellent** test-retest reliability (ICC = 0.97-0.98)

**Children:** (Effgen & Brown, 1992; long-term stability of hand-held dynamometric measurements of shoulder, elbow and wrist in children with myelomeningocele)

- **Moderate to Excellent** test-retest reliability (0.60-0.98)

### **(Taylor et al, 2004; children with cerebral palsy (CP))**

- **Excellent** test-retest reliability (0.81-0.96)  
ankle PF, quads (0.81), hip flex, hip AB and hip ext tested

(Crompton et al, 2007; muscle strength measurement with hand-held dynamometry for children with CP)

- **Low to moderate** test-retest reliability (0.26-0.89) for LE strength testing without stabilization

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                     | <ul style="list-style-type: none"> <li>• <b>Moderate to excellent</b> test-retest reliability (0.62-0.91) for LE strength testing with stabilization</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Interrater / Intrarater Reliability | <p><b><u>Stroke and TBI:</u></b> (Riddle et al 1989; measurements at wrist, elbow, shoulder, hip, knee and ankle)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> intra-rater reliability (ICC = 0.88-0.98)</li> </ul> <p>(Katz-Leurer et al, 2008; children with TBI)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> intra-rater reliability (0.91-0.99)</li> </ul> <p><b><u>Healthy Subjects:</u></b> (Sullivan et al 1988 healthy subjects; shoulder)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> intra-rater reliability (0.98)</li> </ul> <p>(Bohannon and Andrews, 1987; healthy subjects; shoulder)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> inter-rater reliability (0.84-0.94)</li> </ul> <p><b><u>SCI:</u></b> (May et al, 1997; isokinetic measures of shoulder IR/ER rotator strength in persons with SCI)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> intra-rater reliability (0.89-0.96)</li> </ul> <p>(Larson et al, 2010; assessment of postural muscle strength in sitting for persons with SCI)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> intra-rater reliability (-.79-0.99)</li> <li>• <b>Excellent</b> inter-rater reliability (0.96-0.99)</li> </ul> <p><b><u>Children with Cerebral Palsy:</u></b> (Crompton et al, 2007; muscle strength measurement with hand-held dynamometry for children with CP)</p> <ul style="list-style-type: none"> <li>• <b>Moderate to Excellent</b> intra-rater reliability (0.63-0.96) ankle PF &amp; DF, hip flex, &amp; quads (0.63) and hip ext tested</li> </ul> |
|                                     | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

**Criterion Validity  
(Predictive / Concurrent)**

Stroke: (Piao et al, 2004; quadriceps femoris muscle strength on affected side)

- **Excellent relationship** with isokinetic dynamometry (Pearson  $r = 0.99$ )

Huntington's disease: (Busse et al, 2008; LE strength)

- **Adequate to Good** correlation to Unified Huntington's Disease Rating Scale (UHDRS) motor scale (Spearman's  $r = 0.49-0.74$ )
- **Adequate to Good** correlation to functional independence measure (Spearman's  $r = 0.59-0.74$ )

**Construct Validity  
(Convergent / Discriminant)**

**Stroke:**

(Boissy et al, 1999, stroke >1 yr, Chronic Stroke)

- **Adequate** correlation with Fugl-Meyer upper limb performance test ( $r = 0.84$ )
- **Adequate** correlation with TEMPA upper limb function test
- **Adequate** correlation with Box and Block affected upper limb score
- **Adequate** correlation with finger-to-nose affected limb score

(Piao et al. 2004; stroke; measured affected quadriceps)

- **Excellent** convergent validity ( $r = 0.99$ )

(Dorsch et al, 2012, chronic stroke with time since stroke of 1-6 years)

Correlation between strength of the muscle groups of the affected lower limb (adjusted to body weight) and walking speed (10MWT)

| Muscle Group       | Correlation with 10MWT (Pearson correlation coefficient) | Strength of correlation |
|--------------------|----------------------------------------------------------|-------------------------|
| Ankle dorsiflexors | 0.50                                                     | Large                   |
| Hip flexors        | 0.35                                                     | Medium                  |
| Ankle evertors     | 0.33                                                     | Medium                  |
| Knee flexors       | 0.30                                                     | Medium                  |

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|--------|---------------|------|-------|---------------|------|-------|----------------------|------|-------|----------------|------|-------|-----------------|------|-------|---------------|------|-------|-----------------------|------|-------|
|                                          | <table><tr><td>Hip internal rotators</td><td>0.30</td><td>Medium</td></tr><tr><td>Hip extensors</td><td>0.29</td><td>Small</td></tr><tr><td>Hip adductors</td><td>0.29</td><td>Small</td></tr><tr><td>Ankle plantarflexors</td><td>0.29</td><td>small</td></tr><tr><td>Knee extensors</td><td>0.27</td><td>Small</td></tr><tr><td>Ankle invertors</td><td>0.25</td><td>Small</td></tr><tr><td>Hip abductors</td><td>0.24</td><td>Small</td></tr><tr><td>Hip external rotators</td><td>0.22</td><td>small</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                   | Hip internal rotators | 0.30 | Medium | Hip extensors | 0.29 | Small | Hip adductors | 0.29 | Small | Ankle plantarflexors | 0.29 | small | Knee extensors | 0.27 | Small | Ankle invertors | 0.25 | Small | Hip abductors | 0.24 | Small | Hip external rotators | 0.22 | small |
| Hip internal rotators                    | 0.30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Medium                |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Hip extensors                            | 0.29                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Small                 |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Hip adductors                            | 0.29                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Small                 |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Ankle plantarflexors                     | 0.29                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | small                 |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Knee extensors                           | 0.27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Small                 |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Ankle invertors                          | 0.25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Small                 |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Hip abductors                            | 0.24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Small                 |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Hip external rotators                    | 0.22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | small                 |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Content Validity                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Face Validity                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Floor / Ceiling Effects                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Responsiveness                           | <p><b><u>Healthy Adults :</u></b></p> <p>(Nitschke et al, 1999; n = 42; mean age 32.3 (7.3) healthy female subjects &amp; 42.6 (11.8) nonspecific regional pain in upper arm female subjects; Jamar dynamometer)</p> <ul style="list-style-type: none"><li>• A change of more than 6 kg (13.2 lb) is necessary to detect a genuine change in grip strength 95% of the time.</li></ul> <p>(Reddon et al., 1985)</p> <ul style="list-style-type: none"><li>• <b>Small change:</b> effect size 0.01 for men’s non-preferred and women’s preferred hand and 0.13 for men’s preferred and 0.14 for women’s non-preferred hands over 10 week trial</li></ul> <p><b><u>Stroke:</u></b></p> <p>(Roberts et al, 2011)</p> <ul style="list-style-type: none"><li>• Recovery after a stroke estimate the differences in repeat measures of hand grip strength to be between 4.7 kg and 6.2 kg</li></ul> |                       |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |
| Professional Association Recommendations | Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association’s Stroke Taskforce (StrokEDGE II) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                       |      |        |               |      |       |               |      |       |                      |      |       |                |      |       |                 |      |       |               |      |       |                       |      |       |

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

**Abbreviations:**

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br>(CVA < 2 months post) | <b>Subacute</b><br>(CVA 2 to 6 months) | <b>Chronic</b><br>(> 6 months) |
|---------------------|---------------------------------------|----------------------------------------|--------------------------------|
| <b>StrokEDGE II</b> | <i>R</i>                              | <i>R</i>                               | <i>R</i>                       |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>StrokEDGE II</b> | <i>NR</i>         | <i>R</i>                        | <i>NR</i>                       | <i>R</i>                         | <i>NR</i>          |

Recommendations for entry-level physical therapy education and use in research:

|                       | Students should learn to administer this tool? (Y/N)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| <b>StrokEDGE II</b>   | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Yes                                       | Yes                                                         | Yes                                                  |
| <b>Considerations</b> | <ul style="list-style-type: none"> <li>• This document reflects hand-held dynamometry not grip strength testing</li> <li>• Proper stabilization must occur to improve reliability (Compton et al, 2007)</li> <li>• Gender, body weight and grip strength can affect a rater's ability to stabilize a hand-held dynamometer and can influence reliability when "smaller" testers are testing stronger muscle groups (Wadsworth et al, 1992)</li> <li>• Dynamometers are expensive and not always available depending on the setting</li> <li>• Client must be able to follow instructions to complete</li> </ul>                                                                                        |                                           |                                                             |                                                      |
| <b>Bibliography</b>   | <p>Abizanda, P., Navarro, J. L., et al. (2012). "Validity and usefulness of hand-held dynamometry for measuring muscle strength in community-dwelling older persons." Arch Gerontol Geriatr 54(1): 21-27. Find it on PubMed</p> <p>Bertrand, A. M., Mercier, C., et al. (2007). "Reliability of maximal static strength measurements of the arms in subjects with hemiparesis." Clin Rehabil 21(3): 248-257. Find it on PubMed</p> <p>Bohannon RW, Andrews AW. Interrater reliability of hand-held dynamometry. Phys Ther 1987; 67(6):931-933.</p> <p>Bohannon RW. Test-retest reliability of hand-held dynamometry during a single session of strength assessment. Phys Ther 1986; 66(2):206-209.</p> |                                           |                                                             |                                                      |

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>Year published</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Approval Status</b>          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |



## 11. REHAB MEASURES DATABASE—EURO-QUALITY OF LIFE

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     | <a href="#">Instrument available at EuroQol.org (other languages available below)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Title of Assessment</b>    | Euro-QOL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Acronym</b>                | EQ-5D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Sue Saliga, PT, PHSc, CEEAA and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 10/2012<br>Updated by Rie Yoshida and Heather Anderson of the StrokEDGE II task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2016.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Summary Date</b>           | 4/15/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Purpose</b>                | EQ-5D™ is a standardized instrument for use as a measure of health for clinical and economic appraisal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>            | <ul style="list-style-type: none"> <li>• Applicable to a wide range of health conditions and treatments, the EQ-5D health questionnaire provides a simple descriptive profile and a single index value for health status.</li> <li>• Measures the dimensions of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.</li> <li>• Original EQ-5D (EQ-5D-3L) is described by three possible levels of problems (no, mild to moderate, and severe).</li> <li>• The five dimensions measuring health status can be converted to a single utility value (EQ-Index score)</li> <li>• A five-level version, the EuroQoL 5-Dimensions Questionnaire EQ-5D (<b>EQ-5D-5L</b>) also exists where each dimension is described by five possible levels of problems (1, no problem; 2, slight problem; 3, moderate problem; 4, severe problem; and 5, unable to/extreme problem) instead of the original 3</li> <li>• The EQ-ED also includes a visual analog scale (EQ-VAS) which measures subjective health status on a vertical 0- to 100 point VAS scale.</li> </ul> |
| <b>Area of Assessment</b>     | Health status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Body Part</b>              | NA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>ICF Domain</b>             | Body Structure; Body Function; Participation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Domain</b>                 | Cognitive, emotion, motor function and general health                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Assessment Type</b>        | Self-report questionnaire                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Length of Test</b>         | 05 Minutes or Less                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Time to Administer</b>     | A few minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Number of Items</b>        | 6 items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Equipment Required</b>     | Paper and pencil or electronic version on computer/tablet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Training Required</b>      | No formal training, information available on line                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                                                  |                                                                                                                                                                                                   |           |           |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|
| Type of training required                        | No Training                                                                                                                                                                                       |           |           |
| Cost                                             | Not Free                                                                                                                                                                                          |           |           |
| Actual Cost                                      | Fee involved for licensing                                                                                                                                                                        |           |           |
| Age Range                                        | Adults (18-16) and older adults (65+)                                                                                                                                                             |           |           |
| Administration Mode                              | Self-report                                                                                                                                                                                       |           |           |
| Diagnosis                                        | Arthritis; Chronic Obstructive Pulmonary Disease; Concussion; Pain; Stroke                                                                                                                        |           |           |
| Populations Tested                               | <ul style="list-style-type: none"><li>• Rheumatoid Arthritis</li><li>• Eye pathology</li><li>• COPD</li><li>• Irritable Bowel Syndrome</li><li>• Chronic low back pain</li><li>• Stroke</li></ul> |           |           |
| Standard Error of Measurement (SEM)              | Not Established                                                                                                                                                                                   |           |           |
| Minimal Detectable Change (MDC)                  | Not Established                                                                                                                                                                                   |           |           |
| Minimally Clinically Important Difference (MCID) | <u>Chronic Stroke</u> : (Chen et al, 2015; n=65; median time since stroke 19.7 months (range 0.4-94); mean age 52.8 <u>±</u> 11.6 years)                                                          |           |           |
|                                                  |                                                                                                                                                                                                   |           |           |
|                                                  | MCID (EQ-5D-5L)                                                                                                                                                                                   | EQ-Index  | EQ-VAS    |
|                                                  | Anchor-based: SIS recovery score (10-15%)                                                                                                                                                         | 0.10      | 8.62      |
|                                                  | Distribution-based: 0.5 SD                                                                                                                                                                        | 0.10      | 10.82     |
|                                                  | Those exceeding MCID [n (%)]                                                                                                                                                                      |           |           |
|                                                  | Anchor-based: SIS recovery score (10-15%)                                                                                                                                                         | 22 (33.8) | 27 (41.5) |
|                                                  | Distribution-based: 0.5 SD                                                                                                                                                                        | 22 (33.8) | 21 (32.3) |
|                                                  | SIS = Stroke Impact Scale, SD = standard deviation                                                                                                                                                |           |           |
| Cut-Off Scores                                   | Not Established                                                                                                                                                                                   |           |           |
| Normative Data                                   | Not Established                                                                                                                                                                                   |           |           |

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test-retest Reliability                      | <p><b>Traumatic Brain Injury:</b> (Van Agt et al., <math>n=208</math>; mean age=49.3 (18.3); gender=43.3% female; Dutch population)</p> <ul style="list-style-type: none"> <li>Generalizability Theory was used for test-retest reliability assessment; results interpreted as there are some respondents who value some health states very differently the first or the second time, hence, good test retest reliability</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Interrater / Intrarater Reliability          | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Internal Consistency                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Criterion Validity (Predictive / Concurrent) | <p><b>Chronic Stroke:</b> (Chen et al, 2015; <math>n=65</math>; median time since stroke 19.7 months (range 0.4-94); mean age 52.8 <math>\pm</math> 11.6 years)</p> <p>Measures of predictive validity for the 5 item version (EQ-5D-5L):</p> <ul style="list-style-type: none"> <li><b>Fair predictive validity</b> (<math>\rho = 0.25</math>; <math>P &lt; 0.05</math>) between EQ-Index at the pre-intervention session with the Stoke Impact Scale (SIS)-ADL at the post-intervention session</li> <li><b>Fair predictive validity</b> (<math>\rho = -0.27</math>; <math>P &lt; 0.05</math>) between the mobility dimension of the EQ-5D and the Functional Independence Measure (FIM)</li> <li><b>Fair predictive validity</b> between the pain/discomfort dimension of the EQ-5D and the following SIS subscales: <ul style="list-style-type: none"> <li>-strength (<math>\rho = -0.28</math>; <math>P &lt; 0.05</math>)</li> <li>-emotion (<math>\rho = -0.27</math>; <math>P &lt; 0.05</math>)</li> <li>-mobility (<math>\rho = -0.33</math>; <math>P &lt; 0.05</math>)</li> <li>-physical score (<math>\rho = -0.34</math>; <math>P &lt; 0.05</math>)</li> </ul> </li> <li><b>Fair predictive validity</b> (<math>\rho = -0.26</math>; <math>P &lt; 0.05</math>) between the anxiety/depression dimension of the EQ-5D and the SIS hand function</li> </ul> <p>Measures of concurrent validity for EQ-Index, EQ-VAS and individual dimension of EQ-5D</p> <ul style="list-style-type: none"> <li><b>Fair to good concurrent validity</b> between EQ-Index with FIM, SIS-ADL, SIS mobility and SIS physical scores (<math>\rho = 0.255-0.703</math>, <math>P &lt; 0.05</math>)</li> <li><b>Low to fair concurrent validity</b> between EQ-VAS with FIM, SIS mobility and SIS physical scores (<math>\rho = 0.249-0.345</math>, <math>P &lt; 0.05</math>)</li> <li><b>Fair to good concurrent validity</b> between mobility and self care dimensions with physical function criterion measures (SIS strength, SIS mobility and SIS physical scores) and ADL criterion measures (FIM and SIS ADL) (<math>\rho = -0.249</math> to <math>-0.771</math>, <math>P &lt; 0.05</math>)</li> </ul> |

|                                                | <ul style="list-style-type: none"><li>• <b>Fair concurrent validity</b> between usual activity dimension and FIM, SIS-ADL, SIS mobility and SIS physical scores as well as between pain/discomfort and anxiety/depression dimensions and SIS emotion (<math>\rho = -0.298</math> to <math>-0.412</math>, <math>P &lt; 0.05</math>)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |                |                |        |               |     |                |      |  |  |  |  |                |      |      |  |  |  |        |      |      |      |  |  |               |      |      |      |      |  |     |       |       |       |       |      |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|--------|---------------|-----|----------------|------|--|--|--|--|----------------|------|------|--|--|--|--------|------|------|------|--|--|---------------|------|------|------|------|--|-----|-------|-------|-------|-------|------|
| Construct Validity (Convergent / Discriminant) | <p><b>General Population (British sample):</b> (Brazier et al., <math>n=1453</math>; visited general practitioner in previous 2 weeks, attended outpatient in previous 3 months, inpatient in previous year, chronic physical health problem)</p> <ul style="list-style-type: none"><li>• The Spearman Rank correlation coefficients of the total score and the UK SF-36 dimensions were found to be in the range 0.48-0.60 (<math>p &lt; 0.01</math>)</li></ul> <p><b>Traumatic Brain Injury:</b> (Klose et al.; <math>n=104</math>; mean age=41; gender=male <math>n=78</math>)</p> <ul style="list-style-type: none"><li>• Decreased scores on the EuroQoL Visual Analog Scale (VAS) in patients with posttraumatic hypopituitarism 12mo after injury</li></ul> <p><b>Traumatic Brain Injury:</b> (Bell et al, 2005; <math>n=171</math>; telephone intervention <math>n=85</math> and standard follow up <math>n=86</math>; mean age = 36 (15))</p> <ul style="list-style-type: none"><li>• significantly increased EuroQoL scores as an effect of a scheduled telephone intervention in patients with moderate to severe TBI</li></ul> <p><b>Stroke:</b> (Golicki et al, 2015; <math>n=112</math>; mean age 70.6 (SD=11.0); patients assessed at 1 week and 4 months post stroke with the modified Rankin Scale (mRS), Barthel Index (BI) and both the EQ-5D-5L and EQ-5D-3L, including the EQ-VAS.</p> <p>Spearman's rank correlation coefficient between change scores of studied measures:</p> <table><tr><th></th><th>EQ-5D-5L Index</th><th>EQ-5D-3L Index</th><th>EQ VAS</th><th>Barthel Index</th><th>mRS</th></tr><tr><td>EQ-5D-5L Index</td><td>1.00</td><td></td><td></td><td></td><td></td></tr><tr><td>EQ-5D-3L Index</td><td>0.74</td><td>1.00</td><td></td><td></td><td></td></tr><tr><td>EQ VAS</td><td>0.48</td><td>0.41</td><td>1.00</td><td></td><td></td></tr><tr><td>Barthel Index</td><td>0.43</td><td>0.56</td><td>0.27</td><td>1.00</td><td></td></tr><tr><td>mRS</td><td>-0.31</td><td>-0.41</td><td>-0.32</td><td>-0.42</td><td>1.00</td></tr></table> <p><b>Interpretation of extent of correlation:</b> Absent (<math>&lt; 0.20</math>), poor (0.20 - 0.34), moderate (0.35 - 0.50) or strong (<math>&gt; 0.50</math>)</p> |                | EQ-5D-5L Index | EQ-5D-3L Index | EQ VAS | Barthel Index | mRS | EQ-5D-5L Index | 1.00 |  |  |  |  | EQ-5D-3L Index | 0.74 | 1.00 |  |  |  | EQ VAS | 0.48 | 0.41 | 1.00 |  |  | Barthel Index | 0.43 | 0.56 | 0.27 | 1.00 |  | mRS | -0.31 | -0.41 | -0.32 | -0.42 | 1.00 |
|                                                | EQ-5D-5L Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | EQ-5D-3L Index | EQ VAS         | Barthel Index  | mRS    |               |     |                |      |  |  |  |  |                |      |      |  |  |  |        |      |      |      |  |  |               |      |      |      |      |  |     |       |       |       |       |      |
| EQ-5D-5L Index                                 | 1.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |                |                |        |               |     |                |      |  |  |  |  |                |      |      |  |  |  |        |      |      |      |  |  |               |      |      |      |      |  |     |       |       |       |       |      |
| EQ-5D-3L Index                                 | 0.74                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1.00           |                |                |        |               |     |                |      |  |  |  |  |                |      |      |  |  |  |        |      |      |      |  |  |               |      |      |      |      |  |     |       |       |       |       |      |
| EQ VAS                                         | 0.48                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.41           | 1.00           |                |        |               |     |                |      |  |  |  |  |                |      |      |  |  |  |        |      |      |      |  |  |               |      |      |      |      |  |     |       |       |       |       |      |
| Barthel Index                                  | 0.43                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.56           | 0.27           | 1.00           |        |               |     |                |      |  |  |  |  |                |      |      |  |  |  |        |      |      |      |  |  |               |      |      |      |      |  |     |       |       |       |       |      |
| mRS                                            | -0.31                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | -0.41          | -0.32          | -0.42          | 1.00   |               |     |                |      |  |  |  |  |                |      |      |  |  |  |        |      |      |      |  |  |               |      |      |      |      |  |     |       |       |       |       |      |
| Content Validity                               | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |                |                |        |               |     |                |      |  |  |  |  |                |      |      |  |  |  |        |      |      |      |  |  |               |      |      |      |      |  |     |       |       |       |       |      |
| Face Validity                                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |                |                |        |               |     |                |      |  |  |  |  |                |      |      |  |  |  |        |      |      |      |  |  |               |      |      |      |      |  |     |       |       |       |       |      |

## Floor / Ceiling Effects

**General population (British sample):** (Brazier et al, 1993;  $n=1463$ ; age range=16-74; male gender=655)

- Ceiling effects were larger for the EuroQOL dimensions than for the SF-36 dimensions

| Domains            | % at ceiling | % at floor |
|--------------------|--------------|------------|
| Mobility           | 97.0         | 0.1        |
| Self-Care          | 99.1         | 0.1        |
| Main Activity      | 96.5         | 3.5        |
| Family/leisure     | 95.2         | 4.8        |
| Pain/discomfort    | 64.1         | 1.9        |
| Anxiety/depression | 81.1         | 29.9       |
| Total Score        | 54.6         | 0          |

## Responsiveness

**Chronic Stroke:** Chen et al, 2015;  $n=65$ ; mean age 52.8 + 11.6; median months since stroke onset 19.7 (range 0.4 – 94)

Measures of responsiveness for the 5 item version (EQ-5D-5L):

- **Small effect size (ES)** (observed change in scores between pre-intervention and post-intervention divided by the standard deviation of the baseline score) for both the EQ-Index (0.40) and the EQ-VAS (0.30)
- **Moderate Standardized Response Mean (SRM)** (the change in scores between pre-intervention measures divided by the SD of the change scores) for the EQ-Index (0.63)
- **Limited SRM** for the EQ-VAS = 0.34
- **Small criterion-based responsiveness** (determined using the Stroke Impact Scale (SIS) 3.0 as a criterion by calculating the Spearman correlation between the change in EQ-5D and the change in perceived recovery score of the SIS 3.0) for the EQ-Index (0.46)
- **Limited criterion-based responsiveness** for the EQ-VAS (0.29).

**Stroke:** (Golicki et al, 2015;  $n=112$ ; mean age 70.6 (SD=11.0); patients assessed at 1 week and 4 months post stroke with the modified Rankin Scale (mRS), Barthel Index (BI) and both the EQ-5D-5L and EQ-5D-3L, including the EQ-VAS.

ES calculated as the ratio of the mean change to the Standard Deviation of initial measurement

- **Moderate to large ES** (0.63-0.82) for the EQ-5D-3L
- **Moderate ES** (0.51-0.71) for the EQ-5D-5L
- **Moderate ES** (0.51-0.65) for the EQ VAS

SRM calculated as the ratio of the mean change to the Standard Deviation of that change

- **Moderate to large SRM** (0.77-1.06) for the EQ-5D-3L
- **Moderate to large SRM** (0.69-0.86) for the EQ-5D-5L
- **Moderate SRM** (0.59-0.69) for the EQ VAS

**Traumatic Brain Injury (moderate and severe):** (Bell et al, 2005;  $n = 171$ ; telephone intervention  $n = 85$  and standard follow up  $n = 86$ ; mean age = 36 (15)

- Small treatment effect: 0.10

#### Professional Association Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokeEdge II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please

visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

#### Abbreviations:

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|                      | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 months post) | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months) |
|----------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|
| <b>StrokeEdge II</b> | NR                                                                                            | R                                                             | R                              |

Recommendations based on level of care in which the assessment is taken:

|                      | <b>Acute Care</b> | <b>Inpatient<br/>Rehabilitation</b> | <b>Skilled<br/>Nursing<br/>Facility</b> | <b>Outpatient<br/>Rehabilitation</b> | <b>Home Health</b> |
|----------------------|-------------------|-------------------------------------|-----------------------------------------|--------------------------------------|--------------------|
| <b>StrokeEdge II</b> | NR                | R                                   | R                                       | R                                    | R                  |
| <b>TBI EDGE</b>      | NR                | LS                                  | NR                                      | LS                                   | LS                 |

Recommendations for use based on ambulatory status after brain injury:

|                 | Completely Independent | Mildly Dependent | Moderately Dependent | Severely Dependent |
|-----------------|------------------------|------------------|----------------------|--------------------|
| <b>TBI EDGE</b> | N/A                    | N/A              | N/A                  | N/A                |

Recommendations for entry-level physical therapy education and use in research:

|                     | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|---------------------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| <b>StrokEDGE II</b> | No                                                   | Yes                                       | Yes                                                         | Yes                                                  |
| <b>TBI EDGE</b>     | No                                                   | Yes                                       | Yes                                                         | Not reported                                         |

#### Considerations

- Translations available in over 150 languages
- Recommended by the Core Data Elements Workgroup as a supplemental measure in TBI research (Wilde et al, 2010)
- In TBI, the instrument has been used in some outcome studies with good success

#### EuroQOL translations:

Other languages available at <http://www.euroqol.org/eq-5d-products/eq-5d-3l.html>

These translations, and links to them, are subject to the [Terms and Conditions](#) of Use of the Rehab Measures Database. RIC is not responsible for and does not endorse the content, products or services of any third-party website, and does not make any representations regarding its quality, content or accuracy. If you would like to contribute a language translation to the RMD, please contact us at [rehabmeasures@ric.org](mailto:rehabmeasures@ric.org).

Do you see an error or have a suggestion for this instrument summary? Please [e-mail us!](#)

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**Year published**

**Instrument in PDF Format**

Yes

**Approval Status**

Approved

## 12. REHAB MEASURES: FUNCTION IN SITTING TEST

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     | <a href="#">Training and documentation available from Samuel Merritt University's website</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Title of Assessment</b>    | Function in Sitting Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Acronym</b>                | FIST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Heidi Roth, DHS, PT, NCS and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 5/2012; Reviewed by Michele Sulwer, PT, DPT, NCS and Maggie Bland, PT, DPT, of the StrokEDGE II Task Force of the Neurology Section, of the APTA in 02/2017.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Summary Date</b>           | 11/27/2012; 2/2/2017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Purpose</b>                | Bedside evaluation of sitting balance stated to evaluate sensory, motor, proactive, reactive and steady state balance factors.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b>            | <ul style="list-style-type: none"> <li>• 14 items</li> <li>• Ordinal Scale (0-4) for each test item: <ul style="list-style-type: none"> <li>o 4: Independent, Completes the task independently and successfully</li> <li>o 3: Needs Cues, Completes the task independently and successfully; may need verbal / tactile cues or more time</li> <li>o 2: Upper extremity support, Unable to complete task without using upper extremities for support or assistance</li> <li>o 1: Needs assistance, Unable to complete task successfully without physical assistance</li> <li>o 0: Complete assistance, Requires complete physical assistance to perform task successfully, is unable to complete task successfully with physical assistance, or dependent</li> </ul> </li> <li>• Testing Instructions: <ul style="list-style-type: none"> <li>o One trial of each item is allowed</li> </ul> </li> </ul> |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>o Verbal directions and demonstration are given as needed by the therapist</li> <li>o Standard Position: Individual seated at edge of hospital bed with half of upper leg supported (neutral abd/adduction / rotation), hips and knees at 90 degrees and feet flat in support</li> <li>o Hands are placed in lap unless needed for support</li> <li>o See Gorman et al, 2010 for measure</li> </ul> |
| <b>Area of Assessment</b>        | Balance Non-Vestibular                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Body Part</b>                 |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>ICF Domain</b>                | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Domain</b>                    |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Assessment Type</b>           | Performance Measure                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Length of Test</b>            | 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Time to Administer</b>        | Less than 15 minutes                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Number of Items</b>           | 14                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Equipment Required</b>        | <ul style="list-style-type: none"> <li>• Standard hospital bed (without air mattress)</li> <li>• Stopwatch</li> </ul>                                                                                                                                                                                                                                                                                                                      |
| <b>Training Required</b>         |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Type of training required</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Cost</b>                      | Free                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Actual Cost</b>               | Free                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Age Range</b>                 |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Administration Mode</b>       |                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Diagnosis</b>                                        | Stroke; Traumatic Brain Injury                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Populations Tested</b>                               | <ul style="list-style-type: none"> <li>• Acute Stroke</li> <li>• Population-based, inpatient sample of adults with sitting balance dysfunction, excluding persons with SCI, significant bracing/orthotics, and inability to perform testing safely</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Standard Error of Measurement (SEM)</b>              | <p><b><u>Acute Stroke:</u></b> (Gorman et al, 2010; <math>n=31</math>, age 61.5 (10.9) years, <math>\leq 3</math> months post stroke, Modified Rankin Scale of moderate / moderately severe / severe)</p> <ul style="list-style-type: none"> <li>• SEM= 2.03</li> </ul> <p><b><u>Adults With Sitting Balance Dysfunction:</u></b> (Gorman, Harro, Platko and Greenwald, 2014, <math>n=125</math>, age=60.0 (16.6) years)</p> <ul style="list-style-type: none"> <li>• SEM= 1.40</li> </ul> <p><b><u>Balance Participants:</u></b> (Gorman, Rivera, and McCarthy, 2014) (<math>n=6</math>; Mean Age= 68.7)<br/> ***Medical diagnoses of the balance participants included Parkinson's disease (<math>n=1</math>), multiple sclerosis (<math>n=1</math>), and cerebrovascular accident (<math>n=5</math>).</p> <ul style="list-style-type: none"> <li>• SEM= 3.58</li> </ul> |
| <b>Minimal Detectable Change (MDC)</b>                  | <p><b><u>Acute Stroke:</u></b> (Calculated from Gorman et al, 2010)</p> <ul style="list-style-type: none"> <li>• MDC=5.63</li> </ul> <p><b><u>Adults With Sitting Balance Dysfunction:</u></b> (Gorman, Harro, Platko &amp; Greenwald, 2014)</p> <ul style="list-style-type: none"> <li>• MDC=5.5</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Minimally Clinically Important Difference (MCID)</b> | <p><b><u>Adults With Sitting Balance Dysfunction:</u></b> (Gorman, Harro, Platko &amp; Greenwald, 2014)</p> <ul style="list-style-type: none"> <li>• MCID<math>\geq</math> 6.5</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Cut-Off Scores</b>                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Normative Data</b>                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Test-retest Reliability</b>                          | <b><u>Balance Participants:</u></b> (Gorman, Rivera, and McCarthy, 2014), $n=6$ ; mean age = 68.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <p>***Medical diagnoses of the balance participants included Parkinson's disease (n=1), multiple sclerosis (n=1), and cerebrovascular accident (n=5).</p> <ul style="list-style-type: none"> <li>• <b>Excellent:</b> ICC=0.97</li> </ul>                                                                                                                                                                                       |
| <b>Interrater/Intrarater Reliability</b>                | <p><b>Balance Participants:</b> (Gorman, Rivera, and McCarthy, 2014), n=6; mean age = 68.7</p> <p>***Medical diagnoses of the balance participants included Parkinson's disease (n=1), multiple sclerosis (n=1), and cerebrovascular accident (n=5).</p> <ul style="list-style-type: none"> <li>• Intra-rater Reliability: <b>Excellent</b> ICC=0.99</li> <li>• Inter-rater Reliability: <b>Excellent</b> ICC=0.991</li> </ul> |
| <b>Internal Consistency</b>                             | <p><b>Acute Stroke:</b> (Gorman et al, 2010)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> internal consistency (Cronbach's alpha = 0.98)</li> </ul>                                                                                                                                                                                                                                                           |
| <b>Criterion Validity<br/>(Predictive/Concurrent)</b>   | <p><b>Adults With Sitting Balance Dysfunction:</b> (Gorman, Harro, Platko &amp; Greenwald, 2014)</p> <p><b>Concurrent Validity:</b> <b>Good to Excellent</b> concurrent validity with the Berg Balance Scale and Functional Independence Measure at both admission and discharge (Spearman <math>\rho</math> = .71–.85).</p>                                                                                                   |
| <b>Construct Validity<br/>(Convergent/Discriminant)</b> | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Content Validity</b>                                 | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Face Validity</b>                                    | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Floor/Ceiling Effects</b>                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Responsiveness</b>                                   | <p><b>Adults With Sitting Balance Dysfunction:</b> (Gorman, Harro, Platko and Greenwald, 2014, n=125, age=60.0 (16.6) years)</p> <p><b>Responsiveness:</b> Strong as evidenced by the large effect size (.83), standardized response mean (1.04), and index of responsiveness (1.07).</p>                                                                                                                                      |
| <b>Professional Association<br/>Recommendations</b>     | Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy                                                                                                                                                                                                                                                                                                     |

Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokeEdge II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

#### Abbreviations:

|                |                                                                               |
|----------------|-------------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                              |
| <b>R</b>       | Recommend                                                                     |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group<br>/ Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                               |

Recommendations based on level of care in which the assessment is taken:

|                       | Acute Care | Inpatient Rehabilitation | Skilled Nursing Facility | Outpatient Rehabilitation | Home Health |
|-----------------------|------------|--------------------------|--------------------------|---------------------------|-------------|
| <b>MS EDGE</b>        | UR         | UR                       | UR                       | NR                        | UR          |
| <b>TBI EDGE</b>       | LS         | LS                       | LS                       | LS                        | LS          |
| <b>STROKE EDGE II</b> | LS         | LS                       | LS                       | UR                        | UR          |

Recommendations for use based on ambulatory status after brain injury:

|                 | <b>Completely Independent</b> | <b>Mildly dependent</b> | <b>Moderately Dependent</b> | <b>Severely Dependent</b> |
|-----------------|-------------------------------|-------------------------|-----------------------------|---------------------------|
| <b>TBI EDGE</b> | <i>NR</i>                     | <i>LS</i>               | <i>LS</i>                   | <i>LS</i>                 |

Recommendations based on EDSS Classification:

|                | <b>EDSS 0.0 – 3.5</b> | <b>EDSS 4.0 – 5.5</b> | <b>EDSS 6.0 – 7.5</b> | <b>EDSS 8.0 – 9.5</b> |
|----------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <b>MS EDGE</b> | <i>NR</i>             | <i>NR</i>             | <i>NR</i>             | <i>UR</i>             |

Recommendations for entry-level physical therapy education and use in research:

|                       | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|-----------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>MS EDGE</b>        | <i>No</i>                                                   | <i>No</i>                                        | <i>No</i>                                                          | <i>Yes</i>                                                  |
| <b>TBI EDGE</b>       | <i>No</i>                                                   | <i>No</i>                                        | <i>No</i>                                                          | <i>Not reported</i>                                         |
| <b>STROKE EDGE II</b> | <i>No</i>                                                   | <i>Yes</i>                                       | <i>No</i>                                                          | <i>Yes</i>                                                  |

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Considerations</b>           | Do you see an error or have a suggestion for this instrument summary? Please <a href="#">e-mail us</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Bibliography</b>             | <p>Gorman, SL, Radtka, S, et al. "Development and validation of the function in sitting test in adults with acute stroke." Journal of Neurologic Physical Therapy 34(3)(2010): 150-160. <a href="#">Find it on PubMed</a></p> <p>Gorman, SL, et al. "Examining the Function in Sitting Test for Validity, Responsiveness, and Minimal Clinically Important Difference in Inpatient Rehabilitation." Archives of Physical Medicine and Rehabilitation 95.12 (2014): 2304-11.</p> <p>Gorman SL, Rivera M, McCarthy L. "Reliability of the Function in Sitting Test (FIST)." Rehabilitation research and practice. 2014;2014:593280.</p> |
| <b>Year published</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

### 13. REHAB MEASURES DATABASE—FUNCTIONAL INDEPENDENCE MEASURE (FIM)

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | Uniform Data System for Medical Rehabilitation (external link)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Title of Assessment    | FIM® instrument (FIM); FIM® is a trademark of the Uniform Data System from Medical Rehabilitation, a division of UB Foundation Activities, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Acronym                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Instrument Reviewer(s) | Initially reviewed by the Rehabilitation Measures Team; Updated by Eileen Tseng, PT, DPT, NCS, Rachel Tappan, PT, NCS, and the SCI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2012; Updated by Tammie Keller, PT, DPT, MS and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA; Updated by Deb Kegelmeyer, PT, DPT, MS, GCS and the PD EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2013. Updated by Maggie Bland, PT, DPT, NCS and Nancy Byl PT, MPH, PhD, FAPTA and the Stroke Edge II Task Force in 2016. |
| Summary Date           | 10/6/2015; 9/27/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Purpose                | Provides a uniform system of measurement for disability based on the International Classification of Impairment, Disabilities and Handicaps; measures the level of a patient's disability and indicates how much assistance is required for the individual to carry out activities of daily living.                                                                                                                                                                                                                                                                                                                                           |
| Description            | <p>Contains 18 items composed of:</p> <p>13 motor tasks</p> <p>5 cognitive tasks (considered basic activities of daily living)</p> <p>Tasks are rated on a 7 point ordinal scale that ranges from total assistance (or complete dependence) to complete independence</p> <p>Scores range from 18 (lowest) to 126 (highest) indicating level of function</p> <p>Scores are generally rated at admission and discharge</p> <p>Dimensions assessed include:</p> <p>Eating</p> <p>Grooming</p>                                                                                                                                                    |

Bathing

Upper body dressing

Lower body dressing

Toileting

Bladder management

Bowel management

Bed to chair transfer

Toilet transfer

Shower transfer

Locomotion (ambulatory or wheelchair level)

Stairs

Cognitive comprehension

Expression

Social interaction

Problem solving

Memory

FIM Instrument Scoring Criteria: (refer to the users manual for more information)

|                                  |                                                                                      |
|----------------------------------|--------------------------------------------------------------------------------------|
| FIM Instrument Scoring Criteria: |                                                                                      |
| No Helper Required               |                                                                                      |
| Score                            | Description                                                                          |
| 7                                | Complete Independence                                                                |
| 6                                | Modified Independence (patient requires use of a device, but no physical assistance) |
| Helper (Modified Dependence)     |                                                                                      |
| Score                            | Description                                                                          |
| 5                                | Supervision or Setup                                                                 |
| 4                                | Minimal Contact Assistance (patient can perform 75% or more of task)                 |

|                           |                                                                                                                                                                             |                                                                                                             |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
|                           | 3                                                                                                                                                                           | Moderate Assistance (patient can perform 50% to 74% of task)                                                |
|                           | Helper (Complete Dependence)                                                                                                                                                |                                                                                                             |
|                           | Score                                                                                                                                                                       | Description                                                                                                 |
|                           | 2                                                                                                                                                                           | Maximal Assistance (patient can perform 25% to 49% of tasks)                                                |
|                           | 1                                                                                                                                                                           | Total assistance (patient can perform less than 25% of the task or requires more than one person to assist) |
|                           |                                                                                                                                                                             |                                                                                                             |
| Area of Assessment        | Activities of Daily Living                                                                                                                                                  |                                                                                                             |
| Body Part                 | Not Applicable                                                                                                                                                              |                                                                                                             |
| ICF Domain                | Activity                                                                                                                                                                    |                                                                                                             |
| Domain                    | ADL; Cognition; Motor                                                                                                                                                       |                                                                                                             |
| Assessment Type           | Observer                                                                                                                                                                    |                                                                                                             |
| Length of Test            | 31 to 60 Minutes                                                                                                                                                            |                                                                                                             |
| Time to Administer        | 30-45 minutes                                                                                                                                                               |                                                                                                             |
| Number of Items           | 18                                                                                                                                                                          |                                                                                                             |
| Equipment Required        | May vary based on level and impairment category measured.                                                                                                                   |                                                                                                             |
| Training Required         | Yes, certification in administering the FIM instrument is required prior to use. Training is available through UDSMR at: <a href="http://www.udsmr.org">www.udsmr.org</a> . |                                                                                                             |
| Type of training required | Reading an Article/Manual                                                                                                                                                   |                                                                                                             |
| Cost                      | Not Free                                                                                                                                                                    |                                                                                                             |
| Actual Cost               | A license to use the FIM instrument may be obtained at: <a href="http://www.udsmr.org">http://www.udsmr.org</a> .                                                           |                                                                                                             |

|                                                  |                                                                                                                                                                                                                                                    |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                  | Fees vary depending upon type of use.                                                                                                                                                                                                              |
| Age Range                                        | Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                                             |
| Administration Mode                              | Paper/Pencil                                                                                                                                                                                                                                       |
| Diagnosis                                        | Geriatrics; Multiple Sclerosis; Pain; Spinal Cord Injury; Stroke                                                                                                                                                                                   |
| Populations Tested                               | Brain Injury<br>Geriatrics<br>Multiple Sclerosis<br>Orthopedic Conditions including Low Back Pain<br>Parkinson's Disease<br>Spinal Cord Injury<br>Stroke                                                                                           |
| Standard Error of Measurement (SEM)              | Not Established                                                                                                                                                                                                                                    |
| Minimal Detectable Change (MDC)                  | Not Established                                                                                                                                                                                                                                    |
| Minimally Clinically Important Difference (MCID) | Stroke:<br>(Beninato et al, 2006; n = 113; mean age = 63.9 (14.3) years; mean FIM score at admission = 63.4 (24.4) points, Acute Stroke)<br><br>FIM Total Score = 22 points<br>FIM Motor Subscale = 17 points<br>FIM Cognitive Subscale = 3 points |
| Cut-Off Scores                                   | Not Established                                                                                                                                                                                                                                    |
| Normative Data                                   | SCI:<br><br>(Hall et al, 1999; cross-sectional data from SCI Model Systems National Database; average of 8 days post injury [SD = 13 days]; sample size varying pending time post injury, Acute SCI)                                               |

Mean (SD) Motor FIM Scores at Rehabilitation Admission, Discharge, and 1, 2, and 5 Years Post Injury: All Cases at AIS Grades A, B, C

| FIM Motor         | Admission               | Discharge               | 1 yr status post       | 2 yr status post       | 5 yr status post       |
|-------------------|-------------------------|-------------------------|------------------------|------------------------|------------------------|
| C1-C3             | 14.1(4.7)<br>n = 156    | 18.6 (7.8)<br>n = 115   | 25.4 (22.2)<br>n = 29  | 26.5 (26)<br>n = 17    | 22.1 (15.0)<br>n = 18  |
| C4                | 14.9 (6.1)<br>n = 517   | 23.1 (11.6)<br>n = 458  | 26.9 (19.6)<br>n = 118 | 25.4 (17.0)<br>n = 87  | 24.9 (14.9)<br>n = 52  |
| C5                | 16.0 (7.9)<br>n = 578   | 31.3 (15.0)<br>n = 433  | 35.6 (20.7)<br>n = 91  | 37.5 (22.7)<br>n = 81  | 38.5 (22.6)<br>n = 67  |
| C6                | 16.9 (7.8)<br>n = 313   | 37.4 (14.3)<br>n = 394  | 39.7 (19.6)<br>n = 89  | 46.7 (21.9)<br>n = 75  | 42.2 (20.2)<br>n = 63  |
| C7                | 19.6 (9.0)<br>n = 177   | 50.2 (15.8)<br>n = 236  | 59.6 (22.3)<br>n = 56  | 58.3 (22.6)<br>n = 46  | 56.9 (20.5)<br>n = 42  |
| C8                | 22.6 (8.2)<br>n = 55    | 61.9 (16.4)<br>n = 76   | 68.7 (18.7)<br>n = 21  | 68.4 (16.4)<br>n = 14  | 73.3 (17.2)<br>n = 14  |
| Thoracic          | 32.5 (12.0)<br>n = 1718 | 69.3 (13.1)<br>n = 1869 | 72.2 (14.4)<br>n = 402 | 74.7 (12.8)<br>n = 320 | 77.4 (10.0)<br>n = 256 |
| Lumbar/<br>Sacral | 36.7 (12.6)<br>n = 457  | 73.2 (11.9)<br>n = 452  | 79.8 (12.4)<br>n = 97  | 83.2 (5.9)<br>n = 72   | 82.4 (5.5)<br>n = 58   |

Divide the score by 13 (i.e. 13 motor items) to obtain the average ratings on the 1 to 7 scale

Mean (SD) Cognitive FIM Scores at Rehabilitation Admission, Discharge, and 1, 2, and 5 Years Postinjury: All Cases at AIS Grades A, B, C

| FIM Motor | Admission            | Discharge            | 1 yr status post     | 2 yr status post     | 5 yr status post     |
|-----------|----------------------|----------------------|----------------------|----------------------|----------------------|
| C1-C3     | 26.8(9.7)<br>n = 131 | 29.8 (8.2)<br>n = 95 | 33.8 (2.4)<br>n = 17 | 33.4 (2.1)<br>n = 10 | 34.5 (1.2)<br>n = 12 |

|                   |                        |                        |                       |                       |                       |
|-------------------|------------------------|------------------------|-----------------------|-----------------------|-----------------------|
| C4                | 29.0 (7.2)<br>n = 456  | 32.2 (4.8)<br>n = 380  | 33.2 (5.2)<br>n = 67  | 34.3 (1.7)<br>n = 47  | 34.3 (1.4)<br>n = 37  |
| C5                | 29.5 (7.3)<br>n = 541  | 32.5 (4.9)<br>n = 371  | 33.8 (4.2)<br>n = 55  | 34.4 (1.7)<br>n = 55  | 34.1 (2.1)<br>n = 55  |
| C6                | 29.4 (7.1)<br>n = 290  | 32.9 (3.5)<br>n = 351  | 33.5 (3.5)<br>n = 56  | 34.2 (3.3)<br>n = 53  | 34.6 (1.3)<br>n = 48  |
| C7                | 30.1 (7.1)<br>n = 165  | 32.9 (4.4)<br>n = 212  | 34.7 (0.8)<br>n = 40  | 34.9 (0.3)<br>n = 27  | 34.6 (0.8)<br>n = 30  |
| C8                | 30.5 (6.8)<br>n = 52   | 32.3 (4.5)<br>n = 70   | 34.5 (0.9)<br>n = 14  | 35.0 (0.0)<br>n = 6   | 35.0 (0.0)<br>n = 7   |
| Thoracic          | 31.2 (5.9)<br>n = 1594 | 33.3 (3.5)<br>n = 1644 | 34.4 (2.0)<br>n = 249 | 34.5 (1.5)<br>n = 199 | 34.8 (0.9)<br>n = 180 |
| Lumbar/<br>Sacral | 32.1 (5.2)<br>n = 431  | 33.5 (3.4)<br>n = 405  | 34.6 (1.5)<br>n = 59  | 35.0 (0.2)<br>n = 41  | 34.1 (4.2)<br>n = 38  |

Divide the score by 5 (i.e. 5 cognitive items) to obtain the average ratings on the 1 to 7 scale

Mean Motor FIM Scores at Rehabilitation Admission and Discharge by Level and Completeness of Injury

|       | Admission*     |                |                | Discharge*     |               |                |
|-------|----------------|----------------|----------------|----------------|---------------|----------------|
| Level | AIS A          | AIS B          | AIS C          | AIS A          | AIS B         | AIS C          |
| C1-C3 | 13.2 (n = 88)  | 13.0 (n = 14)  | 15.8 (n = 54)  | 17.7 (n = 75)  | 21.0 (n = 13) | 20.0 (n = 27)  |
| C4    | 13.6 (n = 288) | 14.5 (n = 73)  | 17.5 (n = 156) | 20.9 (n = 288) | 24.8 (n = 54) | 27.8 (n = 116) |
| C5    | 14.3 (n = 310) | 16.2 (n = 127) | 19.7 (n = 141) | 28.3 (n = 236) | 31.1 (n = 96) | 38.4 (n = 101) |
| C6    | 15.3           | 17.8           | 21.1           | 35.6           | 37.6          | 43.9           |

|                   |                    |                   |                   |                    |                   |                   |
|-------------------|--------------------|-------------------|-------------------|--------------------|-------------------|-------------------|
|                   | (n = 173)          | (n = 89)          | (n = 51)          | (n = 238)          | (n = 93)          | (n = 63)          |
| C7                | 18.5<br>(n = 90)   | 18.8<br>(n = 52)  | 23.6<br>(n = 35)  | 49.4<br>(n = 123)  | 48.7<br>(n = 56)  | 53.5<br>(n = 57)  |
| C8                | 22.3<br>(n = 27)   | 22.4<br>(n = 17)  | 23.3<br>(n = 11)  | 64.1<br>(n = 34)   | 58.6<br>(n = 27)  | 63.0<br>(n = 15)  |
| Thoracic          | 32.2<br>(n = 1324) | 31.5<br>(n = 202) | 35.5<br>(n = 192) | 69.1<br>(n = 1482) | 67.2<br>(n = 163) | 71.7<br>(n = 224) |
| Lumbar/<br>Sacral | 35.8<br>(n = 147)  | 36.6<br>(n = 105) | 37.3<br>(n = 205) | 71.5<br>(n = 161)  | 74.8<br>(n = 74)  | 74.0<br>(n = 217) |

\*All cases with level and completeness data available; These are not all the same sample of individuals across admission and discharge

(Kay et al, 2010; n = 1780; discharged from one of 479 inpatient rehab facilities in US; age 65-74 years; diagnosed with incomplete paraplegia, Acute SCI)

| Demographic, rehabilitation stay, and discharge FIM self-care and mobility subscore by etiology of incomplete paraplegia |                              |                     |                        |                |                   |
|--------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------|------------------------|----------------|-------------------|
| Characteristics                                                                                                          | Degenerative Spinal Disorder | Benign Spinal Tumor | Malignant Spinal Tumor | Spinal Abscess | Vascular Ischemia |
| Subjects, n                                                                                                              | 1203                         | 81                  | 295                    | 54             | 147               |
| Age, mean                                                                                                                | 70.2                         | 70.1                | 69.2                   | 69.4           | 69.7              |
| LOS in rehab, mean (SD)                                                                                                  | 13.2 (7.7)                   | 17.2 (9.9)          | 17.8 (8.4)             | 21.3 (10.8)    | 26.4 (10.8)       |
| Discharge self-care, mean (SD)                                                                                           | 32.7 (5.8)                   | 33.0 (6.2)          | 29.0 (6.9)             | 27.8 (7.9)     | 29.3 (6.6)        |
| Discharge mobility, mean (SD)                                                                                            | 22.5 (5.6)                   | 22.1 (5.9)          | 17.4 (6.5)             | 16.9 (6.8)     | 17.1 (6.3)        |

Stroke:

(Inouye et al, 2001; n = 243; mean age = 64 (11) years; assessed at admission and discharge, Acute Stroke)

FIM scores of > 73 at admission were significantly younger (58 + 11 [SD] yr) than patients with FIM scores of 37 to 72 (64 + 11 yr) or scores < 36 (66 + 12 yr)

FIM total scores of 37 to 72 at admission showed higher gains (37 + 15) than patients who scored > 73 (20 + 10) or < 36 (29 + 23)

(Tur et al, 2003; n = 102; mean age = 61.6 (10.9) years; 45-60 minutes of daily physical and occupational therapy, speech therapy daily as needed; Turkish sample, Acute Stroke)

|                 | Admission Mean (SD) | Median | Discharge Mean (SD) | Median |
|-----------------|---------------------|--------|---------------------|--------|
| FIM Total Score | 69.2 (27.4)         | 69     | 83.2 (25.7)         | 86     |
| FIM Motor       | 43.8 (20.7)         | 40     | 55.9 (20.3)         | 60     |
| FIM Cognitive   | 25.9 (10.7)         | 31     | 27.2 (9.5)          | 32.5   |

Parkinson's Disease:

(Ellis et al, 2008; n = 68; mean age = 74 (8) years; H&Y stages II - V, number in each stage: II - 1, III - 18, IV - 37, V - 2)

| Mean Score (SD) at: |             |             |
|---------------------|-------------|-------------|
| Measure             | Admission   | Discharge   |
| FIM Total Score     | 45.5 (13.7) | 77.0 (18.6) |
| FIM Motor           | 27.1 (10.4) | 54.8 (14.0) |
| FIM Cognitive       | 18.0 (5.6)  | 22.1 (5.8)  |

(Marciniak et al, 2011; n = 89; mean age = 74.26 (9.38) years)

|                 | Mean Score (SD) at: |              |
|-----------------|---------------------|--------------|
| Measure         | Admission           | Discharge    |
| FIM Total Score | 54.2 (17.4)         | 75.29 (21.9) |
| FIM Motor       | 34.47 (12.4)        | 51.45 (17.1) |
| FIM Cognitive   | 19.73 (7.0)         | 23.84 (6.8)  |

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test-retest Reliability           | <p>Elderly Adults:</p> <p>(Pollak et al 1996; n = 49 elderly residents of a continuing care retirement community; mean age 89.7 years; assessed twice 3 to 8 days apart, Elderly Adults)</p> <ul style="list-style-type: none"> <li>• Excellent FIM Motor test-retest reliability (ICC = 0.90)</li> <li>• Excellent FIM Cognitive test-retest reliability (ICC = 0.80) scores (Hobart et al, 2001; Elderly Adults)</li> <li>• Excellent test-retest reliability (ICC = 0.98 for total FIM, 0.95 and 0.89 for FIM Motor and FIM Cognitive, respectively)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                 |
| Interrater/Intrarater Reliability | <p>Orthopedic Diagnoses and Stroke:</p> <p>(Kohler et al, 2009; n = 143 patients (63% orthopedic and 13% stroke); mean age = 76 years; transferred and assessed from one Rehab unit to another; 1 to 3 days between assessments, Orthopedic Diagnoses and Stroke)</p> <ul style="list-style-type: none"> <li>• Adequate to Poor item-level interrater reliability (ICC = 0.124 to 0.661)</li> <li>• Poor agreement on 4 items: <ul style="list-style-type: none"> <li>• Stairs</li> <li>• Dressing</li> <li>• Walking</li> <li>• Bowel management</li> </ul> </li> </ul> <p>SCI:</p> <p>(Grey and Kennedy, 1993; n = 40; mean age at time of injury = 29.6 (9.57) years; mean time post-injury at discharge = 24.75 (8.57) weeks, Chronic SCI)</p> <ul style="list-style-type: none"> <li>• Excellent correlation between total FIM scores taken by clinician discharge report and self-report at one month (r = 0.828)</li> </ul> |

- Poor to Excellent correlation between FIM subscales scores taken by clinician discharge report and self-report at one month:
- Self care:  $r = 0.841$  (Excellent)
- Sphincter control:  $r = 0.710$  (Adequate)
- Mobility:  $r = 0.733$  (Adequate)
- Locomotion:  $r = 0.454$  (Adequate)
- Communication:  $r = 0.029$  (Poor)
- Social cognition:  $r = 0.085$  (Poor)

(Karamahmetoglu et al, 1997;  $n = 50$ ; mean age = 33.94; 22% with tetraplegia and 78% with paraplegia, SCI)

- Excellent intrarater correlation of FIM scores obtained by questioning the patient and by observation of patient performing the activity ( $r = 0.94$ )

(Kucukdeveci et al, 2001; FIM in Turkey;  $n = 62$ ; mean age = 32.7; mean time since injury = 16.4 months; with cervical injury 21%; with thoracic injury 42%; with lumbar 37%, Chronic SCI)

- Excellent FIM Motor interrater reliability (ICC = 0.90)
- Excellent FIM Cognitive interrater reliability (ICC = 0.98)

(Segal et al, 1993,  $n = 57$ , discharging from acute care and admitting to rehab hospital; data collected within a max of 6 days, Subacute SCI)

- Excellent interrater reliability for total FIM scores across two settings ( $r = 0.83$ )
- Poor to Excellent interrater reliability for individual items ( $r = 0.02 - 0.77$ )
- Excellent interrater reliability for patients with complete quadriplegia ( $n = 14$ ,  $r = 0.87$ ), complete paraplegia ( $n = 13$ ,  $r = 0.74$ ), and incomplete paraplegia ( $n = 9$ ,  $r = 0.85$ )
- Adequate interrater reliability for patients with incomplete quadriplegia ( $n = 17$ ,  $r = 0.49$ )

TBI:

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | <p>(Donaghy &amp; Wass, 1998; TBI)</p> <ul style="list-style-type: none"> <li>• Excellent interrater reliability (ICC = 0.85 for total FIM Scores, 0.92 for FIM Motor, and 0.69 for FIM Cognitive)</li> <li>• Various Diagnoses (meta analytic findings):</li> </ul> <p>(Ottenbacher et al, 1996; n = 11 studies published between 1993 and 1995; total sample size = 1,568 participants, Various Diagnoses)</p> <ul style="list-style-type: none"> <li>• Excellent overall consistency (median interrater reliability = 0.95) between raters across patients with different diagnosis and levels of impairment</li> <li>•</li> </ul>                                                                                                                             |
| Internal Consistency | <p>General Rehab:</p> <p>(Dodds et al, 1993; n = 11,102 (52% Stroke, 10% Orthopedic; 10% Brain Injury); mean age = 65 years, General Rehab)</p> <ul style="list-style-type: none"> <li>• Excellent internal consistency (Cronbach's alpha = 0.93 admission; 0.95 discharge)</li> <li>• Multiple Sclerosis:</li> </ul> <p>(Sharrack et al, 1999; n = 64; mean age = 40 years, MS)</p> <ul style="list-style-type: none"> <li>• Excellent internal consistency (Cronbach's alpha = 0.98)</li> </ul> <p>Neurological Disorders:</p> <p>(Hobart et al, 2001; Neurological Disorders)</p> <ul style="list-style-type: none"> <li>• Excellent internal consistency (Cronbach's alpha = 0.95 FIM Total Score; 0.95 FIM Motor; 0.89 FIM Cognitive)</li> </ul> <p>SCI:</p> |

(Kucukdeveci et al, 2001; FIM instrument version in Turkey, Chronic SCI)

- Excellent internal consistency at admission and discharge for FIM
- Motor (Cronbach's alpha = 0.934 - 0.953) and FIM Cognitive (Cronbach's alpha = 0.930 - 0.983)

(Stineman et al, 1996; with nontraumatic SCI, n = 2,609, mean age = 64.6 years; with traumatic SCI, n = 1,831, mean age = 43.0 years, sample from Uniformed Data System for Medical Rehabilitation [UDSMRSM], SCI)

- Excellent internal consistency for nontraumatic spinal cord diagnosis (Cronbach's alpha for total = 0.91; for FIM Motor = 0.91; for FIM Cognitive = 0.90)
- Excellent internal consistency for traumatic spinal cord diagnosis (Cronbach's alpha for FIM Total Score = 0.92; for FIM Motor = 0.94; for FIM Cognitive = 0.90)

**Stroke:**

(Hsueh et al, 2002; n = 118; mean age = 67.5 (10.9) years; measured at inpatient rehab admission and discharge, Acute Stroke)

- Excellent internal consistency (FIM Motor Subscale) (Cronbach's alpha = 0.88 admission; 0.91 discharge)

Criterion Validity  
(Predictive/Concurrent)

*Predictive Validity Evidence:*

**Neurologic Disorders:**

(Ng, et al., 2007; n= 1502; mean age of total = 61.3 ± 15.0 years; mean acute LOS = 14.5 ± 17.5 days; mean inpatient rehab LOS = 21.5 ± 19.0 days for patients with neurological disorders)

- Admission motor FIM scores ( $\beta = 0.55$ ) and admission cognitive FIM scores ( $\beta = 0.38$ ) had the highest impact on discharge total FIM scores

Stroke:

(Inouye et al, 2001; n = 243; mean age = 64 (11) years; assessed at admission and discharge, Acute Stroke)

- Patients with FIM total scores of 37 to 72 at admission showed higher gains (37 + 15) than patients who scored > 73 (20 + 10) or < 36 (29 + 23)

(Denti et al. 2004; n = 359; mean age = 80.8 (4.7) years; time between stroke onset and admission = 22.3 (14.6) days, Acute Stroke)

- FIM total scores at admission were found to be the most powerful predictor of Montebello Rehabilitation Factor Scores (Beta coefficient = 0.42)

(Salter et al, 2010) 134 patients, a mean age of 68.64 ( $\pm 14.2$ ) years old, and an average of 31.84 ( $\pm 59.2$ ) days post-stroke, receiving care in an inpatient rehabilitation setting, were tested with the FIM at admission and discharge .

- There was excellent, positive and significant correlations with performance on the FIM (total and motor) with the Clinical Outcome Variables Scale [COVS] (0.823 and 0.771 respectively).
- The COVS and FIM had excellent correlation (-0.61,-0.69)) with length of stay ( $P < 0.01$ ), such that lower scores at admission meant shorter length of stay.

(Ward et al, 2011) Thirty inpatients with first ischaemic stroke were evaluated with the FIM, the SIS-16 and the STREAM at admission:

- The FIM score was significantly ( $P < 0.001$ ) and highly correlated (excellent) with the *predicted* length of stay (-0.9438 ) and the *actual* length of stay (-0.6846)
- The validity of the FIM for *predicting the LOS* was higher (-0.9438) than the SIS-16 (-0.6743) and the STREAM (-0.8011)
- The validity of the FIM associated with the actual LOS was lower (-0.6846) compared to the SIS-16 (-0.7953) and the STREAM Total (-0.7972).

(Yang et al, 2013). In a prospective observational study of 122 patients with a first time stroke admitted to a rehabilitation center over a 12 month period:

- The FIM score on admission and discharge significantly predicted the Pittsburgh Rehabilitation Participation Scale [PRPS] (0.53;  $P < 0.0001$  and 0.40;  $P < 0.001$  respectively)
- The level of participation on discharge (PRPS score) was predicted by functional status on admission (FIM; 0.309), cognitive impairment (Elderly Cognitive Assessment Questionnaire-ECAQ; 0.249) and fatigue (Fatigue Severity Scale-FSS; -0.304) .
- Patients with lower levels of participation were more likely to be functionally dependent, cognitively impaired and have more fatigue.

(O'Brien et al, 2013). A sample of 371,211 Medicare beneficiaries who were receiving services in an inpatient rehabilitation facility (IRF) within 60 days post stroke (> 65 years of age, 43.7% male, 41.7% right sided impairment, 796% white) were evaluated with the FIM at admission and discharge. In addition, the change in LOS at the IRF and community discharge was compared over time with the implementation of a prospective payment system (PPS) for individuals on Medicare.

- Average LOS decreased a total of 3.8 days (from 17.9 in 2002 to 16.1 days in 2007)
- Mean admission FIM scores decreased a total of 4.4 points (from 57.2 to 53.8 points)
- The mean discharge FIM scores decreased a total of 3.6 points (from 80.1 to 76.5 points) in 4 of 5 years with no significant decline in 2004.
- Frequency of community discharges declined steadily with an average overall decrease of 5.4 % (from 6.6% to 61.2%) over the 5.5 years of study
- Controlling for study year and covariates, each day in IRF was associated with an increase of 0.50 discharge points (95% CI = 0.48, 0.52)
- The association between LOS and discharge destination was excellent, averaging 0.997 (95% CI = 0.994, 0.999) based on the co-variables of admission FIM, age, gender, ethnicity, side of lesion, complications and year.

(Van Heugten et al, 2015) Systematic review of studies (51) investigating convergent, criterion and predictive validity of cognitive dysfunction in patients in the acute phase (4 weeks) post stroke using multi-domain instruments .

- The Constat, Montreal Cognitive Assessment [MOCA] and Functional Independence Measure-Cognitive showed adequate predictive validity

(Bates, 2015-Part 1) A retrospective analysis of 4020 veterans receiving consultative or comprehensive rehabilitation care post-stroke. The study examined initial characteristics of veterans predictive of grade IV achievement on the FIM.

- The final model contained the following variables: age, initial physical grade, initial cognitive stage, renal failure, nutritional compromise, type of rehabilitation services, and recovery time between admission and discharge assessments. A point system was assigned to each of the above variables, such that the clinician could enter in the above information and determine the likelihood of a patient achieving a grade IV. The area under the ROC curve was adequate of the derivation and validation cohorts (0.84 and 0.83, respectively). The Hosmer-Lemeshow statistic was not significant ( $p = 0.93$ ).

(Bates, 2015-Part 2)

- The above model (Bates, 2015-Part1) was enhanced to become a prognostic index, predicting likelihood of recovery to or above the grade VI benchmark (Modified Independent). There was adequate fit with a non-significant Hosmer-Lemeshow statistic of  $P = 0.38$  and Adequate area under the curve of 0.83 in the derivation cohort and 0.82 in the validation cohort. A similar predictive equation was derived with the sum score quartiles slightly modified.
- (Huang, 2010) Fifty-eight participants an average of 17.85 (range, 7-88) months post-stroke participated in distributed constraint induced therapy two hours per day, five days a week for three weeks. Assessments were administered prior and after therapy, and a Chi-squared Automatic Interaction Detector method was used to identify the strongest predictors of change on the Stroke Impact Scale. Participants with an initial Total FIM score  $\leq 109$  at admission, improved significantly more ( $p = 0.006$ ) on the Stroke Impact Scale and on measures of activities of daily living and instrumental activities of daily living at completion of the intervention.

(Lin, 2010) Seventy-four participants an average age of 54.11 ( $\pm 11.44$ ) years old and 17.46 ( $\pm 17.67$ ) months post-stroke were seen for upper extremity intervention. Participants received constraint-induced movement therapy, bilateral arm training, or conventional rehabilitation for two hour sessions,

five times per week for three weeks. Assessments were done at baseline and post-intervention.

- Poor to excellent predictive validity was found between the domains of the Stroke Impact Scale and the FIM (0.26-0.70,  $p < 0.05$ )
- Poor to excellent predictive validity was found between the domains of the Stroke Specific Quality of Life Scale and the FIM (0.22-0.63,  $p < 0.01$ ). The language, personality, thinking, and vision domains were not significant.

#### Concurrent Validity Evidence:

##### Rehabilitation Patients:

(Heinemann et al, 1994; Rehabilitation Patients) Admission FIM Motor Scores accounted for 52% of variance in discharge motor function among TBI patients, admission FIM Cognitive Scores accounted for 46% of variance in discharge cognitive function – admission motor FIM was the most significant predictor of length of stay.

(Montecchi et al, 2013) In 59 patients with mean age of 48.90 ( $\pm 14.01$ ) years old, admitted to the intensive care unit acutely post acquired brain injury (from trauma, hypoxia, hemorrhage or ischemia), a new Trunk Recovery Scale (TRS) was developed.

- Excellent correlation between the FIM-Motor and the TRS (0.849)

##### Stroke:

(Hsueh et al, 2002; Acute Stroke)

Excellent correlation between the FIM Motor Subscale and the 10-item version of the Barthel Index (BI) ( $r = 0.92$  (at admission) -  $0.94$  (at discharge))

Excellent agreement between the FIM Motor Subscale and 5-item version of BI ( $r = 0.74$  (at admission) -  $0.94$  (at discharge))

(Ward et al 2011) On admission to the acute rehabilitation ward, the FIM and the STREAM were found to be highly correlated in thirty patients acute post ischemic stroke. ( $0.7766$ ;  $P < 0.0001$ )

(Shindo et al, 2015) To explore the concurrent validity of the FIM scale with the Simple Test of Evaluation Hand Function [STEF], 34 inpatients (33-86

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                              | <p>years of age) sub acute post stroke (less than 60 days post episode) were evaluated at admission. The STEF had statistically significant, adequate correlations with the FIM™: FIM Total score (0.444;P&lt;0.009), FIM motor (0.411;P&lt;0.016) and FIM self care (0.402; P&lt;0.019) .</p> <p>(Sasaki et al, 2014) The aim of this study was to explore the validity of the Cognitive Behavioral Rating Scale (CBRS) with the FIM discharge data on 100 patients, mean age of 72.2 (± 10.9) years old and 61.0 (±61.2) days post-stroke. The Spearman Rank Correlation Coefficient was excellent between the CBRS and the FIM total Score (-0.70; p&lt;0.01), the Cognitive FIM (-0.72; P&lt;0.01), and the Motor FIM (-0.63; p&lt;0.01) for patients post stroke.</p> <p>(Caglar, 2014) A retrospective analysis on 142 patients post-stroke that went to an IRF. A linear regression was run to determine which factors contributed to Motor-FIM (M-FIM) gain and Cognitive-FIM (C-FIM) gain.</p> <ul style="list-style-type: none"> <li>• The adjusted R<sup>2</sup> was 0.173 (p = 0.000) for M-FIM gain and the significant factors were the admission M-FIM (B = 0.809, SE = 0.199, β = -0.446, p = 0.000) and if the patient had diabetes Mellitus (B = 14.269, SE = 6.775, β = -0.177, p = 0.037).</li> <li>• The adjusted R<sup>2</sup> was 0.146 (p = 0.001) for C-FIM gain and the significant factors were the admission C-FIM (B = -4.068, SE = 1.048, β = -0.369, p = 0.000) and if the patient had diabetes Mellitus (B = 36.226, SE = 17.904, β = -0.175, p = 0.045).</li> </ul> <p>(Cooke, 2010) One hundred and ninety-seven, first stroke participants were included an average of 45.4 ± 67.6 days post-stroke to examine the relationship of clock drawing post-stroke.</p> <ul style="list-style-type: none"> <li>• A significant relationship was found between the FIM-Motor and the Clock Drawing Test (Exp (B) = 0.984, p = 0.030).</li> </ul> |
| Construct Validity (Convergent/Discriminant) | <p>Convergent Validity Evidence (extent to which the screening instrument corresponds to similar instruments measuring the same function ( expressed as a correlation):</p> <p>SCI:</p> <p>(Ditunno, et al., 2007; n = 141, mean age = 32 years; Entered into study within 8 weeks of onset of SCI; data taken at entry, 3 and 6 and 12 months, subjects required to have score of &lt; 4 on the Locomotor FIM (LFIM) at entry, Acute SCI)</p> <ul style="list-style-type: none"> <li>• Excellent correlation between total FIM score and WISCI at 3,6, and 12 months (Spearman's r = 0.73 - 0.77)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

- Excellent correlation between total FIM score and Berg Balance Scale (Spearman's  $r = 0.72 - 0.77$ ) at 3, 6, and 12 months
- Excellent correlation between LFIM score and Walking Index for Spinal Cord Injury (WISCI) at 3, 6, and 12 months (Spearman's  $r = 0.88 - 0.92$ )
- Excellent correlation between LFIM score and Berg Balance Scale (Spearman's  $r = 0.86 - 0.89$ ) at 3, 6, and 12 months
- Excellent correlation between LFIM score and 50-Foot Walk Test at 3, 6, and 12 months (Spearman's  $r = 0.66 - 0.80$ )
- A comparison of simultaneous performance of the WISCI and the LFIM indicated 1 FIM level per multiple WISCI levels

(Donnelly et al, 2004;  $n = 41$ ; mean age = 49(118.1); mean time since injury = 52 (73.1) days; with paraplegia,  $n = 18$ ; with tetraplegia,  $n = 20$ ; Incomplete,  $n = 27$ ; complete,  $n = 11$ , SCI)

- Adequate correlation between admission and discharge scores of the FIM Total Score and the Canadian Occupational Performance Measure (COPM) Performance ( $r = 0.388 - 0.452$ ) and COPM Satisfaction ( $r = 0.513 - 0.514$ )
- Adequate correlation between change scores of the FIM Total Score and FIM motor with COPM Performance ( $r = 0.364$ ,  $r = 0.351$ ) and Satisfaction ( $r = 0.497$ ,  $r = 0.497$ ) from admission to discharge
- (Fujiwara et al, 1999;  $n = 14$ ; C6 level of injury, mean age = 30.7 years; mean length of time from injury = 462.0 days, Chronic SCI)

- Excellent correlation of FIM motor score and AIS motor score (Spearman's rank correlation coefficient = 0.73)
- Excellent correlation of shoulder strength (sum of MMT for serratus anterior, upper pectoralis major, and latissimus dorsi) and FIM motor score (Spearman's rank correlation coefficient = 0.95)
- Excellent correlation of AIS shoulder strength score (deltoid) and FIM transfer score (Spearman's  $r = 0.93$ )

(Saboe et al, 1997;  $n = 160$ ; mean age = 30 (13) years; assessed at admission, discharge, and 2 years post injury; Length of stay at tertiary care hospital 144 (111) days Chronic SCI)

- Excellent correlation of FIM score 2 years post injury with admission and discharge ASIA motor (Spearman's  $r = 0.68 - 0.80$ ), ASIA light

touch (Spearman's  $r = 0.75 - 0.76$ ), ASIA pinprick (Spearman's  $r = 0.73 - 0.76$ ), and Computed Vibration (Spearman's  $r = 0.64 - 0.67$ )

- Adequate correlation of FIM score 2 years post injury with admission bony injury level (Spearman's  $r = 0.53$ ) and admission and discharge ASIA Impairment (Spearman's  $r = 0.50 - 0.53$ )
- 56% of the variance of FIM scores 2 years post injury is accounted for with ASIA admission light touch scores with age being the next largest contributing factor
- (Yavuz et al, 1998;  $n = 29$ ; mean age = 37 years; mean time between onset and rehab admission = 20 weeks, mean length of stay in inpatient rehab = 18 weeks, Subacute SCI) Excellent correlation of FIM score with ASIA motor ( $r = 0.91$ )
- Adequate correlation of FIM score with ASIA light touch ( $r = 0.58$ ) and ASIA pinprick ( $r = 0.55$ )
- Excellent correlation of Quadriplegia Index of Function and FIM ( $r = 0.97$ )

Stroke:

(Tur et al, 2003; Acute Stroke)

- Adequate correlation with length of hospital stay ( $r = -0.39$ )
- Adequate to Excellent correlation with Brunnstrom's motor recovery stages in upper extremity, lower extremity, and hand at admission and discharge ( $r = 0.51 - 0.68$ )

(Van Heugten et al, 2015) Systematic review of studies (51) investigating convergent, criterion and predictive validity of cognitive dysfunction in patients in the acute phase (4 weeks) post stroke using multi-domain instruments .

- No instrument (including the FIM) assessed all of the commonly affected cognitive domains after a stroke
- Strong significant intercorrelations were found between the Occupational Therapy Cognitive Assessment (LOTCA), the MMSE and the FIM-Cognitive subscale

(Canbek, 2013) Fifty-five participants who experienced their first-ever stroke and went to an IRF an average of  $8 \pm 5$  days post-stroke.

- Poor to Excellent construct validity was seen between the FIM-Motor and the Tinetti POMA

|  |              |                |             |
|--|--------------|----------------|-------------|
|  | Tinetti POMA | Balance Domain | Gait Domain |
|--|--------------|----------------|-------------|

|                     |       |       |       |
|---------------------|-------|-------|-------|
| Admission FIM-Motor | 0.688 | 0.616 | 0.610 |
| Discharge FIM-Motor | 0.609 | 0.588 | 0.536 |
| Change FIM-Motor    | 0.389 | 0.277 | 0.396 |

(Kucukdeveci, 2013) One hundred and eighty-eight community dwelling participants (mean age 63.1  $\pm$  12 years), a median of 27 (range 3-240) months post-stroke were evaluated on the FIM and the World Health Organization Disability Assessment Schedule (WHODAS-II).

- Adequate to Excellent convergent validity was found. All correlations significant at  $p < 0.001$ .

|                                                | FIM Motor | FIM Cognitive |
|------------------------------------------------|-----------|---------------|
| WHODAS-II understanding and communicating      | -0.54     | -0.74         |
| WHODAS-II getting around                       | -0.86     | -0.45         |
| WHODAS-II self-care                            | -0.88     | -0.46         |
| WHODAS-II getting along with people            | -0.55     | -0.71         |
| WHODAS-II life activities (work items removed) | -0.74     | -0.45         |
| WHODAS-II participation in society             | -0.72     | -0.52         |
| WHODAS-II total (work items removed)           | -0.85     | -0.68         |
| WHODAS-II activities                           | -0.85     | -0.64         |
| WHODAS-II participation                        | -0.77     | -0.67         |
| WHODAS-II -12 (work items removed)             | -0.86     | -0.65         |
| WHODAS-II-10                                   | -0.83     | -0.65         |

(Ottiger et al A new multidisciplinary observation scale for inpatients post stroke based on the ICF model of activity and participation was created to document outcomes post stroke (LIMOS). This scale included four components of the ICF:1). interpersonal activities, [mobility and self-care;; 2}. Communication; 3} Knowledge and general tasks; 4) domestic life. The activities were rated as limitations or restriction in domains as: none, slight, moderate, severe or complete. This new scale was correlated with FIM scores.

- Excellent convergent validity was found between the LIMOS and the FIM ( $r=0.89$ ;  $P<0.0001$ )
- An excellent association was reported between the FIM mobility subscale and the LIMOS mobility subscale ( $r=0.90$ ;  $P<0.0001$ )
- Adequate to excellent associations were found between the subscales of the LIMOS (self care, general tasks, domestic life) and the subscales of the FIM ( $r=0.36-0.79$ )

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  | <p>Discriminate Validity Evidence:</p> <p>Rehabilitative patients:</p> <p>(Hobart et al, 2001; n = 169; neurological rehab patient: MS, stroke, TBI, other)</p> <ul style="list-style-type: none"> <li>FIM total and FIM motor scores correlated more strongly with OPCS disability scores, LHS scores, SF-36 physical component scores and WAIS – verbal IQ, than with measures of mental health status or psychological distress (SF36 mental component, General Health Questionnaire)</li> <li>FIM Cognitive Scores correlated most strongly with OPCS Disability scores and WAIS-verbal IQ scores and weakly with LHS, SF-36 physical and mental components, and the General Health Questionnaire (ABIEBR)</li> </ul> <p>Stroke:</p> <p>(Brock et al, 2002; Rasch analysis; n = 106; mean age = 68.7 (11.3) years; median time since onset = 11 days, Acute Stroke)</p> <ul style="list-style-type: none"> <li>Difficult items on motor portion of the scale discriminated better among higher functioning patients</li> <li>Raw FIM scores (as opposed to score subjected to Rasch analysis) may underestimate change</li> </ul> <p>(Cavanagh et al, 2000; ischemic and hemorrhagic stroke patients, Stroke)</p> <ul style="list-style-type: none"> <li>Simple 2-factor model of the FIM instrument may not be sufficient to describe disability following stroke (66% of variance)</li> <li>May not adequately measure within patient change whereas a 3-factor model (self-care, cognition and elimination) accounted for more variance (74.2%)</li> </ul> |
| Content Validity | <p>The FIM instrument was based on the results of a literature review of published and unpublished measures as well as input provided by an expert</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       | <p>panel. Face and content validity were determined using subject matter experts (Granger, Hamilton, Keith, Zielesny, &amp; Sherwins, 1986).</p> <p>Content validity was established through a pilot study done at 11 centers (n = 110 patients evaluated; Keith &amp; Granger, 1987).</p> <p>SCI:</p> <p>(Jackson et al, 2008; n = 54 expert raters assessed locomotion measures as: 1) valid or useful, 2) useful but requires validation or changes/improvements, or 3) not useful or valid for research in SCI, SCI)</p> <p>FIM – Locomotion item was rated as Valid/Useful by 6%, Useful But Requires Validation or Changes by 36%, and Not Useful or Valid for Research in SCI by 58%</p> <p>Traumatic Brain Injury:</p> <p>(Hall et al, 2001; TBI)</p> <p>Although the FIM instrument is reliable and key validity characteristics have been established, it has only 5 items directly addressing cognitive, behavioral, and communication issues, which limits its content validity for TBI</p> |
| Face Validity         | <p>SCI:</p> <p>(Grey and Kennedy, 1993; Chronic SCI)</p> <p>Face validity was evaluated by asking clinicians specific questions addressing:</p> <ul style="list-style-type: none"> <li>• Difficulty of understanding (88% had no difficulty)</li> <li>• Unnecessary items (97% reported no unnecessary items)</li> <li>• Items that should be added (83% felt no extra items needed)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Floor/Ceiling Effects | <p>Rehabilitation Patients:</p> <p>(Coster et al, 2006; n = 516 subjects with neurologic, orthopedic, or complex medical conditions; mean age = 68.3 (14.97) years; discharged from tertiary care or rehab hospital, Rehabilitation Patients)</p> <ul style="list-style-type: none"> <li>• Ceiling effect on FIM motor scale after discharge ranging from 10% at 1 month to 15% at 12 months</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

- Ceiling effect on the FIM cognitive scale after discharge for 70% of subjects at 1 month, reducing to 53% at 12 months

SCI:

(Grey and Kennedy, 1993; Chronic SCI)

- 92% of subjects and 88% of clinicians reported a max score on communication
- 75% of subjects and 73% of clinicians reported a max score on social cognition

(Hall et al, 1999; Acute SCI)

| Percentage of Floor and Ceiling FIM Scores by Level of Injury |           |           |      |       |       |
|---------------------------------------------------------------|-----------|-----------|------|-------|-------|
|                                                               | Admission | Discharge | 1 yr | 2 yrs | 5 yrs |
| High Tetraplegia: C1 (no motor ceiling effect)                |           |           |      |       |       |
| Motor Floor effect(%)*                                        | 86        | 21        | 28   | 25    | 13    |
| Cognitive Ceiling effect(%)~                                  | 59        | 80        | 89   | 96    | 98    |
| Low Tetraplegia: C5-C8                                        |           |           |      |       |       |
| Motor Floor effect(%)*                                        | 61        | 3         | 5    | 4     | 3     |
| Motor Ceiling effect(%)~                                      | 0         | 4         | 15   | 18    | 16    |
| Cognitive Ceiling effect(%)~                                  | 67        | 86        | 95   | 99    | 96    |
| Paraplegia (no motor floor effect)                            |           |           |      |       |       |
| Motor Ceiling effect(%)~                                      | 0         | 36        | 55   | 66    | 75    |
| Cognitive Ceiling effect (%)~                                 | 76        | 90        | 97   | 98    | 99    |
| * Floor effect: Score of 1; Ceiling effect: Score of 6 or 7   |           |           |      |       |       |

Stroke:

(Brock et al, 2002; Acute Stroke)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | <ul style="list-style-type: none"> <li>Minimal ceiling effect: 16% achieved ceiling on FIM Motor Subscale during inpatient rehabilitation<br/>(Dromerick et al, 2003; n = 95, Acute Stroke)</li> <li>No floor or ceiling effects at either time using the FIM instrument<br/>(Hsueh et al, 2002; Acute Stroke)</li> </ul> <p>FIM Motor subscale:</p> <ul style="list-style-type: none"> <li>Minimal floor effect at admission to inpatient rehab (5.8%) and at discharge from inpatient rehab (3.5%)</li> <li>No ceiling effect at admission to inpatient rehab (0%) and at discharge from inpatient rehab (0%)</li> </ul>                                                                                                                                                                                                                                              |
| Responsiveness | <p>Rehabilitation Patients:</p> <p>(Coster et al, 2006; Rehabilitation Patients)</p> <ul style="list-style-type: none"> <li>Small, positive effect size observed for FIM motor (SRM = 0.73 to 1.05) and FIM cognitive (SRM = 0.34 to 0.35) Small to Moderate, negative effect size observed for FIM motor (SRM = 1.3 to 1.31) and FIM cognitive (SRM = 1.34 to 2.24)</li> <li>For FIM motor, 15-36% of subjects presented with positive change exceeding the MDC and 15- 25% with negative change exceeding the MDC</li> <li>For FIM cognitive, 8-9% of subjects presented with positive change exceeding the MDC and 20-24% presented with negative change exceeding the MDC</li> </ul> <p>SCI:</p> <p>(Spooren et al, 2006; n = 60; mean age = 38.9 years old; first measurement taken when subjects were first able to sit up in a chair for 3 hours, Acute SCI)</p> |

- Large effect size for all subjects regardless of AIS classification between initial measurement (T1) and 3 months later (T2) as well as between initial measurement (T1) and discharge from rehab (T3)
- Small to moderate effect size for subjects between T2 and T3 (ES = 0.37-0.79)

Stroke:

(Hsueh et al, 2002; Acute Stroke)

Motor subscale:

- Large effect size with standardized response mean = 1.3

(Ward et al, 2011) A prospective cohort study of 30 subjects newly diagnosed with ischemic stroke (mean days since stroke onset 7.8 days ( $\pm$  3.5)) was designed to demonstrate sensitivity of the FIM to change in an acute rehabilitation setting.

- The FIM score on admission was significantly associated (adequate to excellent correlations) with discharge destination as well as predicted and actual length of stay.
- The SRM (admission to discharge change score) was 2.34 for the motor FIM ( $P < 0.0001$ ). This FIM SRM was greater than the SRM for the SIS-16 and SRM for the STREAM.

(Salter et al, 2010) Following admission and discharge of 292 patients post stroke (134 with complete data and 158 with incomplete data, respectively an average of 31.8 and 67.3 days post stroke), FIM<sup>TM</sup> scores improved significantly ( $P < 0.0001$ ) from admission to discharge from a mean of 73.86 (24.13) to 95.70 (24.65) . The SRM was 1.36.

Professional Association  
Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokeEdge II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

Abbreviations:

|         |                                                                            |
|---------|----------------------------------------------------------------------------|
| HR      | Highly Recommend                                                           |
| R       | Recommend                                                                  |
| LS / UR | Reasonable to use, but limited study in target group / Unable to Recommend |
| NR      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|              | Acute<br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post) | Subacute<br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | Chronic<br>(> 6 months) |
|--------------|---------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------|
| SCI EDGE     | R                                                                                     | R                                                      | R                       |
| StrokEDGE II | HR                                                                                    | HR                                                     | UR                      |

Recommendations Based on Parkinson Disease Hoehn and Yahr stage:

|         | I  | II | III   | IV    | V     |
|---------|----|----|-------|-------|-------|
| PD EDGE | NR | NR | LS/UR | LS/UR | LS/UR |

Recommendations based on level of care in which the assessment is taken:

|              | Acute Care | Inpatient Rehabilitation | Skilled Nursing Facility | Outpatient Rehabilitation | Home Health |
|--------------|------------|--------------------------|--------------------------|---------------------------|-------------|
| MS EDGE      | NR         | R                        | R                        | NR                        | NR          |
| StrokEDGE II | UR         | HR                       | UR                       | UR                        | UR          |
| TBI EDGE     | LS         | R                        | LS                       | LS                        | LS          |

Recommendations based on SCI AIS Classification:

|          | AIS A/B | AIS C/D |
|----------|---------|---------|
| SCI EDGE | R       | R       |

Recommendations for use based on ambulatory status after brain injury:

|          | Completely Independent | Mildly Dependent | Moderately Dependent | Severely Dependent |
|----------|------------------------|------------------|----------------------|--------------------|
| TBI EDGE | LS                     | R                | R                    | R                  |

Recommendations based on EDSS Classification for MS:

|         | EDSS 0.0 – 3.5 | EDSS 4.0 – 5.5 | EDSS 6.0 – 7.5 | EDSS 8.0 – 9.5 |
|---------|----------------|----------------|----------------|----------------|
| MS EDGE | R              | R              | R              | R              |

Recommendations for entry-level physical therapy education and use in research:

|              | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|--------------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| MS EDGE      | Yes                                                  | Yes                                       | Yes                                                         | No                                                   |
| PD EDGE      | No                                                   | No                                        | No                                                          | Not reported                                         |
| SCI EDGE     | Yes                                                  | Yes                                       | Yes                                                         | Not reported                                         |
| StrokEDGE II | Yes                                                  | Yes                                       | Yes                                                         | No                                                   |
| TBI EDGE     | Yes                                                  | Yes                                       | Yes                                                         | Not reported                                         |

#### Considerations

Motor items in the FIM instrument have been shown to have cross-diagnostic Differential Item Functioning (DIF), indicating varying level of difficulty of items pending diagnosis which reduces comparison between patients. (Lundgren-Nilsson, 2006; Kucukdeveci A, 2001)

Subjective reports of pain (15.5%) and loss of strength (17.9%) were most frequently identified as causes of change in FIM instrument activities and quality of life for individuals with chronic SCI (Price et al. 2004)

For assessment of individuals with SCI, Rasch analysis indicates a four-category rating scale vs. the original seven-category scale has increased reliability (Nilsson, et al. 2005)

With Rasch analysis, the FIM instrument had decreased cross-cultural validity of raw motor scores with 7 of 13 items suggesting that FIM Motor Subscale scores should not be pooled in their raw form or compared between countries. (Lawton et al, 2006)

Rasch analysis indicates decreased correlation for difficulty of bladder and bowel management and individuals' ease of performing tasks. (Lundgren-Nilsson, 2006)

#### *Rasch Analysis of FIM*

Questions on the uni-dimensionality of the FIM Motor Scale have been raised. Thus, data from 340 patients involved in post stroke rehabilitation were fitted to a Rasch model. The FIM Motor Scale satisfied Rasch model expectations including the uni-dimensionality assumption without requiring

deletion of any of the 13 items. This analysis reinforces that the FIM Motor Scale contains clinically important items. (Lungren Nilsson et al 2011)

A secondary Rasch analysis combining the FIM and the Nottingham Extended Activities of Daily Living (NEADL) assessment was done on 188 participants (average of  $19.45 \pm 15.96$  months post-stroke) from an upper extremity intervention trial. The scoring on the FIM was recoded to a 3-point scale to indicate degrees of independence and the final model (from both assessments) contained 36-items, the bowel management item was removed as it was highly correlated (0.81) with the bladder management item (Chen, 2013).

The Barthel Index is commonly administered by nursing and medical staff to measure functional recovery following an inpatient stay for patients post stroke or neurologic disorders while the rehabilitation staff use the FIM. The Barthel Index can be measured directly or estimated from the Northwick Park Dependency Scale (NPDS) or the FIM. Following hospital discharge of 717 patients (TBI and stroke), there was excellent agreement of intra-class correlations between the total scores on the FIM and the NPDS (0.93;  $P < 0.001$ ; 95% CI 0.92-0.94). Item by item agreement ranged from adequate (0.41; dressing) to excellent (0.77; mobility) with the average absolute item % agreement from 71.1% (Dressing) to 90.6% (transfers). (Turner et al, 2010)

#### *Comments from StrokEdge Task Force Members*

The FIM instrument must be administered by a trained and certified evaluator and ideally scored by consensus with a multi-disciplinary team. Although the FIM instrument was originally developed to address issues of sensitivity and comprehensiveness for Barthel Index (BI), subsequent studies demonstrated that psychometric properties of the FIM instrument and BI are similar (Hsueh et al, 2002; Stroke EDGE task force)

“The FIM instrument does not contain key activity or participation elements of patient recovery important for measuring outcome and burden of illness (e.g., return to work, relationships, social and recreational pastimes, etc.)” (Nichol et al., 2011) The FIM instrument is appropriate for patients at all levels of EDSS; rating reflects limited responsiveness data, training required, and copyright issues (MS EDGE task force)

#### *Diversity Sensitivity of FIM*

The FIM instrument was examined in white, black, and Hispanic people post-stroke that were admitted to inpatient rehabilitation. FIM scores were

tracked at admission, discharge, three and 12 months after discharge. At three months, black and Hispanic patients had lower FIM totals when compared to whites. In addition, total FIM ratings increased for all three group from discharge to three months post, but then showed little change after. Racial/ethnic group, age, length of stay and medical comorbidities were significant predictors of total FIM ratings over the four time points. (Berges et al, 2012; Stroke EDGE task force)

#### *FIM converted to other Languages*

(Miki et al, 2015). Internal consistency and reliability were measured with the Japanese FIM+FAM-J in 42 patients a mean 30.2 ( $\pm$  21.2) days post CVA .

- Excellent internal consistency was observed for the FIM+FAM-J (full scale [0.968], motor scale [0.954] and cognitive subscales [0.949])
- Excellent intra rater reliability was observed within the FIM+FAM-J full scale, motor subscale and cognitive subscale ((0.83, 0.80 and 0.98 respectively).
- Excellent criterion validity was measured between the FIM+FAM-j full scale and the Motor Scale with the Barthel Index [ BI], the National Institutes of Health Stroke Scale [NIHSS], modified Rankin Scale [mRS] and Brunnstrom Recovery State [BRS L/E] ( $r=0.83$ ,  $-0.75$ ,  $-0.82$  and  $0.79$  respectively with the total scale and  $0.88$ ,  $-0.77$ ,  $-0.87$ , and  $0.83$  respectively for the motor scale)
- Adequate criterion validity of the FIM+FAM-J cognitive scale with the BI, NIHSS, mRS and BRSL/E ( $0.56$ ,  $-0.53$ ,  $-0.54$  and  $0.53$  respectively)
- Adequate correlations with the Mini Mental Status Examination [MMSE] and the Frontal Assessment Battery [FAB] ( $0.60$  and  $0.58$ ) but a floor effect with the Catherine Bergego Scale [CBS].

(Naghdi et al, 2016) Two raters administered the Persian FIM and the Barthel Index to 40 patient, mean age of 60 ( $\pm$ 14.9) years old and an average of 21 ( $\pm$  23) months post first stroke .

- Excellent intra-rater reliability was measured {0.88-0.98}
- Internal consistency of the PFIM was excellent, ranging from 0.70 to 0.96
- Construct validity was supported by a significant Pearson Correlation between the PFIM and the Persian Barthel Index ( $r=0.95$ )

#### *Systematic Reviews*

In a systematic review of outcome measures used with patients post stroke participating in robot-assisted exercise trials (RAET), the FIM™ Motor Scale

was used as a measure of activity level in 9 of 28 RAET trials. With scores ranging from 13-91, the MCID was 11. The FIM Motor Scale had high/excellent reliability (test-retest and inter-rater reliability) and high/excellent validity (>0.75). However, the FIM Motor Scale had only moderate responsiveness (0.4-0.74), with chronic stroke survivors with severe impairments (persisting beyond 6 months) demonstrating little change on the FIM Motor Scale. As a measure of global physical activities, the FIM Motor Scale may be impacted by many other factors beyond specific arm function. The CAHAI or the ARAT may be a more appropriate arm outcome measure for stroke survivors with severe impairments. (Sivan et al, 2011)

Do you see an error or have a suggestion for this instrument summary?  
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|                          |                                                                                                                                                                                                                            |
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|                          | Yavuz, N., Tezyurek, M., et al. (1998). "A comparison of two functional tests in quadriplegia: the quadriplegia index of function and the functional independence measure." Spinal Cord 36(12): 832-837. Find it on PubMed |
| Year published           | 1983                                                                                                                                                                                                                       |
| Instrument in PDF Format | Yes                                                                                                                                                                                                                        |
| Approval Status          | Approved                                                                                                                                                                                                                   |

#### 14. REHAB MEASURES: FUGL-MEYER ASSESSMENT OF MOTOR RECOVERY AFTER STROKE

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of Assessment</b>    | Fugl-Meyer Assessment of Motor and Sensory Recovery after Stroke                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Acronym</b>                | FMA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Instrument Reviewer(s)</b> | Updated by Carmen Capo-Lugo, PT, PhD and Dorian Rose PT, PhD of the Stroke Edge II Task Force in 2016.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Summary Date</b>           | 11/12/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Purpose</b>                | <ul style="list-style-type: none"> <li>Evaluates and measures recovery in post-stroke hemiplegic patients</li> <li>Used in both clinical and research settings</li> <li>One of the most widely used quantitative measures of motor impairment (Gladstone et al, 2002)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b>            | <ul style="list-style-type: none"> <li>Items are scored on a 3-point ordinal scale <ul style="list-style-type: none"> <li>0 = <i>cannot perform</i></li> <li>1 = <i>performs partially</i></li> <li>2 = <i>performs fully</i></li> </ul> </li> <li>Maximum Score = 226 points</li> <li>The Five domains assessed include: <ul style="list-style-type: none"> <li>Motor function (UE maximum score = 66; LE maximum score = 34)</li> <li>Sensory function (maximum score = 24)</li> <li>Balance (maximum score = 14)</li> <li>Joint range of motion (maximum score = 44)</li> <li>Joint pain (maximum score = 44)</li> </ul> </li> <li>Subscales can be administered without the using the full test</li> <li>Modified (abbreviated) versions have been developed (Hsueh et al, 2008)</li> </ul> |
| <b>Area of Assessment</b>     | Activities of Daily Living; Functional Mobility; Pain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Body Part</b>              | Not Applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                                            |                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ICF Domain</b>                          | Body Function                                                                                                                                                                                                                                                                                                                                            |
| <b>Domain</b>                              | Motor; Sensory                                                                                                                                                                                                                                                                                                                                           |
| <b>Assessment Type</b>                     | Observer                                                                                                                                                                                                                                                                                                                                                 |
| <b>Length of Test</b>                      | 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                         |
| <b>Time to Administer</b>                  | 30 minutes (shortened versions $\geq$ 10 minutes)                                                                                                                                                                                                                                                                                                        |
| <b>Number of Items</b>                     | 226 items across 5 domains                                                                                                                                                                                                                                                                                                                               |
| <b>Equipment Required</b>                  | <p>The FMA Motor Test requires:</p> <ul style="list-style-type: none"> <li>• Tennis ball</li> <li>• A small spherical shaped container</li> <li>• A tool to administer reflex tests</li> <li>• Enough space is needed for a patient to move around freely</li> <li>• If possible, space should be a quiet, private room with few distractions</li> </ul> |
| <b>Training Required</b>                   | Review of manual                                                                                                                                                                                                                                                                                                                                         |
| <b>Type of training required</b>           | Reading an Article/Manual                                                                                                                                                                                                                                                                                                                                |
| <b>Cost</b>                                | Free                                                                                                                                                                                                                                                                                                                                                     |
| <b>Actual Cost</b>                         | Nominal - cost of equipment only                                                                                                                                                                                                                                                                                                                         |
| <b>Age Range</b>                           | Adolescent: 13-17 years; Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                                                                                                                          |
| <b>Administration Mode</b>                 | Paper/Pencil                                                                                                                                                                                                                                                                                                                                             |
| <b>Diagnosis</b>                           | Stroke                                                                                                                                                                                                                                                                                                                                                   |
| <b>Populations Tested</b>                  | The FMA was designed for post-stroke hemiplegic patients of all ages                                                                                                                                                                                                                                                                                     |
| <b>Standard Error of Measurement (SEM)</b> | <p><b><u>Stroke:</u></b></p> <p>(Sanford et al, 1993; <math>n = 12</math>; mean age = 66 years; stroke onset &lt; 6 months, Acute Stroke)</p>                                                                                                                                                                                                            |

|                                                       | <ul style="list-style-type: none"><li>FMA total scores: 9.4</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                       |                  |                  |                  |                  |  |  |        |   |   |   |   |   |   |            |                 |                 |                  |                  |                  |                  |     |                |                |                |                |                |              |         |                 |                 |                 |                  |                  |             |          |                 |                  |                  |                  |                 |             |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|------------------|------------------|------------------|------------------|--|--|--------|---|---|---|---|---|---|------------|-----------------|-----------------|------------------|------------------|------------------|------------------|-----|----------------|----------------|----------------|----------------|----------------|--------------|---------|-----------------|-----------------|-----------------|------------------|------------------|-------------|----------|-----------------|------------------|------------------|------------------|-----------------|-------------|
| Minimal Detectable Change (MDC)                       | <p><b><u>Stroke:</u></b></p> <p>(Wagner et al, 2008, <math>n = 14</math>, mean age = 59.9 (14.6) years, assessed on average 14 (6.5) months post stroke, Chronic Stroke)</p> <ul style="list-style-type: none"><li>FMA = 5.2 points for the Upper Extremity portion of the assessment</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                       |                  |                  |                  |                  |  |  |        |   |   |   |   |   |   |            |                 |                 |                  |                  |                  |                  |     |                |                |                |                |                |              |         |                 |                 |                 |                  |                  |             |          |                 |                  |                  |                  |                 |             |
| Minimally Clinically Important Difference (MCID)      | <p><b><u>Stroke:</u></b></p> <p>(Shelton et al, 2001; <math>n = 171</math>; mean age 70 (11) years; assessed within 17 (12) days of stroke, Acute Stroke)</p> <p>FMA Motor Scores from Admission to Discharge</p> <ul style="list-style-type: none"><li><b>10 point increase</b> in FMA Upper Extremity = <b>1.5 change</b> in discharge FIM</li><li><b>10 point increase</b> in FMA Lower Extremity = <b>1.9 change</b> in discharge FIM</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                       |                  |                  |                  |                  |  |  |        |   |   |   |   |   |   |            |                 |                 |                  |                  |                  |                  |     |                |                |                |                |                |              |         |                 |                 |                 |                  |                  |             |          |                 |                  |                  |                  |                 |             |
| Cut-Off Scores                                        | <p><b><u>Stroke:</u></b></p> <p>(Duncan et al, 2000; <math>n = 459</math>; mean age = 70 (11.4) years; stroke onset within 14 days, Acute Stroke)</p> <table><tr><th colspan="7">Six month outcomes by modified Rankin classifications</th></tr><tr><th>Rankin</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr><tr><td>Fugl-Meyer</td><td>99.31<br/>(1.49)</td><td>91.76<br/>(9.51)</td><td>82.94<br/>(17.18)</td><td>62.58<br/>(24.04)</td><td>39.15<br/>(25.42)</td><td>16.69<br/>(23.89)</td></tr><tr><td>NIH</td><td>0.07<br/>(0.27)</td><td>0.78<br/>(1.12)</td><td>2.06<br/>(1.63)</td><td>3.93<br/>(2.55)</td><td>7.94<br/>(4.80)</td><td>18.71(11.74)</td></tr><tr><td>Barthel</td><td>99.23<br/>(1.88)</td><td>98.97<br/>(2.83)</td><td>96.52<br/>(5.08)</td><td>83.40<br/>(13.50)</td><td>42.83<br/>(18.25)</td><td>6.43 (8.86)</td></tr><tr><td>SF36-PFI</td><td>85.38<br/>(9.46)</td><td>70.12<br/>(21.06)</td><td>54.23<br/>(22.98)</td><td>29.38<br/>(21.04)</td><td>8.68<br/>(11.87)</td><td>1.67 (4.08)</td></tr></table> | Six month outcomes by modified Rankin classifications |                  |                  |                  |                  |  |  | Rankin | 1 | 2 | 3 | 4 | 5 | 6 | Fugl-Meyer | 99.31<br>(1.49) | 91.76<br>(9.51) | 82.94<br>(17.18) | 62.58<br>(24.04) | 39.15<br>(25.42) | 16.69<br>(23.89) | NIH | 0.07<br>(0.27) | 0.78<br>(1.12) | 2.06<br>(1.63) | 3.93<br>(2.55) | 7.94<br>(4.80) | 18.71(11.74) | Barthel | 99.23<br>(1.88) | 98.97<br>(2.83) | 96.52<br>(5.08) | 83.40<br>(13.50) | 42.83<br>(18.25) | 6.43 (8.86) | SF36-PFI | 85.38<br>(9.46) | 70.12<br>(21.06) | 54.23<br>(22.98) | 29.38<br>(21.04) | 8.68<br>(11.87) | 1.67 (4.08) |
| Six month outcomes by modified Rankin classifications |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                       |                  |                  |                  |                  |  |  |        |   |   |   |   |   |   |            |                 |                 |                  |                  |                  |                  |     |                |                |                |                |                |              |         |                 |                 |                 |                  |                  |             |          |                 |                  |                  |                  |                 |             |
| Rankin                                                | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2                                                     | 3                | 4                | 5                | 6                |  |  |        |   |   |   |   |   |   |            |                 |                 |                  |                  |                  |                  |     |                |                |                |                |                |              |         |                 |                 |                 |                  |                  |             |          |                 |                  |                  |                  |                 |             |
| Fugl-Meyer                                            | 99.31<br>(1.49)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 91.76<br>(9.51)                                       | 82.94<br>(17.18) | 62.58<br>(24.04) | 39.15<br>(25.42) | 16.69<br>(23.89) |  |  |        |   |   |   |   |   |   |            |                 |                 |                  |                  |                  |                  |     |                |                |                |                |                |              |         |                 |                 |                 |                  |                  |             |          |                 |                  |                  |                  |                 |             |
| NIH                                                   | 0.07<br>(0.27)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.78<br>(1.12)                                        | 2.06<br>(1.63)   | 3.93<br>(2.55)   | 7.94<br>(4.80)   | 18.71(11.74)     |  |  |        |   |   |   |   |   |   |            |                 |                 |                  |                  |                  |                  |     |                |                |                |                |                |              |         |                 |                 |                 |                  |                  |             |          |                 |                  |                  |                  |                 |             |
| Barthel                                               | 99.23<br>(1.88)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 98.97<br>(2.83)                                       | 96.52<br>(5.08)  | 83.40<br>(13.50) | 42.83<br>(18.25) | 6.43 (8.86)      |  |  |        |   |   |   |   |   |   |            |                 |                 |                  |                  |                  |                  |     |                |                |                |                |                |              |         |                 |                 |                 |                  |                  |             |          |                 |                  |                  |                  |                 |             |
| SF36-PFI                                              | 85.38<br>(9.46)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 70.12<br>(21.06)                                      | 54.23<br>(22.98) | 29.38<br>(21.04) | 8.68<br>(11.87)  | 1.67 (4.08)      |  |  |        |   |   |   |   |   |   |            |                 |                 |                  |                  |                  |                  |     |                |                |                |                |                |              |         |                 |                 |                 |                  |                  |             |          |                 |                  |                  |                  |                 |             |
| Normative Data                                        | <p><b><u>Stroke:</u></b></p> <p>(Duncan et al, 2000, Acute Stroke)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                       |                  |                  |                  |                  |  |  |        |   |   |   |   |   |   |            |                 |                 |                  |                  |                  |                  |     |                |                |                |                |                |              |         |                 |                 |                 |                  |                  |             |          |                 |                  |                  |                  |                 |             |

**Percent of cohort that achieved recovery**

|                 | NIH $\leq$ 1 | Fugl-Meyer $>$ 90 | Barthel $>$ 90 | SF36<br>Female<br>PFI $>$ 66 | SF36<br>Male<br>PFI $>$ 75 | Rankin $\leq$ 1 | Rankin $\leq$ 2 |
|-----------------|--------------|-------------------|----------------|------------------------------|----------------------------|-----------------|-----------------|
| <b>Baseline</b> | 10.46        | 13.07             | 8.06           | 0.00                         | 0.00                       | 1.74            | 12.20           |
| <b>1 Month</b>  | 16.78        | 12.85             | 26.14          | 9.44                         | 12.08                      | 5.45            | 21.57           |
| <b>3 Month</b>  | 11.11        | 7.84              | 13.94          | 10.73                        | 11.59                      | 9.80            | 12.85           |
| <b>6 Month</b>  | 6.54         | 3.05              | 9.15           | 3.86                         | 4.83                       | 7.41            | 7.19            |
| <b>Never</b>    | 55.10        | 63.20             | 42.70          | 76.00                        | 71.50                      | 75.60           | 46.20           |

**Test-retest Reliability**

**General Rehab Sample:**

(Platz et al, 2005;  $n = 37$  stroke, 14 MS, and 5 TBI patients; assessed twice within a 7 day interval, General Rehab Sample)

- **Excellent** Total Motor Score (ICC = 0.97)
- **Excellent** Sensation (ICC = 0.81)
- **Excellent** Passive Joint motion (ICC = 0.95)

**Interrater/Intrarater Reliability**

**Stroke:**

(Duncan et al, 1983;  $n = 19$ ; mean age = 56 (13) years; same PT rating on 3 occasions each 3 weeks apart; VA sample, Chronic Stroke)

**Interrater Reliability**

| Rating           | Doman           | Pearson's $r$       |
|------------------|-----------------|---------------------|
| <b>Excellent</b> | FMA total score | $r = 0.98-0.99$     |
| <b>Excellent</b> | Upper Extremity | $r = 0.995 - 0.996$ |
| <b>Excellent</b> | Lower Extremity | $r = 0.96$          |
| <b>Excellent</b> | Sensation       | $r = 0.95 - 0.96$   |

|                  |                    |                    |
|------------------|--------------------|--------------------|
| <b>Excellent</b> | Joint Range / Pain | $r = 0.86 - 0.996$ |
| <b>Excellent</b> | Balance            | $r = 0.89 - 0.98$  |

**Excellent Interrater Reliability:**

(Duncan et al, 1983; 4 PT's using the above sample)

| <b>FMA Domain</b> | <b>Pearson's <math>r</math></b> |
|-------------------|---------------------------------|
| Upper Extremity   | $r = 0.98 - 0.995$              |
| Lower Extremity   | $r = 0.89 - 0.95$               |

(Sanford et al, 1993;  $n = 12$ ; mean age = 66 (11.5) years; 0 to 6 months post stroke, Acute Stroke)

- **Excellent** interrater reliability, FMA Total Score: (ICC = 0.96)

| <b>Rating</b> | <b>FMA Domain</b>     | <b>ICC</b> |
|---------------|-----------------------|------------|
| Excellent     | Upper Extremity       | 0.97       |
| Excellent     | Lower Extremity       | 0.92       |
| Adequate      | Sensation             | 0.85       |
| Adequate      | Joint Range of Motion | 0.85       |
| Poor          | Pain                  | 0.61       |

|                                                                                                                                                                 |                         |                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------|
| Sullivan et al, 2011; $n=15$ patients (10-71 days post-stroke; mean age 62.8 yrs. One expert PT rater compared to 17 trained PT's using standardized procedures | Intra-rater Reliability | Inter-rater Reliability |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------|

|                            |           |          |           |           |
|----------------------------|-----------|----------|-----------|-----------|
| developed for LEAPS trial. |           |          |           |           |
| FM Domain                  | ICC (3,1) | 95% CI   | ICC (2,1) | 95% CI    |
| Motor: Total               | 0.99      | 0.83-1.0 | 0.98      | 0.93-0.99 |
| Motor: UE                  | 0.95      | 0.66-1.0 | 0.99      | 0.97-1.0  |
| Motor: LE                  | 0.99      | 0.91-1.0 | 0.91      | 0.69-0.97 |
| Sensory: Total             | 0.96      | 0.70-1.0 | 0.93      | 0.83-0.98 |
| Sensory: Light Touch       | 1.0       | 1.0-1.0  | 0.87      | 0.69-0.95 |
| Sensory: Proprioception    | 0.95      | 0.63-1.0 | 0.96      | 0.90-0.99 |

See et al, 2013; n=31 patients (54±47 mo post-stroke; mean age 61.1yrs. Three therapist raters. Testing was conducted on the UE FMA only. Performance for the total UE FMA, proximal arm subsection, and distal arm (wrist/hand) were examined separately. Reliability was assessed utilizing standardized procedures developed for a Phase II RCT.

| Test                   | UE FMA Total Score | UE FMA Proximal Subscore | UE FMA Hand/Wrist Subscore |
|------------------------|--------------------|--------------------------|----------------------------|
| Intrarater reliability |                    |                          |                            |
| Spearman's $r^2$       | 0.99               | 0.99                     | 0.94                       |
| ICC                    | 0.99               | 0.99                     | 0.99                       |
| MDC <sub>90</sub>      | 3.2 pts            | 1.7 pts                  | 1.7 pts                    |
| Interrater reliability |                    |                          |                            |
| Spearman's $r^2$       | 0.97               | 0.95                     | 0.85                       |
| ICC                    | 0.99               | 0.98                     | 0.98                       |
| MDC <sub>90</sub>      | 3.2 pts            | 1.6 pts                  | 2.5 pts                    |

## Internal Consistency

### Stroke:

(Lin et al, 2004;  $n = 176$ ; mean age = 67.9 (10.9) years; assessed 14, 30, 90 and 180 days after stroke, Acute Stroke)

- **Excellent** internal consistency: alpha = 0.94 to 0.98 across 4 administrations

### Subsection to FMA Total Score Correlations:

(Wood-Dauphinee et al, 1990;  $n = 167$ ; assessed at admission and 5 weeks)

- **Excellent** correlation : Upper Extremity & FMA Total ( $r = 0.97$ )
- **Excellent** correlation: Lower Extremity & FMA Total ( $r = 0.90$ )
- **Adequate** correlation: Balance & FMA Total ( $r = 0.88$ )

## Criterion Validity (Predictive/Concurrent)

### Stroke:

(Malouin et al, 1994;  $n = 32$ ; mean age = 60; mean time since stroke = 64.5 days, Acute Stroke)

- **Excellent** FMA & Motor Assessment Scale (MAS) total score correlations ( $r = 0.96$ )
- **Poor** FMA & MAS sitting balance item correlations ( $r = -0.10$ )
- **Motor and sensory FMA scores** 5 days post-stroke were the **strongest predictor of motor recovery** 6 months post-stroke (Duncan et al, 1992)

Gait Speed (Nadeau et al, 1999;  $n = 16$ ; mean age = 47.9 (15.6) years; mean number of months post-stroke = 43.9, Chronic Stroke)

- **Poor correlations** between FMA Sensation and Gait speed ( $r = 0.05$ ) and comfort ( $r = 0.14$ )
- **Excellent correlations** between FMA total motor scores and gait speed ( $m = 1.09$  meter per second;  $r = 0.61$ ); and comfort ( $m = 0.76$  meters per second;  $r = 0.61$ )

See et al, 2013;  $n=12$ . These exams were performed on 12 patients (of the cohort of 31 described under Reliability testing above), 4 separate visits across a treatment period, for a total of 48 exams. Testing was conducted on the UE FMA only. Performance for the total UE FMA, proximal arm subsection, and distal arm (wrist/hand) were examined separately.

| Test                                   | Baseline Value | Correlation with UE FMA Total Score | Correlation with UE FMA Proximal Score | Correlation with UE FMA Hand/Wrist Subscore |
|----------------------------------------|----------------|-------------------------------------|----------------------------------------|---------------------------------------------|
| Max. Grip force, affected/nonaffected  | 0.29±0.22      | 0.74                                | 0.73                                   | 0.73                                        |
| Max. Pinch force, affected/nonaffected | 0.40±0.30      | 0.88                                | 0.87                                   | 0.85                                        |
| Box & Blocks (no. Of blocks)           | 0 (0-29)       | 0.86                                | 0.79                                   | 0.88                                        |
| ARAT score                             | 27.2±22.5      | 0.93                                | 0.88                                   | 0.89                                        |
| 9-hole peg (no. Of pegs placed)        | 0 (0-7)        | 0.75                                | 0.64                                   | 0.80                                        |
| SIS hand subscore                      | 2.3±1.3        | 0.86                                | 0.79                                   | 0.88                                        |

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                 | <p>ARAT = Action Research Arm Test; SIS = Stroke Impact Scale. Baseline values are mean <math>\pm</math> SD except for Box &amp; Blocks and 9-hole peg scores, which are median. Correlation values are Spearman <math>r</math> values which in all cases were significant with <math>p &lt; 0.0001</math>.</p> <p>(Wei et al, 2011; <math>n=27</math> with chronic stroke (<math>4.92 \pm 0.45</math> yrs post-stroke)</p> <p>Excellent correlations were observed both pre-training and post-training among the Upper Extremity Fugl-Meyer Assessment , the Motor Status Scale and the Action Research Arm Test (<math>\rho=0.91-0.93</math>). Modified Ashworth Scale and the UE FMA were fairly to moderately correlated (<math>\rho=0.42-0.62</math>)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Construct Validity<br>(Convergent/Discriminant) | <p><b>Stroke:</b></p> <p><b>Acute Stroke:</b></p> <ul style="list-style-type: none"> <li>• <b>Excellent correlation:</b> modified Balance Subscale on FMA and the Barthel Index; <math>r = 0.86 - 0.89</math> (Mao et al, 2002)</li> <li>• <b>Excellent</b> correlation: FMA and Functional Independence Measures (FIM) administered to 172 inpatients who had recently had a stroke; <math>r = 0.63</math> (Shelton et al, 2000)</li> <li>• FMA effectively distinguished between three levels of self care (Independent, Partly Dependant, and Dependant) in a sample of 109 recent (<math>&lt; 90</math> days) stroke survivors (Bernspang et al, 1987).</li> <li>• FMA was a better measure of higher-level recovery than the MAS (Malouin, et al, 1994)</li> </ul> <p><b>Chronic Stroke</b></p> <p>(Dettmann et al, 1987; <math>n = 15</math>; mean age = 64 years; mean time since stroke, 2 years, Chronic Stroke)</p> <ul style="list-style-type: none"> <li>• The <b>FMA</b> and the <b>Barthel Index</b> were used to assess a group of 15 participants at an average of 2 years post stroke. Correlations between the measures were <b>excellent</b> (<math>r = 0.67</math>). The strongest correlations were observed in the <b>Balance subscore</b> (<math>r = 0.76</math>) the <b>Upper Extremity</b> subscore of the motor domain (<math>r = 0.75</math>) and <b>FMA Motor total score</b> (<math>r = 0.74</math>)</li> </ul> <p>(Hsieh et al, 2009; onset <math>&gt; 6</math> months, Chronic Stroke)</p> <p>FMA Construct Validity (Spearman's rho followed by 95% CI)</p> |

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | <ul style="list-style-type: none"> <li>• <b>Excellent</b> correlation between FMA and Action Research Arm Test: 0.73** (0.58, 0.83)</li> <li>• <b>Excellent</b> correlation between FMA and Wolf Motor Function Test-TIME: 0.76** (0.63, 0.86)</li> <li>• <b>Excellent</b> correlation between FMA and Wolf Motor Function Test-Functional Ability Scale: 0.71** (0.56, 0.82)</li> <li>• <b>Adequate</b> correlation between the FMA and FIM-motor: 0.49** (0.27, 0.66)</li> </ul> <p>*P &lt; 0.05<br/>**P &lt; 0.01</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Content Validity</b> | <p><b><u>Stroke:</u></b></p> <p>(Woodbury et al, 2008; <i>n</i> = 377; men age = 69.2 (11.2) years, Acute Stroke)</p> <p><b>Upper extremity</b> (modified version, 3 reflex items removed)</p> <ul style="list-style-type: none"> <li>• Administered at admission and 6-months post stroke</li> <li>• Rasch Analysis demonstrated adequate fit for each of the 30 items <b>except</b> the hook grasp item</li> <li>• Results suggest items contained in modified FMA, (except the hook grasp item) were assessing the same underlying construct</li> </ul> <p>(Crow et al, 2008; <i>n</i> = 62; retrospective analysis, Chronic Stroke)</p> <p><b>Upper and lower-extremity</b> (excluding balance) portions of FMA:</p> <ul style="list-style-type: none"> <li>• Items within a scale are valid, unidimensional and cumulative</li> <li>• Results suggest that if a patient is able to successfully complete an item of a certain difficulty, that same patient should be able to complete less difficult items, implying that a shortened administration of the FMA may produce valid results</li> </ul> |
| <b>Face Validity</b>    | <p>Gladestone et al, 2002:</p> <ul style="list-style-type: none"> <li>• Face and content validity for the motor domain are "very good"</li> <li>• Scaling is heavily weighted for the upper extremity</li> <li>• Reflexes may be overrepresented in the scoring system</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## Floor/Ceiling Effects

### Stroke: (Lin et al, 2004, Acute Stroke)

- **Ceiling effects** have been observed with the Sensation subscore. The following percentages of acute stroke patients reaching the highest possible score:

| Days Post Stroke | % Highest Possible Score |
|------------------|--------------------------|
| 14-30 days       | 44.4%                    |
| 14-180 days      | 72.1%                    |
| 30-90 days       | 48.9%                    |
| 90-180 days      | 48.9%                    |
| 90-180 days      | 62.7%                    |

- Possible ceiling effects on hand and lower extremity items (Gladstone, et al, 2002).
- **Floor effects** have been reported for the modified Balance domain. The strongest effects were observed 14 days post stroke with 29.3% of participants not able to achieve the lowest possible score on the measure (Mao et al, 2002)

## Responsiveness

### Stroke:

(Mao et al, 2002, Acute Stroke)

- **Excellent** on the modified version of the FMA Balance score
  - o Between assessments at 14, 30, 90 and 180 days post-stroke
  - o Responsiveness decreased as the time between stroke and assessments increased

**Moderate to Low:** (Lin et al, 2004) responsiveness was found for the Sensation subscale of the FMA as assessed by Standardized Response Means (SRM).

- Means were low at:
  - o 14-30 days: SRM = 0.42
  - o 30-90 days: SRM = 0.43
  - o 90-180 days: SRM = 0.27

- **Moderate** responsiveness when assessed from 14 to 180 days (SRM = 0.67)

(Hsueh et al, 2009, Chronic Stroke)

- **Small to moderate** effect sizes were observed on the FMA, the Stroke Rehabilitation Assessment of Movement instrument (STREAM) and each of the measures shortened versions.
- **Moderate** effect sizes on the shortened version of both measures (0.53 and 0.51)
- **Small** effect sizes on the long version of the measure (0.045 and 0.38)

(Wei et al, 2011; n=27 with chronic stroke (4.92±0.45 yrs post-stroke

Pre- and post-training which consisted of 20 sessions of UE robotic training that could be completed in 4-7 weeks.

|                  | SRM                               | GRI* |
|------------------|-----------------------------------|------|
| UE FMA           | 0.85                              | 3.62 |
| Shoulder & elbow | 0.84<br>(large responsiveness)    | 2.70 |
| Wrist & Hand     | 0.67<br>(moderate responsiveness) | 3.45 |

\*GRI has no recommended value. Bigger GRI values mean larger effect size and more responsiveness. SRM = Standardized Response Mean; GRI= Guyatt's Responsiveness Index

## Professional Association Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD Edge), Spinal Cord Injury Taskforce (PD Edge), Stroke Taskforce (StrokeEdge II), Traumatic Brain Injury Taskforce (TBI Edge), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

### Abbreviations:

|           |                  |
|-----------|------------------|
| <b>HR</b> | Highly Recommend |
|-----------|------------------|

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post) | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months) |
|---------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|
| <b>StrokEDGE II</b> | <i>HR</i>                                                                                    | <i>HR</i>                                                     | <i>HR</i>                      |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>StrokEDGE II</b> | <i>UR</i>         | <i>HR</i>                       | <i>HR</i>                       | <i>HR</i>                        | <i>HR</i>          |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|---------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>StrokEDGE II</b> | <i>Yes</i>                                                  | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Not reported</i>                                         |

## Considerations

### **Limitations:** (Gladstone et al, 2002)

- The Sensation, Balance, Joint Range of Motion and Joint Pain domains have been criticized as less well suited for this instrument given its intended purpose
- Joint Range of Motion may be a confounding variable, so the inclusion of the Joint Pain domain may be unnecessary
- Distal fine motor functions may be underrepresented
- Finger movement not assessed (but gross hand function is included)
- Arm scores are more heavily weighting the leg scores
- Better measure of balance are now available
- Inclusion of subjective items on the Sensation and Joint Pain domains may reduce the measures reliability
- The Sensory Scale's psychometric properties suggest that it should NOT be used to assess stroke patients (Lin et al, 2004)

Do you see an error or have a suggestion for this instrument summary? Please [e-mail us!](#)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>Year published</b>           | 1975                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## 15. REHAB MEASURES DATABASE—MODIFIED ASHWORTH SCALE

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | Modified Ashworth Scale Instructions (other languages below)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Title of Assessment    | Ashworth Scale / Modified Ashworth Scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Acronym                | AS / MAS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Instrument Reviewer(s) | Initially reviewed by the Rehabilitation Measures Team; Updated by Phyllis Palma PT, DPT and Christopher Newman PT, MPT, NCS and the SCI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 9/2012; Updated with references for the TBI population by Irene Ward, PT, DPT, NCS and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2012; Updated with references for Pediatrics and Cerebral Palsy by Anna Wetzel, SPT, Brian Baranyi, SPT, and Stephanie Johnson, SPT in 11/2012; Updated by Dorian, Rose, PhD, PT and Carmen Capo-Lugo, PhD, PT of the StrokEdge II Task Force, Academy of Neurologic Physical Therapy - a component of APTA. |
| Summary Date           | 5/26/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Purpose                | Originally developed to assess the effects of antispasticity drugs on spasticity in Multiple Sclerosis<br><br>Modified Ashworth: measures spasticity in patients with lesions of the Central Nervous System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Description            | Original Ashworth Scale:<br><br>Tests resistance to passive movement about a joint with varying degrees of velocity<br><br>Scores range from 0-4, with 5 choices<br><br>A score of 1 indicates no resistance and 5 indicates rigidity<br><br>Modified Ashworth Scale :<br><br>Similar to Ashworth, but adds a 1+ scoring category to indicate resistance through less than half of the movement. Thus scores range from 0-4, with 6 choices (Bohannon & Smith, 1987)                                                                                                                                                                                                                                                               |

|                    | Score                         | Ashworth Scale (1964)                                                                  | Modified Ashworth Scale Bohannon & Smith (1987)                                                                                                                                         |
|--------------------|-------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | 0 (0)                         | No increase in tone                                                                    | No increase in muscle tone                                                                                                                                                              |
|                    | 1 (1)                         | Slight increase in tone giving a catch when the limb was moved in flexion or extension | Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension |
|                    | 1+ (2)                        |                                                                                        | Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM (range of movement)                          |
|                    | 2 (3)                         | More marked increase in tone but limb easily flexed                                    | More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved                                                                                          |
|                    | 3 (4)                         | Considerable increase in tone - passive movement difficult                             | Considerable increase in muscle tone passive, movement difficult                                                                                                                        |
|                    | 4 (5)                         | Limb rigid in flexion or extension                                                     | Affected part(s) rigid in flexion or extension                                                                                                                                          |
| Area of Assessment | Spasticity                    |                                                                                        |                                                                                                                                                                                         |
| Body Part          | Not Applicable                |                                                                                        |                                                                                                                                                                                         |
| ICF Domain         | Body Structure; Body Function |                                                                                        |                                                                                                                                                                                         |
| Domain             | Motor                         |                                                                                        |                                                                                                                                                                                         |
| Assessment Type    | Observer                      |                                                                                        |                                                                                                                                                                                         |
| Length of Test     | 05 Minutes or Less            |                                                                                        |                                                                                                                                                                                         |

|                           |                                                                                                                                                                                          |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Time to Administer        | < 5 minutes, dependent upon the number of muscles/joints tested                                                                                                                          |
| Number of Items           | AS uses a 5 point scale (range 0 to 4); MAS uses 6 point scale (range 0 to 4)                                                                                                            |
| Equipment Required        | Mat Table                                                                                                                                                                                |
| Training Required         | None                                                                                                                                                                                     |
| Type of training required | No Training                                                                                                                                                                              |
| Cost                      | Free                                                                                                                                                                                     |
| Actual Cost               | Free                                                                                                                                                                                     |
| Age Range                 | Child: 6-12 years; Adult: 18-64 years                                                                                                                                                    |
| Administrati on Mode      | Paper/Pencil                                                                                                                                                                             |
| Diagnosis                 | Cerebral Palsy; Multiple Sclerosis; Spinal Cord Injury; Stroke; Traumatic Brain Injury                                                                                                   |
| Populations Tested        | Adults and children with lesions of the Central Nervous System<br>Cerebral Palsy<br>Multiple Sclerosis<br>Pediatric Hypertonia<br>Spinal Cord Injury<br>Stroke<br>Traumatic Brain Injury |
| Standard Error of         | Not Established                                                                                                                                                                          |

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measurement (SEM)                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Minimal Detectable Change (MDC)                  | <p>Stroke:</p> <p>(Shaw et al, 2010; n = 333; adults with upper limb spasticity at the shoulder, elbow, wrist or hand and reduced upper limb function due to stroke more than 1 month previously.)</p> <p>Response to Botox: the magnitude of initial change in muscle tone/spasticity was approximately a one-point decrease on the MAS which reflects a clinically significant improvement.</p>                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Minimally Clinically Important Difference (MCID) | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Cut-Off Scores                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Normative Data                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Test-retest Reliability                          | <p>Modified Ashworth Scale</p> <p>Children with Cerebral Palsy:</p> <p>(Mutlu et al, 2008; n = 38; mean age = 52.9 (19.6) months, Children with CP)</p> <p>Poor to Excellent test-retest reliability (ICC = 0.36-0.83)</p> <p>(Fosang et al, 2003; n = 18; mean age = 6.4 years, Children with CP)</p> <p>Adequate to excellent test-retest reliability for hamstrings (ICC = 0.66-0.80)</p> <p>Poor to adequate test-retest reliability for calf (ICC = 0.21-0.72)</p> <p>Adequate to excellent test-retest reliability for hip adductors (ICC = 0.59-0.82)</p> <p>SCI:</p> <p>(Tederko et al, 2007, n = 30; 5 = unable to sit up, 14 = adapted to sitting position, 11 patients = adapted to standing position or able to walk; mean age = 33.9 (range = 17-65); mean time since injury 14.1 months, Chronic SCI)</p> |

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                   | <p>Adequate reliability for individual muscle groups (ICC = 0.56), however the MAS may be a more appropriate measure of global muscle tone.</p> <p>The reliability of muscle tone assessments were weaker among younger patients</p> <p>Joint contractures decreased the reliability of the MAS</p> <p>Stroke:</p> <p>(Gregson et al, 2000; n = 32; median age = 74 years; median Barthel score = 8; median time since onset = 40 (IQR = 19 - 78) days. Blackburn et al, 2002; n = 32; mean age = 76.1 (7.89) years; assessed 12 weeks post-stroke, Acute Stroke)</p> <p>Excellent intra-rater reliability for elbow (kw = 0.84) (Gregson et al, 1999)</p> <p>Adequate intra-rater reliability for elbow (kw = 0.77 – 0.84); ankle (kw = 0.59 – 0.64); wrist (kw = 0.80 – 0.88) and knee (kw = 0.77 – 0.94) (Gregson et al, 2000)</p> <p>Adequate intra-rater reliability in the lower extremity of 73.3% (Kendall tau-b = 0.567) (Blackburn et al, 2002)</p> <p>Traumatic Brain Injury:</p> <p>Adequate test-retest reliability for the Shoulder, elbow, wrist, hip, knee and ankle (kappa = 0.47-0.62) (Mehrholtz et al, 2005)</p> <p>Excellent test-retest for the ankle (r = 0.82; k = 0.422) (Allison et al, 1996)</p> |
| Interrater/Intrarater Reliability | <p>Modified Ashworth Scale:</p> <p>Patients with central nervous system lesions:</p> <p>(Bohannon &amp; Smith, 1987, n = 30, mean age = 59.3 (17.6) years, patients with central nervous system lesions)</p> <p>Excellent interrater reliability between two experienced raters (Kendall's tau = 0.847, p &lt; 0.001)</p> <p>Patients with severe cerebral damage:</p> <p>(Mehrholtz et al, 2005, patients with severe cerebral damage)</p> <p>Poor to adequate Inter-rater reliability (kappa = 0.16 to 0.42)</p> <p>SCI:</p> <p>(Haas et al, 1996, n = 30, mean age = 40.3 years, mean time since injury = 17.23 months; Frankel Grade A = 18, B = 3, C = 2, D = 6, E = 1, Chronic SCI)</p> <p>Poor to adequate interrater reliability depending on the muscle group (Kappa = 0.21 to 0.61)</p>                                                                                                                                                                                                                                                                                                                                                                                                                           |

(Craven et al, 2010, n = 20, C5-T10, AIS A-D > 12 months, Chronic SCI)

Inter-rater reliability was poor to adequate ( $Kappa < 0.6$ ) for all muscle groups

Inter-session reliability for a single rater was adequate ( $0.4 < ICC < 0.75$ ) for all muscle groups

MAS not reliable as an intrarater tool for all raters, and showed poor inter-rater and adequate inter-session reliability.

MAS has poor reliability for determining lower extremity spasticity between raters (interrater) or over time (intersession)

(Toderko et al, 2007; n = 30 (16 complete & 14 with incomplete); mean age = 33.9 (14.7) years; time since injury = 4-66; rated by 6 independent observers, Acute SCI)

Adequate interrater reliability ( $ICC = 0.56$ )

Stroke:

(Blackburn et al, 2002, Acute Stroke)

Adequate intrarater reliability. Agreement ranged from 57.5% (Kendall Tau-b = 0.44) to 85% (Kendall Tau-b = 0.66)

Poor interrater reliability. Agreement ranged from 50% (Kendall Tau-b = 0.20) to 42.5% (Kendall Tau-b = 0.16)

The authors concluded that the MAS was a reliable measurements for lower limb assessments made by a single rater, with highest agreement at the grade of 0. However, reliability between examiners was poor.

(Li et al, 2014; chronic stroke (3.7 +/- 4.30 months post-stroke); n=51)

This study assessed intra- and inter-rater reliability for the MAS.

| Reliability |                 | Kappa | Standard error | T-value | P-values | Interpretation        |
|-------------|-----------------|-------|----------------|---------|----------|-----------------------|
| Inter-rater | Elbow flexors   | 0.66  | 0.09           | 6.64    | <0.001   | Substantial agreement |
|             | Plantar flexors | 0.48  | 0.09           | 5.73    | <0.001   | Moderate agreement    |
| Intra-rater | Elbow flexors   | 0.69  | 0.09           | 7.06    | <0.001   | Substantial agreement |
|             | Plantar flexors | 0.48  | 0.10           | 5.42    | <0.001   | Moderate agreement    |

TBI:

(Allison et al, 1996, n = 30, mean age = 28.3 (10.8) years; mean time since injury = 56 (48.4) months, Chronic TBI)

Adequate interrater reliability ( $r = 0.727$ ) for plantar flexor spasticity

Original Ashworth Scale:

Children with Cerebral Palsy:

(Mutlu, 2008, Children with CP)

Excellent interrater reliability for measures hamstrings (ICC = 0.76, 0.73)

Excellent interrater reliability for measures of hip adductors (ICC = 0.83, 0.87)

Adequate to excellent interrater reliability for measure of hip internal rotators (ICC = 0.61, 0.84)

Adequate interrater reliability for measures of hip flexors (ICC = 0.71, 0.74)

Adequate interrater reliability for measures of gastrocnemius (ICC = 0.64, 0.68)

Poor to excellent intrarater reliability:

Lowest intrarater reliability found for hip internal rotators (ICC = 0.36)

Highest intrarater reliability found for hip flexors (ICC = 0.83)

Authors concluded that assessments of spasticity using the Modified Ashworth Scale are not very reliable for this population and should be used with caution

(Fosang, 2003, Children with CP)

Hamstrings

Poor to adequate interrater reliability (ICC = 0.37-0.48)

Adequate to Excellent intrarater reliability (ICC = 0.66-0.80)

Calf

Poor to Adequate interrater reliability (ICC: 0.27-0.45)

Poor to Adequate intrarater reliability (ICC: 0.21-0.70)

Adductors

Adequate interrater reliability (ICC = 0.54-0.56)

Adequate intrarater reliability (ICC = 0.59-0.72)

(Yam, 2005; n = 17, mean age=7.9 years, Children with CP)

Poor to adequate interrater reliability for hip adductors, knee flexed (ICC = 0.41)

Adequate interrater reliability for hip adductors, knee extended (ICC = 0.73)

Adequate interrater reliability for ankle plantarflexors, knee extended (ICC = 0.56)

Adequate interrater reliability for ankle plantarflexors, knee flexed (ICC = 0.46)

The authors caution the use of this test in this population due to none of the measures possessing excellent interrater reliability (ICC > 0.75)

Pediatric Hypertonia:

(Clopton, 2005; n = 17, mean age = 7 years, Pediatric Hypertonia)

Excellent interrater reliability for elbow flexors and hamstrings (ICC > 0.75)

Poor to adequate interrater reliability for other muscles (ICC < 0.50)

Lower than clinically acceptable

Excellent intrarater reliability for hamstrings (ICC > 0.75)

Adequate intrarater reliability for other muscles (ICC 0.50-0.75)

Potentially lower than clinically acceptable

Stroke:

(Kaya et al, 2011, n = 64, mean age = 60.5 (11.9) years; mean time since stroke = 15.7 (10.2) weeks, Stroke)

Excellent for both MAS and modified MAS (Ansari et al, 2006), with weighted kappa values of 0.868 and 0.892

MAS and MMAS have very good inter-rater reliability for assessment of poststroke elbow flexor spasticity

Neither scale is superior to grade spasticity in patients with hemiplegia for this particular muscle group

(Brashear et al, 2002, n = 10, mean age = 59.9 (16.17) years, Chronic Stroke)

Adequate intrarater reliability (across 10 raters)

|                    | Elbow | Wrist | Fingers | Thumb |
|--------------------|-------|-------|---------|-------|
| Overall weighted K | 0.668 | 0.740 | 0.740   | 0.680 |
| p                  | 0.998 | 0.972 | 1.000   | 0.985 |

Adequate to excellent interrater reliability (depending on joint)

Mean of evaluations 1 and 2 (Kendall W)

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |       |         |       |       |       |       |       |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|---------|-------|-------|-------|-------|-------|
|                                             | <table><tr><td>Elbow</td><td>Wrist</td><td>Fingers</td><td>Thumb</td></tr><tr><td>0.765</td><td>0.598</td><td>0.792</td><td>0.611</td></tr></table> <p>TBI:</p> <p>(Ansari et al., n = 15; mean age of 57.3 (14.4) years. They had brain injury on average of 33.3 (26.2) months earlier, Chronic TBI)</p> <p>Adequate: the weighted Kappa (kappaw) values were calculated for reliability. The kappaw was 0.61 (adequate) for elbow flexor and 0.78 (excellent) for wrist flexor. Results support the adequate to excellent interrater reliability of the MMAS for persons with upper limb spasticity</p>                                                                                                                                                                                                                                                                       | Elbow   | Wrist | Fingers | Thumb | 0.765 | 0.598 | 0.792 | 0.611 |
| Elbow                                       | Wrist                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Fingers | Thumb |         |       |       |       |       |       |
| 0.765                                       | 0.598                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.792   | 0.611 |         |       |       |       |       |       |
| Internal Consistency                        | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |       |         |       |       |       |       |       |
| Criterion Validity (Predictive/C oncurrent) | <p>Modified Ashworth Scale:</p> <p>Children with Children:</p> <p>(Alhusani, 2010; n = 27, mean age = 7 (1.9) years, Children with CP)</p> <p>Percentage of Exact Agreement with lab measurement (stretch-induced electromyographic activity) in identifying spasticity</p> <p>81.5% non-significant fair agreement (K = 0.24)</p> <p>P = 0.057 non-significant</p> <p>Pearson Correlation with lab measurement to identify the severity of spasticity</p> <p>R = 0.009 not a significant correlation</p> <p>P = 0.7 not a significant correlation</p> <p>Traumatic Brain Injury:</p> <p>(Allison &amp; Abraham, 1995, n = 34, mean age = 30.4 years, TBI)</p> <p>Adequate concurrent validity with:</p> <p>Timed toe tapping (r = -0.042)</p> <p>Reflex Threshold Angle (r = 0.49)</p> <p>H-reflex during dorsiflexion (r = 0.47)</p> <p>H-wave during vibration (r = 0.39)</p> |         |       |         |       |       |       |       |       |

|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construct<br>Validity<br>(Convergent/<br>Discriminant) | <p>Modified Ashworth Scale:</p> <p>SCI:</p> <p>(Smith et al, 2002; n = 22; 14 quadriplegia (3 incomplete), 8 paraplegia (1 incomplete); mean age = 33.4 (12.5) years, SCI)</p> <p>Excellent: Correlation with the Wartenberg Pendulum Test &amp; MAS (r = -0.69)</p> <p>Stroke:</p> <p>(Katz 1992, n = 10; Lin &amp; Sabbahi, 1999, n = 10, mean age = 59 (4) years, Chronic Stroke)</p> <p>Excellent convergent validity with:</p> <p>Fugl-Meyer (r = -0.94)</p> <p>Electromyography (r = -0.79)</p> <p>Box-Block Test (r = -0.83)</p> <p>Active Range of Motion (r = -0.74)</p> <p>Grip Strength (r = -0.86)</p> <p>Pendulum test (r = -0.67)</p> <p>(Min et al, 2012; acute stroke (32.2 +/- 7.3 days post-stroke); n=21)</p> <p>The Spearman correlation coefficients showed a high correlation between MAS and amplitude of T-reflex of the biceps (Rater 1 = 0.464, Rater 2 = 0.573). No correlation was found between MAS and latency of the biceps' T-reflex .</p> <p>(Lee et al, 2015; chronic stroke (15.21 +/- 3.32 months post-stroke); n=43)</p> <p>This study assessed correlation between outcome measures using Pearson correlations coefficients. MAS was negatively correlated with Fugl-Meyer Upper Extremity (FM-UE; -0.72, p&lt;0.05), FM-wrist/hand (-0.34, p&lt;0.05), and Action Research Arm Test (ARAT; -0.41, p&lt;0.05).</p> |
| Content<br>Validity                                    | <p>Theoretical basis of the Modified Ashworth Scale:</p> <p>Implicit Assumptions:</p> <p>(Pandyan et al, 1999, Implicit Assumptions)</p> <p>Changes in the resistance to passive movement are due to changes in spasticity</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |  |    |                  |   |           |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--|----|------------------|---|-----------|
|                                          | <p>Stretch mechanoreceptors in the muscle would elongate with similar velocity during repeated measures</p> <p>Range of movement on each joint during repeated measures is unaltered</p> <p>These authors suggested:</p> <p>Caution is required when stating that the Modified Ashworth Scale is a measure of spasticity</p> <p>Evidence suggests that the resistance to passive movement is not an exclusive measure of spasticity</p> <p>Resistance will vary according to the level of activity in the alpha motor neuron of agonist and antagonist muscles, the viscoelastic properties of soft tissues and joints.</p>                                                                                                                                                                                                                                                                                                                                                                                  |                |  |    |                  |   |           |
| Face Validity                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |  |    |                  |   |           |
| Floor/Ceiling Effects                    | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |  |    |                  |   |           |
| Responsiveness                           | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |  |    |                  |   |           |
| Professional Association Recommendations | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokeEdge, StrokeEdge II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> <table border="1"> <tr> <td colspan="2">Abbreviations:</td></tr> <tr> <td>HR</td><td>Highly Recommend</td></tr> <tr> <td>R</td><td>Recommend</td></tr> </table> | Abbreviations: |  | HR | Highly Recommend | R | Recommend |
| Abbreviations:                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |  |    |                  |   |           |
| HR                                       | Highly Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |  |    |                  |   |           |
| R                                        | Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                |  |    |                  |   |           |

|         |                                                                            |
|---------|----------------------------------------------------------------------------|
| LS / UR | Reasonable to use, but limited study in target group / Unable to Recommend |
| NR      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|             | Acute<br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 months post) | Subacute<br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | Chronic<br>(> 6 months) |
|-------------|----------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------|
| SCI EDGE    | NR                                                                                     | NR                                                     | NR                      |
| StrokEDGEII | UR                                                                                     | NR                                                     | NR                      |

Recommendations based on level of care in which the assessment is taken:

|             | Acute Care | Inpatient Rehabilitation | Skilled Nursing Facility | Outpatient Rehabilitation | Home Health |
|-------------|------------|--------------------------|--------------------------|---------------------------|-------------|
| StrokEDGEII | UR         | UR                       | NR                       | NR                        | NR          |

Recommendations for entry-level physical therapy education and use in research:

|             | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|-------------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| SCI EDGE    | No                                                   | No                                        | No                                                          | Not reported                                         |
| StrokEDGEII | No                                                   | Yes                                       | Yes                                                         | Not reported                                         |

Ashworth Scale, Modified

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEDGE), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE),

Stroke Taskforce (StrokEDGE, StrokEDGEII), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

Abbreviations:

|         |                                                                            |
|---------|----------------------------------------------------------------------------|
| HR      | Highly Recommend                                                           |
| R       | Recommend                                                                  |
| LS / UR | Reasonable to use, but limited study in target group / Unable to Recommend |
| NR      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|          | Acute<br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 months post) | Subacute<br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | Chronic<br>(> 6 months) |
|----------|----------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------|
| SCI EDGE | LS                                                                                     | LS                                                     | LS                      |

Recommendations based on level of care in which the assessment is taken:

|          | Acute Care | Inpatient Rehabilitation | Skilled Nursing Facility | Outpatient Rehabilitation | Home Health |
|----------|------------|--------------------------|--------------------------|---------------------------|-------------|
| MS EDGE  | UR         | UR                       | UR                       | UR                        | UR          |
| TBI EDGE | LS         | R                        | R                        | R                         | R           |

Recommendations based on SCI AIS Classification:

|          | AIS A/B | AIS C/D |
|----------|---------|---------|
| SCI EDGE | LS      | LS      |

Recommendations for use based on ambulatory status after brain injury:

|          | Completely Independent | Mildly dependant | Moderately Dependant | Severely Dependant |
|----------|------------------------|------------------|----------------------|--------------------|
| TBI EDGE | N/A                    | N/A              | N/A                  | N/A                |

Recommendations based on EDSS Classification:

|         | EDSS 0.0 – 3.5 | EDSS 4.0 – 5.5 | EDSS 6.0 – 7.5 | EDSS 8.0 – 10.0 |
|---------|----------------|----------------|----------------|-----------------|
| MS EDGE | UR             | UR             | UR             | UR              |

Recommendations based on vestibular diagnosis

|  | Peripheral | Central | Benign Paroxysmal Positional Vertigo (BPPV) | Other |
|--|------------|---------|---------------------------------------------|-------|
|  |            |         |                                             |       |

Recommendations for entry-level physical therapy education and use in research:

|          | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|----------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| MS EDGE  | No                                                   | No                                        | No                                                          | Yes                                                  |
| SCI EDGE | No                                                   | Yes                                       | No                                                          | Not reported                                         |
| TBI EDGE | Yes                                                  | Yes                                       | Yes                                                         | Not reported                                         |

Considerations

Adequate training is required to ensure inter-rater reliability

Reliability differs from muscle to muscle

Assessment technique must be standardized

Some critics question the validity of the Ashworth scale and Modified Ashworth Scale in measuring spasticity. It may be a description of resistance to passive movement. Therefore, measuring only one aspect of spasticity, not a comprehensive assessment. (Salter et al, 2005)

It was concluded that the Ashworth scale is of limited use in the assessment of spasticity in the lower limb of patients with SCI

The Ashworth scale produces a global assessment of the resistance to passive movement of an extremity, not just stretch-reflex hyperexcitability. Specifically, the Ashworth score is likely to be influenced by non-contractile soft tissue properties, by persistent muscle activity (dystonia), by intrinsic joint stiffness, and by stretch reflex responses (Kamper et al., 2001)

Ambiguity of wording and lack of standardized procedures limit the scale's usefulness for comparison across studies as well as reliability

The Modified Ashworth scale does not comply with the concept of spasticity (a velocity-dependent increase in muscle tone) (Scholtes, 2007)

The Modified Ashworth Scale measures muscle tone intensity at one, unspecified, velocity which can make comparisons difficult (Scholtes, 2007)

Translated Modified Ashworth Scale:

Chinese (simplified):

[http://www.haodf.com/zhuanjiaguandian/liubaoqiong\\_1077075591.htm](http://www.haodf.com/zhuanjiaguandian/liubaoqiong_1077075591.htm)

French:

<http://www.cofemer.fr/UserFiles/File/ECH.1.2.2.Asworth.pdf>

German:

[http://www.patientensicherheit.ch/dms/de/themen/3126\\_sturz\\_testbeschreibung\\_ch\\_edoke\\_master\\_d/Testbeschreibung%20chedoke%20MC%20Master.pdf](http://www.patientensicherheit.ch/dms/de/themen/3126_sturz_testbeschreibung_ch_edoke_master_d/Testbeschreibung%20chedoke%20MC%20Master.pdf)

Italian (p103):

<http://www.iss.it/binary/publ/cont/08-39%20web.1233562284.pdf>

Japanese (p2):

[https://www.jstage.jst.go.jp/article/jkpt/12/0/12\\_1/\\_pdf](https://www.jstage.jst.go.jp/article/jkpt/12/0/12_1/_pdf)

Korean:

<http://blog.naver.com/PostView.nhn?blogId=3c273&logNo=10000521558>

Spanish (p40):

<http://www.tdx.cat/bitstream/handle/10803/3840/nml1de1.pdf;jsessionid=1CF6D8957E26C2A044019951FEBF24F2.tdx2?sequence=1>

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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|              | <p>These translations, and links to them, are subject to the Terms and Conditions of Use of the Rehab Measures Database. RIC is not responsible for and does not endorse the content, products or services of any third-party website, and does not make any representations regarding its quality, content or accuracy. If you would like to contribute a language translation to the RMD, please contact us at <a href="mailto:rehabmeasures@ric.org">rehabmeasures@ric.org</a>.</p> <p>Do you see an error or have a suggestion for this instrument summary? Please e-mail us!</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| Year published           | 1964                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Instrument in PDF Format | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

Approval  
Status

Approved

## 16. REHAB MEASURES DATABASE—MODIFIED FATIGUE IMPACT SCALE

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | <a href="#">Download the MSQLI: A User's Manual (PDF)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Title of Assessment    | Modified Fatigue Impact Scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Acronym                | MFIS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Instrument Reviewer(s) | Initially reviewed by Tammie Johnson, PT, DPT, MS and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 9/2012. Updated by Genevieve Pinto-Zipp of the StrokEdge II task force, Neurology Section, APTA 2016.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Summary Date           | 1/20/2017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Purpose                | The MFIS is a modified form of the Fatigue Impact Scale (Fisk et al, 1994) based on items derived from interviews with MS patients concerning how fatigue impacts their lives. This instrument provides an assessment of the effects of fatigue in terms of physical, cognitive, and psychosocial functioning.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Description            | <ul style="list-style-type: none"> <li>The full-length MFIS has 21 items while the abbreviated version has 5 items. The full-length version has the advantage of generating subscales.</li> <li>The MFIS is a 21-item shortened version of the 40-item FIS and has been recommended for use by the Multiple Sclerosis Council for Clinical Practice Guidelines. It assesses the perceived impact of fatigue on the subscales physical, cognitive and psychosocial functioning during the past 4 weeks (Rietberg et al., 2010).</li> <li>The MFIS is one of the components of the MSQLI.</li> <li>Description of scoring: Likert scale. Participants rate on a 5-point Likert scale, with 0 = 'Never' to 4 = 'Almost always' their agreement with 21 statements.</li> <li>Total score (0-84) and subscales for physical (0-36), cognitive (0-40) and psychosocial functioning (0-8). The 5 item version is scored (0-20). Higher numbers indicate greater fatigue.</li> <li>Rasch analysis revealed that the 21-item scale was found to contain a "physical" and a "cognitive" dimension (the original 2 social items were found to be part of the physical dimension).</li> <li>Scoring for Standard 21-item version: either represented as a total score by summing the totals from each subscale or by each individual subscale (see below).</li> <li>Physical subscale: range from 0-36</li> </ul> |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>o Add raw scores on items: 4+6+7+10+13+14+17+20+21</li> <li>• Cognitive subscale: range from 0-40 <ul style="list-style-type: none"> <li>o Add raw scores on items: 1+2+3+5+11+12+15+16+18+19</li> </ul> </li> <li>• Psychosocial subscale: range from 0-8 <ul style="list-style-type: none"> <li>o Add raw scores on items: 8+9</li> </ul> </li> <li>• Scoring for 5-item version: <ul style="list-style-type: none"> <li>o Total score is the sum of items 1+9+10+17+19</li> <li>o Range from 0-20</li> </ul> </li> </ul> |
| <b>Area of Assessment</b>        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Body Part</b>                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>ICF Domain</b>                | Body Structure; Body Function; Activity; Participation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Domain</b>                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Assessment Type</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Length of Test</b>            | 05 Minutes or Less; 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Time to Administer</b>        | Administration time is approximately 5-10 minutes for the full-length version and 2-3 minutes for the abbreviated version.                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Number of Items</b>           | The standard version of the MFIS consists of 21 items. The abbreviated version of the MFIS consists of 5 items.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Equipment Required</b>        | <ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Pen</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Training Required</b>         | Training can be done by downloading and reading the <a href="#">MSQLI</a> document on the MS site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Type of training required</b> | Reading an Article/Manual                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Cost</b>                      | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Actual Cost</b>               | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Age Range</b>                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Administration Mode</b>       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Diagnosis</b>                 | Traumatic Brain Injury                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Populations Tested                               | <ul style="list-style-type: none"> <li>Multiple Sclerosis</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Standard Error of Measurement (SEM)              | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Minimal Detectable Change (MDC)                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Minimally Clinically Important Difference (MCID) | <p><b>Multiple Sclerosis:</b> (Rietberg, 2010; <math>n=43</math>; ambulatory patients with MS (mean age 48.7 years; SD 7 years; 30 women; median Expanded Disability Status Scale score 3.5)</p> <ul style="list-style-type: none"> <li>Smallest Detectable Change (SDC) = 16.2</li> <li>Minimal Detectable Change (MDC) % = 19.3%</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Cut-Off Scores                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Normative Data                                   | <p><b>Multiple Sclerosis:</b> (Tellez et al, 2005; 231 MS patients and 123 healthy controls, 164 patients with relapsing-remitting, 47 with secondary progressive, 12 with primary progressive)</p> <ul style="list-style-type: none"> <li>Median MFIS score= 33.0 (range 0-82)</li> </ul> <p><b>Traumatic Brain Injury:</b> (Sendroy-Terrill et al., 2010, <math>n=243</math>, 73% men, less than 5% of participants unconsciousness of &lt; 1 day, 41 % showed LOC 1 day to 1 week, 31 % LOC from 1 week to 1 month, 24% had LOCs from 1 month to 1 year. Received treatment in a comprehensive inpatient rehabilitation hospital. Cohorts based on years postinjury (1 to &gt;30 years))</p> <ul style="list-style-type: none"> <li>Mean for total MFIS= 23.7<math>\pm</math>21.1</li> <li>Mean for MFIS - Physical= 10.2<math>\pm</math>9.6</li> <li>Mean for MFIS - Cognitive=11.4<math>\pm</math>10.4</li> <li>Mean for MFIS - Psychosocial= 2.0<math>\pm</math>2.0</li> </ul> |
| Test-retest Reliability                          | <p><b>Multiple Sclerosis:</b> (Rietberg, 2010; <math>n=43</math>; ambulatory patients with MS (mean age 48.7 years; SD 7 years; 30 women; median Expanded Disability Status Scale score 3.5)</p> <ul style="list-style-type: none"> <li><b>Excellent</b> test-retest reliability (ICC =0.85)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interrater / Intrarater Reliability          | <p><b><u>Multiple Sclerosis:</u></b> (Amtmann et al, 2012; <math>n=1271</math> individuals with MS living in the community, 80% female, 36.2% reported being employed 20 or more hours a week; mean age 50.7, mean disease duration 13.2 years, MS severity as minimal (<math>EDSS \leq 4.0</math>) for 32.4% and intermediate (<math>EDSS 4.5-6.5</math>) for 47.9% and advanced (<math>EDSS \geq 7.0</math>) for 19.7%)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> reliability: Cronbach's alpha = 0.94-0.96 for total MFIS</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Internal Consistency                         | <p><b><u>Multiple Sclerosis:</u></b> (Kos et al, 2005)</p> <ul style="list-style-type: none"> <li>• MFIS has been found to show change after intervention.</li> <li>• After a 4-week rehabilitation program, the MFIS did change, but the FSS did not.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Criterion Validity (Predictive / Concurrent) | <p>Concurrent validity:</p> <p><b><u>Multiple Sclerosis:</u></b> (Rietberg, 2010; <math>n= 43</math>; ambulatory patients with MS; mean age 48.7 years; SD 7 years; 30 women; median Expanded Disability Status Scale score 3.5)</p> <ul style="list-style-type: none"> <li>• <b>Excellent:</b> MFIS vs. Fatigue Severity Scale (FSS): <math>r = 0.66</math>; MFIS vs. the Checklist Individual Strength (CIS20R): <math>r = 0.54</math></li> </ul> <p><b><u>Multiple Sclerosis:</u></b> (Tellez et al, 2005; (231 MS patients and 123 healthy controls, 164 patients with relapsing-remitting, 47 with secondary progressive, 12 with primary progressive)</p> <ul style="list-style-type: none"> <li>• <b>Excellent:</b> between MFIS and FSS (<math>r=0.68</math>, <math>p&lt;0.0001</math>)</li> <li>• <b>Adequate to Excellent:</b> between MFIS subscale and FSS <ul style="list-style-type: none"> <li>o MFIS-physical: <math>r=0.75</math>, <math>p&lt;0.0001</math></li> <li>o MFIS-cognitive: <math>r=0.44</math>, <math>p&lt;0.0001</math></li> <li>o MFIS-psychosocial: <math>r= 0.62</math>, <math>p&lt;0.0001</math></li> </ul> </li> </ul> <p>Predictive Validity:</p> <p><b><u>Traumatic Brain Injury:</u></b> (Sendroy-Terrill et al., 2010, <math>n=243</math>, 73% men, less than 5% of participants unconsciousness of &lt; 1 day, 41 % showed LOC 1 day to 1 week, 31 % LOC from 1 week to 1 month, 24% had LOCs from 1 month to 1</p> |

|                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                | <p>year. Received treatment in a comprehensive inpatient rehabilitation hospital. Cohorts based on years postinjury (1 to &gt;30 years))</p> <ul style="list-style-type: none"> <li>MFIS-physical: with each additional decade of age at time of injury, there was a 2 point increase on the MFIS-physical score (<math>P=.02</math>)</li> <li>MFIS-psychosocial: with each additional decade of age at time of injury, there was a 0.5 point increase (<math>P=.01</math>)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Construct Validity (Convergent / Discriminant) | <p><b>Multiple Sclerosis:</b> (Mills et al, 2010; <math>n=415</math>)</p> <ul style="list-style-type: none"> <li>Given the Rasch analysis, Mills et al. suggested that the physical and cognitive subscales should be used separately eliminating questions 4, 14, 17 from the physical and questions 1-3, 5, and 11. In addition, the authors suggest the total score not be used.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Content Validity                               | <p><b>Multiple Sclerosis:</b> (Amtmann et al., 2012; <math>n=1271</math> individuals with MS living in the community, 80% female, 36.2% reported being employed 20 or more hours a week. Mean age 50.7, mean disease duration 13.2 years, MS severity as minimal (<math>EDSS \leq 4.0</math>) for 32.4% and intermediate (<math>EDSS 4.5-6.5</math>) for 47.9% and advanced (<math>EDSS \geq 7.0</math>) for 19.7%)</p> <ul style="list-style-type: none"> <li>Validity: Spearman Rank Correlation Fatigue Severity Scale to MFIS: <ul style="list-style-type: none"> <li><b>Excellent</b> for MFIS total and subscales of physical and psychosocial (0.69-0.77)</li> <li><b>Adequate</b> for MFIS cognitive subscale</li> </ul> </li> <li>IRT analyses indicate that the FSS is less precise in measuring both low and high levels of fatigue, compared with the MFIS.</li> <li>For those interested in measuring both physical and cognitive aspects of fatigue, and whose sample is expected to have higher levels of fatigue, the MFIS is a better choice even though it is longer.</li> </ul> |
| Face Validity                                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Floor / Ceiling Effects                        | <p><b>Multiple Sclerosis:</b> (Amtmann et al., 2012; <math>n=1271</math> individuals with MS living in the community, 80% female, 36.2% reported being employed 20 or more hours a week; mean age 50.7, mean disease duration 13.2 years, MS severity as minimal (<math>EDSS \leq 4.0</math>) for 32.4% and intermediate (<math>EDSS 4.5-6.5</math>) for 47.9% and advanced (<math>EDSS \geq 7.0</math>) for 19.7%)</p> <ul style="list-style-type: none"> <li>Floor effects: (number of respondents with the lowest possible score)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                                          | <ul style="list-style-type: none"><li>o MFIS total= 1.1%</li><li>o MFIS-phy=1.6%</li><li>o MFIS-cog=2.7%</li><li>o MFIS-psychosocial=7.4%</li><li>• Ceiling effect: (number of respondents with the highest possible score)<ul style="list-style-type: none"><li>o MFIS total= 0.7%</li><li>o MFIS-phy=1.6%</li><li>o MFIS-cog=0.9%</li><li>o MFIS-psychosocial=9.0%</li></ul></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |                     |    |    |    |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|-----------|------------------|----------|-----------|----------------|----------------------------------------------------------------------------|-----------|-----------------|--|----------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|---------------------|----|----|----|
| Responsiveness                           | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |                     |    |    |    |
| Professional Association Recommendations | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> <table><tr><th colspan="2">Abbreviations:</th></tr><tr><td><b>HR</b></td><td>Highly Recommend</td></tr><tr><td><b>R</b></td><td>Recommend</td></tr><tr><td><b>LS / UR</b></td><td>Reasonable to use, but limited study in target group / Unable to Recommend</td></tr><tr><td><b>NR</b></td><td>Not Recommended</td></tr></table> <p>Recommendations for use based on acuity level of the patient:</p> <table><tr><th></th><th><b>Acute</b><br/>(CVA &lt; 2 months post)<br/>(SCI &lt; 1 month post)<br/>(Vestibular &lt; 6 weeks post)</th><th><b>Subacute</b><br/>(CVA 2 to 6 months)<br/>(SCI 3 to 6 months)</th><th><b>Chronic</b><br/>(&gt; 6 months)</th></tr><tr><td><b>StrokEDGE II</b></td><td>NR</td><td>UR</td><td>UR</td></tr></table> <p>Recommendations based on level of care in which the assessment is taken:</p> | Abbreviations:                                                |                                | <b>HR</b> | Highly Recommend | <b>R</b> | Recommend | <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend | <b>NR</b> | Not Recommended |  | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post) | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months) | <b>StrokEDGE II</b> | NR | UR | UR |
| Abbreviations:                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |                     |    |    |    |
| <b>HR</b>                                | Highly Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |                     |    |    |    |
| <b>R</b>                                 | Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |                     |    |    |    |
| <b>LS / UR</b>                           | Reasonable to use, but limited study in target group / Unable to Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |                     |    |    |    |
| <b>NR</b>                                | Not Recommended                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |                     |    |    |    |
|                                          | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months) |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |                     |    |    |    |
| <b>StrokEDGE II</b>                      | NR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | UR                                                            | UR                             |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |                     |    |    |    |

|                     | Acute Care | Inpatient Rehabilitation | Skilled Nursing Facility | Outpatient Rehabilitation | Home Health |
|---------------------|------------|--------------------------|--------------------------|---------------------------|-------------|
| <b>MS EDGE</b>      | <i>R</i>   | <i>R</i>                 | <i>R</i>                 | <i>R</i>                  | <i>R</i>    |
| <b>StrokEDGE II</b> | <i>NR</i>  | <i>NR</i>                | <i>UR</i>                | <i>UR</i>                 | <i>UR</i>   |
| <b>TBI EDGE</b>     | <i>NR</i>  | <i>LS</i>                | <i>LS</i>                | <i>LS</i>                 | <i>LS</i>   |

Recommendations for use based on ambulatory status after brain injury:

|                 | Completely Independent | Mildly dependant | Moderately Dependant |
|-----------------|------------------------|------------------|----------------------|
| <b>TBI EDGE</b> | <i>N/A</i>             | <i>N/A</i>       | <i>N/A</i>           |

Recommendations based on EDSS Classification:

|                | EDSS 0.0 – 3.5 | EDSS 4.0 – 5.5 | EDSS 6.0 – 7.5 |
|----------------|----------------|----------------|----------------|
| <b>MS EDGE</b> | <i>R</i>       | <i>R</i>       | <i>R</i>       |

Recommendations for entry-level physical therapy education and use in research:

|                     | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|---------------------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| <b>MS EDGE</b>      | <i>No</i>                                            | <i>Yes</i>                                | <i>Yes</i>                                                  | <i>No</i>                                            |
| <b>StrokEDGE II</b> | <i>No</i>                                            | <i>No</i>                                 | <i>Yes</i>                                                  | <i>Not reported</i>                                  |
| <b>TBI EDGE</b>     | <i>No</i>                                            | <i>No</i>                                 | <i>No</i>                                                   | <i>Not reported</i>                                  |

#### Considerations

- The MFIS is a shortened modification of the Fatigue Impact Scale, designed as a self-report measure to rate fatigue in Multiple Sclerosis.
- The MFIS cannot be used to generate a single overall score of fatigue. The conceptual interaction between the two dimensions remains unclear, which poses problems when interpreting change scores in these individual scales. Studies in which a global MFIS score was used as either an outcome measure or selection tool may need to be re-evaluated (Mills et al., 2010).

Do you see an error or have a suggestion for this instrument summary? Please [e-mail us!](#)

#### Bibliography

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|                          |          |
|--------------------------|----------|
| Year published           |          |
| Instrument in PDF Format | Yes      |
| Approval Status          | Approved |

## 17. REHAB MEASURES DATABASE—MODIFIED RANKIN HANDICAP SCALE

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | <a href="#">Measure available at Strokecenter.org (external link)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Title of Assessment    | Modified Rankin Handicap Scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Acronym                | mRS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Instrument Reviewer(s) | Maggie Bland, PT, DPT, NCS and Nancy Byl, PT, MPH, PhD, FAPTA and the StrokEdge II Task Force of the Academy of Neurologic Physical Therapy - a component of APTA updated the review in 2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Summary Date           | April 2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Purpose                | Categorizes level of functional independence with reference to pre-stroke activities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Description            | <ul style="list-style-type: none"> <li>• A single-item global outcomes rating scale</li> <li>• Assessment is carried out by asking the patient about their activities of daily living, including outdoor activities</li> <li>• Information about the patient's neurological deficits on examination, including aphasia and intellectual deficits, should be obtained</li> <li>• All aspects of the patient's physical, mental performance, and speech should be combined in the single MRS score</li> <li>• One MRS grade should be assigned based on the following criteria (Dromerick, Edwards, &amp; Diringer, 2003):</li> </ul> <ol style="list-style-type: none"> <li>0. No symptoms</li> <li>1. No significant disability despite symptoms; able to carry out all usual duties and activities</li> <li>2. Slight disability: unable to carry out all previous activities but able to look after own affairs without assistance</li> <li>3. Moderate disability: requiring some help, but able to walk without assistance</li> <li>4. Moderately severe disability: unable to walk without assistance, and unable to attend to own bodily needs without assistance</li> <li>5. Severe disability: bedridden, incontinent, and requiring constant nursing care and attention</li> </ol> |

|                                                  |                                                                                                                             |              |                                 |               |                         |                           |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------|---------------|-------------------------|---------------------------|
| Area of Assessment                               | Activities of Daily Living; Functional Mobility                                                                             |              |                                 |               |                         |                           |
| Body Part                                        | Not Applicable                                                                                                              |              |                                 |               |                         |                           |
| ICF Domain                                       | Activity                                                                                                                    |              |                                 |               |                         |                           |
| Domain                                           | ADL; Motor                                                                                                                  |              |                                 |               |                         |                           |
| Assessment Type                                  | Patient Reported Outcomes (self report or interview)                                                                        |              |                                 |               |                         |                           |
| Length of Test                                   | 06 to 30 Minutes                                                                                                            |              |                                 |               |                         |                           |
| Time to Administer                               | 5-15 minutes                                                                                                                |              |                                 |               |                         |                           |
| Number of Items                                  | 1                                                                                                                           |              |                                 |               |                         |                           |
| Equipment Required                               | None necessary                                                                                                              |              |                                 |               |                         |                           |
| Training Required                                | None necessary                                                                                                              |              |                                 |               |                         |                           |
| Type of training required                        | No Training                                                                                                                 |              |                                 |               |                         |                           |
| Cost                                             | Free                                                                                                                        |              |                                 |               |                         |                           |
| Actual Cost                                      | Free                                                                                                                        |              |                                 |               |                         |                           |
| Age Range                                        | Adult: 18-64 years; Elderly adult: 65+                                                                                      |              |                                 |               |                         |                           |
| Administration Mode                              | Paper/Pencil                                                                                                                |              |                                 |               |                         |                           |
| Diagnosis                                        | Stroke                                                                                                                      |              |                                 |               |                         |                           |
| Populations Tested                               | Stroke                                                                                                                      |              |                                 |               |                         |                           |
| Standard Error of Measurement (SEM)              | Not Established                                                                                                             |              |                                 |               |                         |                           |
| Minimal Detectable Change (MDC)                  | Not Established                                                                                                             |              |                                 |               |                         |                           |
| Minimally Clinically Important Difference (MCID) | Not Established                                                                                                             |              |                                 |               |                         |                           |
| Cut-Off Scores                                   | Not Established                                                                                                             |              |                                 |               |                         |                           |
| Normative Data                                   | <b><u>Acute Stroke:</u></b> (Table from Dromerick et al, 2003; <i>n</i> = 95, length of rehabilitation was 19.5 (8.3) days) |              |                                 |               |                         |                           |
|                                                  | Measure                                                                                                                     | Mean Change* | Percent of Subjects Changed (%) | Median Change | Floor Effect, Admission | Ceiling Effect, Discharge |

|             |             |     |                  |           |          |
|-------------|-------------|-----|------------------|-----------|----------|
| <b>MRS</b>  | -           | 47  | 1 level (0-2)    | 17 (18%)  | 0 (0%)   |
| <b>ISTM</b> | -           | 24  | 0 level (0-1)    | 95 (100%) | 0 (0%)   |
| <b>BI</b>   | 28 ± 16.2   | 100 | 30 points (0-70) | 5 (5%)    | 26 (27%) |
| <b>FIM</b>  | 23.2 ± 10.6 | 100 | 22 points (4-55) | 0 (0%)    | 0 (0%)   |

\*Data are mean ± standard deviation. Percent of subjects with a change of score. Data are medians with ranges in parentheses.

BI = Barthel Index  
FIM = Functional Independence Measure  
ISTM = International Stroke Trial Measure  
MRS = Modified Rankin Scale

#### Test-retest Reliability

##### **Acute Stroke:** (Wolfe et al, 1991)

- **Excellent** test-retest reliability (Kappa w = 0.95)

##### **Post-Stroke- 6 months:** (Wilson et al, 2005)

- **Excellent** test-retest reliability  
(Rater 1: Kappa = 0.81; 0.94 and  
Rater 2: Kappa = 0.95; 0.99)

#### Interrater / Intrarater Reliability

##### **Acute Stroke:**

(Wolfe et al, 1991)

- **Excellent** intra-rater reliability (Kappa w = 0.95)
- **Excellent** inter-rater reliability (Kappa range 0.75 - 0.96)

(van Swieten et al, 1988):

- **Excellent** inter-rater reliability (Kappa = 0.82, out-patient)
- **Adequate** inter-rater reliability (Kappa = 0.51, in-patient)

(Wilson et al, 2002, 2005):

**Excellent** inter-rater reliability (Kappa = 0.78)

(Shinohara et al, 2006)

- **Excellent** inter-rater reliability (ICC = 0.95 neurologists; 0.96 nurses)

(Quinn et al, 2008))

- **Adequate** inter-rater reliability (Kappa = 0.67, overall)

(Quinn et al, 2010)

- The longer the interview, the more variability in rater consistency
- With focused assessment, patients struggle to answer categorically leaving room for rater interpretation
- Further study of reliability is needed on the modified, *simplified* modified Rankin score and the standard mRS

(Bruno et al 2010; 50 patients post stroke having treatment in an outpatient setting were rated with the simplified mRS (smRS) (yes/no questions) by 9 mRS web-certified raters with repeat testing within 20 minutes of the first rating )

- **Excellent** test re-test reliability of the simplified mRS questionnaire with a non-structured interview (smRS) had a k statistic of 0.72 (CI<sub>95</sub> 0.58-0.85) with 78% agreement between raters (compared to previous research on the mRS with a structured interview with **adequate** reliability  $r=0.62$  with 73% agreement)( Quinn et al, 2009;Cincura et al, 2009, Shinohara et al, 2006)
- Administration time was 1.67 minutes( less time than the structured interview format for the mRS (@15 minutes)

(Ghandehari, K., et al. 2012) Five raters administered the Asian Stroke Disability Scale (ASDS) and compared it to the interrater reliability of the modified Rankin Scale (mRS) for 25 subjects post stroke (65.5 years of age, 56% males).

- The difference in scores between the raters on the ASDS and the mRS were not significant (  $F = 1.061$ ,  $p=0.379$ )The Interrater variability for the mRS did not differ significantly( $X^2 = 1.758$ ,  $p = 0.780$ ).. The paired interrater variability of the mRS did also not vary significantly ( $X^2 = 0.553$ ,  $p = 1.000$ )

(Fearon, et al 2012; Bruno et al 2012)

- In a study of 74 stroke survivors (median age = 72 years [IQR = 62-79]; median time since stroke = 5 days [IQR = 3-0]), prestroke measures of the mRS and the standard mRS with interview had only **adequate** inter rater reliability (pw= 0.55; with 55% agreement and pw=0.70 with 70% agreement respectively) (Fearon et al, 2012)
- The mRS cannot be used as a prestroke measure. It must only be used as a post stroke measure because some of the items cannot be scored as 0, 1 or 2 because the patient needs to compare post stroke function with pre stroke function; thus before the first stroke, there are no stroke symptoms. (Bruno et al letter, 2012)

(Bruno et al 2011) With 50 consecutive outpatients 4.83 ( $\pm$ 3.00) months post stroke, 9 paired raters administered the msRSq by a standard interview twice (one 20 minutes after the first) and then repeated test administration over the telephone 1-3 days later .

- The average estimated time to administer the smRSq in person was 1.29 minutes (range, 0.50 to 2.25 minutes).
- The In-person raters agreed 78% of the time ( $k = 0.71$ ; CI, 0.57 to 0.86 with weighted  $K_w = 0.86$ ; CI, 0.79 to 0.94).
- The first in-person and telephone raters agreed 82% ( $k = 0.76$ ; CI, 0.63 to 0.90 and  $K_w = 0.87$ ; CI, 0.79 to 0.95).
- The second in-person and telephone raters agreed 82% ( $k = 0.77$ ; CI, 0.63 to 0.90 and  $K_w = 0.89$ ; CI, 0.82 to 0.96).

(Zhao, et al, 2010) 56 participants, mean age = 71 years old ( $\pm$  13.6), less than 4 days post-stroke were administered the mRS by three trained rater groups (experienced (Exp), inexperienced (Inexp), and inexperienced with a decision tool (Inexp+DT).

- **Adequate** reliability was found across all groups (ICC = 0.675, 95% CI = 0.559-0.791)

- **Adequate** reliability was found between each of the groups
  - o Exp vs. Inexp ( $K_w = 0.686$ , 95% CI = 0.541-0.819,  $p = 0.032$ )
  - o Exp vs. Inexp+DT ( $K_w = 0.568$ , 95% CI = 0.359-0.724,  $p = 0.553$ )
  - o Inexp vs. Inexp+DT ( $K_w = 0.736$ , 95% CI = 0.557-0.859,  $p = 0.121$ )

#### **Sub-Acute Stroke:**

(Saver, 2010) n = 50 patients, average 71.5 years old (range 43-93).

Participants received the Rankin Focused Assessment to derive the mRS (administered by two coordinators) at their 90 day assessment as part of the Phase III National Institutes of Health Field Administration of Stroke Therapy-Magnesium Trial.

- Among all participants the percent agreement was 94% ( $K_w = 0.99$ , 95% CI = 0.99-1.00;  $K = 0.93$ , 95% CI = 0.85-1.00). Among the 43 participants living at the 90 day assessments the percent agreement was 93% ( $K_w = 0.99$ , 95% CI = 0.98-1.0,  $K_w = 0.91$ , 95% CI 0.82-1.00)

**Telephone Administration:** (Janssen, 2010; Dennis, 2011)

#### **Acute**

(Dennis, 2012) compared two postal versions of the mRS: one with a tick box for the five descriptions, the other was the simplified modified Rankin questionnaire (smRSq) that has yes/no responses and derives the mRS score. Both were followed-up with a telephone interview using the Rankin Focused Assessment

- **Adequate** reliability ( $Kappa = 0.44$ ,  $Kappa w = 0.68$ ) between the two postal versions of the mRS
- **Adequate** reliability ( $Kappa = 0.47$ ,  $Kappa w = 0.66$ ) between the tick box version of the mRS and the telephone interview
- **Adequate** reliability ( $Kappa = 0.55$ ,  $Kappa w = 0.73$ ) between the smRSq and the telephone interview

(Savio et al 2013) 131 patients post stroke were interviewed by 2 certified

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                              | <p>nurses. Half of the patients were randomized to be interviewed by telephone followed by face to face assessment and half the reverse order.</p> <ul style="list-style-type: none"> <li>Telephone assessment of stroke disability with the modified Rankin Scale is similar in reliability in comparison to direct face to-face assessment.</li> <li>The median value of the modified Rankin Scale score was 4 (IQR 3-5) by telephone as well as by face-to-face assessment (<math>p = 0.8</math>).</li> <li><b>Excellent</b> reliability between the two methods was <math>K_w = 0.82</math> (CI <math>_{95}:0.77-0.88</math>).</li> <li>Sensitivity of the telephone assessment was lower for scores 2 and 3 (17% and 46%, respectively) than for scores 4-5 (range 67-90%).</li> </ul> <p><b>Subacute</b></p> <p>(Janssen, 2010) compared mRS scores for 83 participants a median of 5 months post-stroke comparing administration face to face to over the telephone.</p> <ul style="list-style-type: none"> <li><b>Adequate</b> reliability (Kappa = 0.41, 95% CI 0.26-0.55; Kappa weighted = 0.71, 95% CI 0.59-0.82).</li> <li></li> </ul> |
| Internal Consistency                         | Not established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Criterion Validity (Predictive / Concurrent) | <p>Predictive Validity</p> <p>(Bruno et al, 2013) Forty subjects, documented in severity with the National Institutes of Health Stroke Scale (NIHSS) post treatment with intravenous tissue plasminogen activator in the ER Department were followed up to assess functional outcomes using the simplified Modified Rankin Scale (smRSq) . The participants averaged 69 years of age (<math>\pm 14</math>), represented 45% males, had an average initial NIHSS score of 10 and were, on average, 3-7 months post stroke.</p> <ul style="list-style-type: none"> <li>Median follow up score on the smRSq was 3 (IQR = 1-6).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

- The correlation of the NIHSS and the smRSq had an excellent and significant correlation ( $r=0.69$ ;  $p<0001$ ).
- The smRSq is simple and brief and can be administered over the phone and still preserve validity

(Fearon et al, 2012)

- In a data set of 231 stroke survivors, the prestroke mRS and the Rockwood Frailty Index had a correlation of 0.82 (CI<sub>95</sub> 0.78-0.86) and 0.50 (CI<sub>95</sub> 0.40-0.59) for the Charlson comorbidity index
- There was no association between the prestroke mRS and need for caregivers (correlation = 0.10)

(Bruno et al 2011)

- In a sample of patients receiving rehabilitation in an outpatient setting approximately 5 years post stroke, the smRSq correlated adequately with the physical component of the SF Short Form 12 ( $r=0.50$ ,  $P<0.005$ ) and the mental component ( $r=0.36$ ,  $P<0.048$ ).

(Gorelick et al, 2012)

This review of randomized clinical trials of stroke intravenous thrombolytic studies (rt-PA) was carried out to determine the relationships between baseline stroke severity associated with efficacy (based on functional outcomes of the NIH Stroke Scale [NIHSS] and the modified Rankin Scale [mRS] and safety.

Summary of Findings Acute Post Stroke (5 major RCT's)

| Variable              | Outcome                                                                       |
|-----------------------|-------------------------------------------------------------------------------|
| t-PA treatment        | Better outcomes                                                               |
| Age x NIHSS           | Higher age , worse NIHSS outcomes<br>Maintained outcomes for young (OR =1.42) |
| mRS score at 3 months | Better outcomes than no t-PA                                                  |

|                        |                                               |
|------------------------|-----------------------------------------------|
| History of diabetes    | Worse outcomes                                |
| Age x admission        | Higher age and MAP; better outcomes           |
| Mean Arterial Pressure | Better outcomes                               |
| Early CT Findings      | Worse outcomes                                |
| Female                 | Better outcomes                               |
| Very elderly           | Maintained outcomes: (Very elderly, OR =1.34) |

(Bruno et al, 2013)

Thirty two of 60 subjects post stroke enrolled in a reliability study met the criteria to participate in the current study (mean age 59.6 years ( $\pm$  15), 53% men) to correlate stroke size (acute ischemic stroke) with smRSq scores. The patients had either computed tomography or magnetic resonance imaging to confirm an ischemic stroke and were scored on the smRSq at least 3 months post stroke. Stroke volume was computed and strokes were classified into 2 size categories: *lacunar type* measuring  $\leq 6.28 \text{ cm}^3$ , which corresponds to a cylinder with a maximum diameter and height of 2.00 cm, *or strokes*  $>6.28 \text{ cm}^3$ . The Spearman correlation analysis compared the smRSq between the lacunar type and the larger strokes.

- Acute stroke size correlated well with the smRSq supporting the validity of the smRSq for assessing functional outcomes after stroke
  - Lacunar stroke volumes (n = 17) ranged from 0.03 to 4.58  $\text{cm}^3$ , and the larger stroke volumes (n =15) ranged from 11.52 to 250.02  $\text{cm}^3$ .
  - Lacunar strokes were associated with lower smRSq scores (median 1) compared to the larger strokes (median 4) ‘
  - There was an adequate correlation of stroke size with the smRSq score (r=0.68; P<0.001)

- (Tilson et al, 2010; n =283; mean age 63. 5 ( $\pm$  12.5) years; assessed patients approximately 20 and 60 days post-stroke); data is from the Locomotor Experience Applied Post Stroke study, and the mRS was used as the anchor for determining the minimally clinically important difference. A poor, but substantial relationship was found between the mRS and comfortable gait speed
- The area under the curve was calculated as 0.69 (95% CI = 0.63-0.75).

#### Concurrent Validity

##### **Acute Stroke:**

(Cup et al 2003; n = 26; mean age 68 (15) years):

- **Excellent** concurrent validity with:  
Barthel Index ( $r = - 0.81$ )  
Frenchay Activities Index ( $r = - 0.80$ )  
EQ-56 ( $r = 0.68$ )
- **Adequate** concurrent validity with:  
SA-SIP-30 ( $r = 0.47$ )

(Kwon et al, 2004, n = 459; mean age = 70 (11.4) years):

##### **Excellent** concurrent validity with:

Barthel Index ( $r = - 0.89$ )  
FIM-motor dimension ( $r = - 0.89$ )

(Weimer et al 2004, n = 4246; mean age = 67.1 (69) years):

- **Excellent** concurrent validity with:
  - SF-36 Physical Function ( $r = 0.84$ )
  - Barthel Index ( $r = 0.82$ )

(Liotta et al, 2013, to determine readmission of patients with ICF as measured by the Rankin Scale ( mRS) at 14 days, 28 days and 3 months post stroke)

Retrospective evaluation of 246 patients readmitted 30 days following treatment of acute intracranial hemorrhage on the ICU. Of 246 patients with a mean age of 65 years:

- 78% survived discharge. Of these, 22 (11%) were re-admitted 4-15 days post ICU discharge.
- The most common reason for readmission was infection (n = 10) and vascular event (n = 6)
- Readmitted patients had similar mRS scores to those not readmitted at 14 days (median 4 [IQR = 4-5], median 5 [IQR = 4-5], respectively), but those who were readmitted had higher mRS scores at three months post stroke (median 5 [IQR = 3-6] for those readmitted and 3 [IQR = 1-4] for those not readmitted.

(Kerr et al, 2012)

Within the Virtual International Stroke Trials Archive, the rt-PA-treated patients were compared to the non rt-PA treated patients (10,000 samples). The end points of the mRS at 30 and 90 days and NIHSS at 7 and 90 days post stroke were studied.

- The smallest sample sizes to generate statistical power greater than 80 % were 620 and 480 respectively for the mRS and 370 and 420 respectively for the NIHSS
- The 7 day NIHSS was the most sensitive outcome measurement to detect differences in the rt-PA treated patients.

(Ali, 2013; n = 3787 with complete data available, n = 3872 Stroke Impact Scale data available at 3 months; mean age for those self-reporting 68 (58-76) years and those requiring proxy 75 (66-80). Authors examined outcomes data from the Virtual International Stroke Trials Archive.

- Excellent concurrent validity of the mRS at three months post-stroke with the European Quality of Life Scale-5D (EQ-5D) Weighted Scores (-0.75,  $p < 0.0001$ ), the EQ-5D Visual Analog Scale (-0.64,  $p < 0.0001$ ), Stroke Impact Scale Recovery (-0.73,  $p < 0.0001$ ), and Stroke Impact Scale-16 (-0.083,  $p < 0.0001$ ).
- The mRS was used to examine the proportion of patients classified as having a good primary outcome (mRS  $\leq 1$ ), but a poorer quality of life and was found to be superior.

### **Subacute Stroke**

(Goldie, 2014; n= 12, 370, mean age of 69.5 years old (range = 18-130), from a systematic search and review across 11 studies.

Coefficients reported from assessments completed at 90 days post-stroke.

- The mRS explained 80.8% (p = 0.000) of the variance in the National Institutes of Health Stroke Scale (NIHSS), 87.6% (p = 0.000) of the variance in the Barthel Index (BI), 83.0% (p = 0.000) of the variance in the Stroke Impact Scale-16 (SIS-16), and 76.9% (p = 0.000) of the variance in the Scandanavian Stroke Scale(SSS) at 90 days post-stroke.
- Once the Baseline age and NIHSS were adjusted for, the mRS explained 56.6% (p < 0.001) of the variance in the NIHSS, 75.2% (p < 0.001) of the variance in the BI, and 80.5% (p < 0.001) of the variance in the SIS-16 at 90 days post-stroke.

### **Close Head Injury**

(Schaefer et al, 2004)

- **Excellent** concurrent validity with:
  - Signal-intensity abnormal volume on diffusion weighted images (r = 0.77)
  - Number of lesions on images (r = 0.66)
- **Adequate** concurrent validity with:
  - Lesion location in the corpus callosum (r = 0.51)

**Construct Validity  
(Convergent / Discriminant  
;**

### **Stroke**

Berzina, 2015; n= 266, Median age = 65 years old (IQR = 57.5-77), Median time post-stroke = 8 months (IQR = 1-12), participants were interviewed with the Comprehensive International Classification of Functioning, Disabilities, and Health (ICF) Core Stroke Set, and then this information was used to score the mRS and mRS-Systematic Interview (mRS-SI).

- **Poor to Adequate** significant correlations were found between the mRS and the sum of problems in 'Body Function' (0.59, p < 0.001), 'Body Structures' (0.23, p < 0.001), and 'Activities and Participation' (0.69, p < 0.001) of the ICF.
- Authors found that the mRS is mostly associated with problems under "Activities and Participation," specifically "Self-Care" and 'Walking.'

Owolabi, 2010; n= 100, mean age = 58.9 (± 10.7) at least one month post-stroke were administered the mRS, the health-related quality of life for stroke patients (HRQOLISP) and the SF-36.

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | <ul style="list-style-type: none"> <li>The physical domains of the HRQOLISP were found to differ among the mRS strata (<math>p &lt; 0.006</math>), however the domains of the spiritual dimension did not (<math>0.217 \leq p \leq 0.906</math>).</li> <li>All SF-36 subscales differed among mRS strata (<math>p \leq 0.023</math>)</li> </ul> <p>Golicki, 2015; <math>n = 408</math>, mean age = <math>69.0 (\pm 12.9)</math>, median time post-stroke 8 days; participants completed the mRS, EuroQol-5 dimensions- 5 levels of severity (EQ-5D-5L), the EuroQol-5 dimensions- 3 levels of severity (EQ-5D-3L) as well as additional measures.</p> <ul style="list-style-type: none"> <li><b>Adequate to Excellent</b> convergent validity was found between the mRS and the dimensions of the EQ-5D-5L (0.42-0.79) and the EQ-5D-3L (0.36-0.78)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                   |
| Content Validity        | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Face Validity           | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Floor / Ceiling Effects | <p><b>Acute Stroke:</b> (Dromerick et al, 2003)</p> <ul style="list-style-type: none"> <li><b>Adequate</b> Floor Effect in 18% of stroke sample at admission to rehabilitation (see normative data for more information).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Responsiveness          | <p><b>Acute Stroke:</b> (Dromerick et al, 2003)</p> <ul style="list-style-type: none"> <li><b>Poor</b> at detecting change compared to the FIM (<math>C = 0.59</math>)*</li> </ul> <p>*see normative data for more information</p> <p>(Batcho, C.S., et al. 2014)</p> <p>68 subjects participated in a 2 month longitudinal study to evaluate responsiveness of patients receiving early versus late intervention post stroke.</p> <ul style="list-style-type: none"> <li>Across subject groups, there was a change of 1 point on the mRS from before to after therapy (<math>p &lt; 0.001</math>)</li> <li>There were no significant changes in the mRS scores (mean score of 2 (with range of 2-3.5 pre and post; <math>p = 0.99</math>) in patients who had delayed intervention post stroke ( mean 10.3 months [<math>\pm 7.7</math> months])</li> <li>There was a significant one point change in the mRS score (<math>P &lt; 0.001</math>) for the patients who received early intervention post stroke (average at 2.01 months [<math>\pm 2.6</math> month])</li> <li>There was a significant, <b>adequate</b> positive correlation (<math>p = 0.64</math>; <math>p &lt; 0.001</math>) between the pre-post test change scores</li> </ul> |

## Professional Association Recommendations

on the mRS and the ACTIVLIM-Stroke Score ( a 20 item self reported Rasch built questionnaire that measures the ability of stroke patients to perform daily living activities).

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StroKEDGE, StroKEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

### Abbreviations:

|                |                                                                              |
|----------------|------------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                             |
| <b>R</b>       | Recommend                                                                    |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group.<br>Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                              |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute<br/>(CVA &lt; 2 months<br/>post)<br/>(SCI &lt; 1 month<br/>post)<br/>(Vestibular &lt; 6<br/>weeks post)</b> | <b>Subacute<br/>(CVA 2 to 6<br/>months)<br/>(SCI 3 to 6<br/>months)</b> | <b>Chronic<br/>(&gt; 6 months)</b> |
|---------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------|
| <b>StroKEDGE II</b> | <i>R</i>                                                                                                             | <i>R</i>                                                                | <i>R</i>                           |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute<br/>Care</b> | <b>Inpatient<br/>Rehabilita-<br/>tion</b> | <b>Skilled<br/>Nursing<br/>Facility</b> | <b>Outpatient<br/>Rehabilita-<br/>tion</b> | <b>Home<br/>Health</b> |
|---------------------|-----------------------|-------------------------------------------|-----------------------------------------|--------------------------------------------|------------------------|
| <b>StroKEDGE II</b> | <i>R</i>              | <i>R</i>                                  | <i>R</i>                                | <i>R</i>                                   | <i>R</i>               |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|---------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>StrokEDGE II</b> | No                                                          | Yes                                              | Yes                                                                | <i>Not reported</i>                                         |

#### Considerations

The categories within the MRS have been criticized as being broad and poorly defined, left open to the interpretation of the individual rater (Wilson et al, 2002).

Bruno, A., Switzer, J.A. (2013 Letter to Editor), The authors reinforce that the mRS is not designed to determine pre-stroke ability. More research is needed to further examine the new mRS instruments or in evaluating other clinometric assessments for use in determining function pre-stroke.

Dromerick, Edwards, and Diringier (2003) administered the MRS to 95 stroke rehabilitation inpatients and reported that the MRS displayed an adequate floor effect (18%) at admission to rehabilitation.

Harrison, et al. 2013 reviewed the clinometric properties of several stroke assessments. They noted that care should be taken with respect to validity and reliability when the mRS is administered by proxy or used to determine pre-stroke scores.

Rivero-Arias, et.al. (2010; n = 1283 stroke and TIA patients) examined the association between the mRS and EuroQol (EQ-5D) tariff values and the mRS and EQ-5D question responses. Patients were followed up at 1,6,12, and 24 months post. For the ordinary least squares regression model  $R^2 = 0.4503$ , suggesting 45% of the variability in the EQ-5D tariff was explained by the mRS scores and the Pseudo- $R^2$  for the multiple regression model range from 0.0667-0.4061

Tilson, et al. (2010) found a significant shift of mRS category (meaningful improvement defined as  $\geq 1$  improvement of mRS scores) between days 20 and 60 post-stroke for participants in the Locomotor Experience Applied Post Stroke study.

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | <p>Do you see an error or have a suggestion for this instrument summary? Please <a href="#">e-mail us!</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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|                          |          |
|--------------------------|----------|
| Year published           | 1957     |
| Instrument in PDF Format | Yes      |
| Approval Status          | Approved |



## 18. REHAB MEASURES: MOTOR ACTIVITY LOG

|                               |                                                                                                                                                                                                                                  |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     |                                                                                                                                                                                                                                  |
| <b>Title of Assessment</b>    | Motor Activity Log                                                                                                                                                                                                               |
| <b>Acronym</b>                | MAL                                                                                                                                                                                                                              |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Jane Sullivan, PT in 2013. Updated by Maggie Bland PT,DPT,NCS and Nancy Byl PT,MPH,PhD, FAPTA and the StrokEDGE II task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2016. |
| <b>Summary Date</b>           | 7/24/2014; 3/2016                                                                                                                                                                                                                |
| <b>Purpose</b>                | Semi-structured interview to assess arm function.                                                                                                                                                                                |

## Description

Individuals are asked to rate Quality of Movement (QOM) and Amount of Movement (AOM) during 30 daily functional tasks (original MAL), 28 functional tasks (MAL 28) or 14 tasks (MAL 14). Target tasks include object manipulation (e.g. pen, fork, comb, and cup) as well as the use of the arm during gross motor activities (e.g. transferring to a car, steadying oneself during standing, pulling a chair into a table while sitting).

Items scored on a 6-point ordinal scale.

### Scoring on Amount of Use Scale:

0. The weaker arm was not used at all for that activity (never)
1. Occasionally used weaker arm, but only very rarely (very rarely)
2. Sometimes used weaker arm but did the activity most of the time with stronger arm (rarely)
3. Used weaker arm about half as much as before the stroke (half pre-stroke)
4. Used weaker arm almost as much as before the stroke (3/4 pre-stroke)
5. The ability to use the weaker arm for that activity was as good as before the stroke (normal)

### Scoring on Quality of Movement Scale:

0. The weaker arm was not used at all for that activity (never)
1. The weaker arm was moved during that activity but was not helpful (very poor)
2. The weaker arm was of some use during the activity but needed help from the stronger arm or moved very slowly or with difficulty (poor)
3. The weaker arm was used for the purpose indicated but movements were slow or were made with only some effort (fair)
4. The movements made by the weaker arm were almost normal, but were not quite as fast or accurate as normal (almost normal)
5. The ability to use the weaker arm for that activity was as good as before the stroke (normal)

## Area of Assessment

|                                            |                                                                                                                                                                                                                       |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Body Part</b>                           | Upper extremity                                                                                                                                                                                                       |
| <b>ICF Domain</b>                          | Participation                                                                                                                                                                                                         |
| <b>Domain</b>                              | Activity                                                                                                                                                                                                              |
| <b>Assessment Type</b>                     | Patient Reported Outcomes                                                                                                                                                                                             |
| <b>Length of Test</b>                      | 06 to 30 Minutes                                                                                                                                                                                                      |
| <b>Time to Administer</b>                  | Approximately 20 minutes                                                                                                                                                                                              |
| <b>Number of Items</b>                     | 30, 28 or 14                                                                                                                                                                                                          |
| <b>Equipment Required</b>                  | Survey Instrument                                                                                                                                                                                                     |
| <b>Training Required</b>                   | Students should be aware of this as an example of self-report arm function measure. This measure is often used in outcome studies of arm intervention most commonly for patients post stroke.                         |
| <b>Type of training required</b>           | Reading an Article/Manual                                                                                                                                                                                             |
| <b>Cost</b>                                | Free                                                                                                                                                                                                                  |
| <b>Actual Cost</b>                         | Free                                                                                                                                                                                                                  |
| <b>Age Range</b>                           | Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                |
| <b>Administration Mode</b>                 | Paper/Pencil                                                                                                                                                                                                          |
| <b>Diagnosis</b>                           | Stroke; Head injury with hemiparesis                                                                                                                                                                                  |
| <b>Populations Tested</b>                  | Stroke                                                                                                                                                                                                                |
| <b>Standard Error of Measurement (SEM)</b> | Not Established                                                                                                                                                                                                       |
| <b>Minimal Detectable Change (MDC)</b>     | <p>(Simpson, 2015; systematic review of articles for patients post stroke)<sup>4</sup></p> <ul style="list-style-type: none"> <li>• MDC<sub>90</sub> = 0.56- 1.06</li> <li>• MDC<sub>95</sub> = 0.67- 1.27</li> </ul> |

|                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Minimally Clinically Important Difference (MCID; Responsiveness Ratio)</b> | <p><b><u>Stroke:</u></b><br/>(Simpson, 2015)<sup>4</sup></p> <ul style="list-style-type: none"> <li>• MCID = 1.0-1.1</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Cut-Off Scores</b>                                                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Normative Data</b>                                                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Test-retest Reliability</b>                                                | <p><b><u>Stroke:</u></b><br/>(Van der Lee JH et al, 2004<sup>3</sup>; <math>n = 56</math> chronic stroke patients)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> test retest reliability for MAL AOU (<math>r = 0.70</math> to <math>0.85</math>)</li> <li>• <b>Excellent</b> test retest reliability for MAL QOM (<math>r = 0.61</math> to <math>0.71</math>)</li> </ul> <p>(Uswatte G et al, 2006<sup>1</sup>; <math>n = 41</math> chronic stroke patients complete MALs before and after CI therapy or a placebo control; <math>n = 27</math> in second study for chronic stroke patients who complete MALs and wore accelerometers that monitored their arm movements for 3 days outside the laboratory before and after an automated form of CI therapy)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> test retest reliability for MAL 14 QOM (<math>r &gt; 0.91</math>)</li> <li>• Participant AOU and caregiver QOM and AOU scales were not reliable</li> </ul> |
| <b>Interrater/ Intrarater Reliability</b>                                     | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Internal Consistency</b>                                                   | <p><b><u>Stroke:</u></b><br/>(Van der Lee JH et al, 2004)<sup>3</sup></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> internal consistency for AOU (<math>\alpha = 0.88</math>)</li> <li>• <b>Excellent</b> internal consistency for AOU (<math>\alpha = 0.91</math>)</li> <li>• Limits of agreement for AOU and QOM (<math>r = -0.70</math> to <math>0.85</math> and <math>0.61</math> to <math>0.71</math>)</li> </ul> <p>(Uswatte G et al, 2006)<sup>1</sup></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> internal consistency of the MAL 14 (<math>\alpha &gt; 0.81</math>)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                              |

## Criterion Validity (Predictive/Concurrent)

### Stroke:

Note: concurrent validity is reported as a correlation which is interpreted in terms of strength. Squaring the correlation value tells you how much of the variance in the test 2 score can be explained by the score on test 1.

(Uswatte G et al, 2005)<sup>2</sup>

- **Excellent** concurrent correlation between QOM (MAL 28) and Stroke Impact Scale Hand Function scores ( $r = 0.72$ )
- **Adequate** concurrent correlation between QOM (MAL 28) and accelerometry ( $r = 0.52$ ) (Van Der Lee JH et al, 2004)<sup>3</sup>
- **Excellent** concurrent correlation between the Action Research Arm Test and MAL 28 ( $r = 0.63$ )

(Uswatte G et al, 2005<sup>2</sup>;  $n = 106$  post stroke patients with mild to moderate paresis of upper extremity who took MAL before and after treatment;  $n = 116$  took MAL an equivalent no-treatment period)

- **Excellent** concurrent correlation between the participant QOM scale (MAL 14) and caregiver COM scale ( $r = 0.70$ )
- **Excellent** concurrent correlation between the participant QOM scale (MAL 14) and caregiver MAL amount of use (AOU) scale ( $r = 0.73$ )
- **Excellent** concurrent correlation between participant QOM scale (MAL 14) and accelerometer recordings ( $r = 0.91$ )

(Hammer AM, Lindmark B, 2010<sup>5</sup>;  $n=30$  subacute patients post-stroke underwent CIMT training)

- **Poor to Adequate** concurrent correlations of the MAL (30) AOU and QOM scales (MAL 30) compared to the FMA-UE, ARAT, MAS-UE and Grippit ratio for 30 subjects 1-6 months post-stroke., explaining minimal variance:

|                   | MAL AOU   |                | MAL QOM   |                |
|-------------------|-----------|----------------|-----------|----------------|
|                   | Rho       | R <sup>2</sup> | Rho       | R <sup>2</sup> |
| Pre-Intervention  | 0.50-0.53 | 0.25-0.28      | 0.45-0.50 | 0.20-0.25      |
| Post-Intervention | 0.23-0.45 | 0.05-0.20      | 0.31-0.48 | 0.10-0.23      |

|                   |           |           |           |           |
|-------------------|-----------|-----------|-----------|-----------|
| 3 Month Follow-Up | 0.41-0.52 | 0.17-0.27 | 0.32-0.54 | 0.10-0.28 |
|-------------------|-----------|-----------|-----------|-----------|

- **Poor to Adequate** correlations of intervention *change* scores were seen with the MAL AOU (30) and MAL QOM (30) compared to FAM-UE, ARAT, MAS-UE, and Grippit ratio with most variance in change scores pre to 3 month post intervention. **Excellent** correlations at 3 months post intervention were seen between the MAL AOU (30) and the 16 Hole Peg Test, explaining 41% of the variance:

|                                        | MAL AOU   |                | MAL QOM   |                |
|----------------------------------------|-----------|----------------|-----------|----------------|
|                                        | Rho       | R <sup>2</sup> | Rho       | R <sup>2</sup> |
| FAM-UE, ARAT, MAS-UE, Grippit ratio    |           |                |           |                |
| During Intervention                    | 0.12-0.44 | 0.01-0.20      | 0.05-0.67 | 0.00-0.45      |
| Pre-intervention to- 3 Month follow-up | 0.26-0.53 | 0.07-0.28      | 0.17-0.43 | 0.03-0.18      |
| Sixteen hole peg test with MAL         |           |                |           |                |
| Pre-Intervention                       | -0.44     | 0.19           | -0.41     | 0.16           |
| Post-Intervention                      | -0.30     | 0.09           | -0.41     | 0.16           |
| 3 Month Follow-Up                      | -0.64     | 0.41           | -0.67     | 0.45           |

(Lin K, et al, 2010 <sup>6</sup>; n=59 chronic stroke patients (16.1±14.0 months) receiving either constraint induced therapy or bilateral arm training)

- **Poor to Adequate** correlations for concurrent validity were seen with the MAL AOU (30) and MAL OQM (30) with Box and Block Test, Nine Hole Peg Test, and Action Research Arm Test, explaining minimal variance.

|              |                  |                   |
|--------------|------------------|-------------------|
| MAL-AOU (30) | Pre-Intervention | Post-Intervention |
|--------------|------------------|-------------------|

|                  | Rho<br>(95% CI)        | R <sup>2</sup> | Rho<br>(95% CI)              | R <sup>2</sup> |
|------------------|------------------------|----------------|------------------------------|----------------|
| BBT              | 0.13-0.57<br>(0.37)    | 0.134          | 0.27-0.66<br>(0.49)          | 0.24           |
| NHPT             | -0.40-0.10 (-<br>0.16) | 0.03           | -0.46- 0.03<br>(-0.23)       | 0.05           |
| ARAT             | 0.06-0.52<br>(0.31)    | 0.10           | 0.07-0.53<br>(.0.32)         | 0.10           |
|                  |                        |                |                              |                |
| MAL-<br>QOM (30) | Pre-Intervention       |                | Post-Intervention            |                |
| BBT              | 0.31—0.68<br>(0.52)    | 0.27           | 0.31- 0.68<br>(0.52)         | 0.27           |
| NHPT             | -0.48-0.01)<br>(-0.26) | 0.07           | -0.54- -<br>0.08 (-<br>0.33) | 0.11           |
| ARAT             | 0.15- 0.59<br>(0.39)   | 0.15           | 0.10 -<br>0.56(0.35)         | 0.12           |

(Lin K, et al, 2010<sup>7</sup>; n= 74 chronic stroke patients (17.5±17.7 months post-stroke) who received either distributed constraint induced movement therapy, bilateral arm training, or conventional rehabilitation. This study measured criterion-related validity of the Stroke Impact Scale, SIS and Stroke-Specific Quality of Life Scale, SS-QOL)

- **Poor to Excellent** correlations (0.24-0.68) were seen across each SIS domains. The highest correlations between SIS Hand function (0.58-0.59 for MAL AOU and 0.65-0.68 for MAL QOM).
- **Poor to Adequate** correlations (0.25-0.39) between the MAL-AOU and MAL QOM with the SS-QOL for UE function, self-care, work/productivity, family roles, social roles, and mobility.

(Wu C, et al, 2011<sup>8</sup>; n= 70 chronic stroke patients (19.9±12.5 months post-stroke) received either distributed constraint induced movement therapy, bilateral arm training or control treatment for three weeks)

- **Poor to Adequate** concurrent validity.

|                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Pre-Intervention (95% CI)          |                           | Post-Intervention (95% CI)         |                           |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|---------------------------|------------------------------------|---------------------------|
|                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Modified Nottingham Extended Scale | Frenchay Activities Index | Modified Nottingham Extended Scale | Frenchay Activities Index |
|                                                      | MAL AOU (30)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.3 (0.1-0.5)                      | 0.3 (0.1-0.5)             | 0.3 (0.1-0.5)                      | 0.4 (0.2-0.6)             |
|                                                      | MAL QOL (3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.3 (0.1-0.5)                      | 0.3 (0.1-0.5)             | 0.2 (0-0.4)                        | 0.3 (0.1-0.5)             |
| <b>Construct Validity (Convergent/Discriminant )</b> | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |                           |                                    |                           |
| <b>Content Validity</b>                              | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |                           |                                    |                           |
| <b>Face Validity</b>                                 | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |                           |                                    |                           |
| <b>Floor/Ceiling Effects</b>                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |                           |                                    |                           |
| <b>Responsiveness ( MDC; effect size)</b>            | <p><b><u>Stroke:</u></b></p> <p>(Van Der Le JH et al, 2004)<sup>3</sup></p> <ul style="list-style-type: none"> <li>In individuals with subacute chronic stroke undergoing constraint induced movement therapy, improvement on the MAL during the intervention was only weakly related to a global change rating and to the improvement on the Action Research Arm Test (Spearman rho = 0.16 to 0.22; responsiveness ratio = 1.9 (AOU) and 2.0 (QOM))</li> </ul> <p>(Unswatte G et al, 2005)<sup>2</sup></p> <ul style="list-style-type: none"> <li>For the MAL 14, the responsiveness ratio &gt; 3 of the participant QOM scale was supported</li> </ul> <p>(Simpson and Eng 2013)<sup>4</sup></p> <p>In this systematic review across 68 studies, the effect size for <i>Patient perception</i> of change (MAL) were 1.6 to 6.2 (mean 1.66) larger than <i>lab-based functional performance measures</i> (ARAT or Wolf)<sup>4</sup></p> <p>Effect sizes were larger with greater variance for patients 1-2 months post stroke versus patients &gt; 3 months post stroke<sup>4</sup></p> |                                    |                           |                                    |                           |

Effect sizes were larger for patients with less severe impairments at 1-2 months post stroke. <sup>4</sup>

Effect sizes calculated based on change score divided by baseline standard deviation (population effect size) were lower than standardized response mean (based on change score divided by the change score standard deviation) for the same measure.

(Hammer and Lindmark, 2010) <sup>5</sup>

- Effect Size

Effect Size: .51 MAL-AOU and .54 MAL-QOM during intervention and 1.02 MAL-AOU and 1.17 MAL-QOM pre intervention to 3 mo F/U<sup>5</sup>

SRM: 1.28 MAL-AOU and 1.03 MAL QOM during intervention and 1.14 MAL-AOU and 1.19 MAL-QOM 3 mo after treatment <sup>5</sup>

- Responsiveness Ratios

RR: 1.22 MAL-AOU and 1.23 MAL-QOM during intervention and 2.44 MAL-AOU and 2.69 MAL-QOM 3 month after treatment <sup>5</sup>

## Professional Association Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokeEdge II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

### Abbreviations:

|           |                  |
|-----------|------------------|
| <b>HR</b> | Highly Recommend |
| <b>R</b>  | Recommend        |

|                       |                                                                               |
|-----------------------|-------------------------------------------------------------------------------|
| <b><i>LS / UR</i></b> | Reasonable to use, but limited study in target group /<br>Unable to Recommend |
| <b><i>NR</i></b>      | Not Recommended                                                               |

Recommendations for use based on acuity level of the patient:

|                         | <b>Acute</b><br><br>(CVA < 2 months<br>post)<br><br>(SCI < 1 month<br>post)<br><br>(Vestibular < 6<br>weeks post) | <b>Subacute</b><br><br>(CVA 2 to 6<br>months)<br><br>(SCI 3 to 6<br>months) | <b>Chronic</b><br><br>(> 6 months) |
|-------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------|
| <b>StrokEDGE<br/>II</b> | <i>NR</i>                                                                                                         | <i>HR</i>                                                                   | <i>HR</i>                          |

Recommendations based on level of care in which the assessment is taken:

|                         | <b>Acute<br/>Care</b> | <b>Inpatient<br/>Rehabilitation</b> | <b>Skilled<br/>Nursing<br/>Facility</b> | <b>Outpatient<br/>Rehabilitation</b> | <b>Home<br/>Health</b> |
|-------------------------|-----------------------|-------------------------------------|-----------------------------------------|--------------------------------------|------------------------|
| <b>StrokEDGE<br/>II</b> | <i>NR</i>             | <i>NR</i>                           | <i>NR</i>                               | <i>UR</i>                            | <i>UR</i>              |

Recommendations for entry-level physical therapy education and use in research:

|  | <b>Students<br/>should<br/>learn to<br/>administer<br/>this tool?<br/>(Y/N)</b> | <b>Students<br/>should be<br/>exposed<br/>to tool?<br/>(Y/N)</b> | <b>Appropriate<br/>for use in<br/>intervention<br/>research<br/>studies? (Y/N)</b> | <b>Is additional<br/>research<br/>warranted<br/>for this tool<br/>(Y/N)</b> |
|--|---------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
|  |                                                                                 |                                                                  |                                                                                    |                                                                             |

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |     |     |                                                                   |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-----|-------------------------------------------------------------------|
|                       | <b>StrokEDGE II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | No | Yes | Yes | <i>Yes; There are no studies on content or construct validity</i> |
| <b>Considerations</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |     |     |                                                                   |
| <b>Bibliography</b>   | <ol style="list-style-type: none"> <li>1. Uswatte, G., Taub, E., et al. (2006). "The Motor Activity Log-28 Assessing daily use of the hemiparetic arm after stroke." <i>Neurology</i> 67(7): 1189-1194. <a href="#">Find it on PubMed</a></li> <li>2. Uswatte, G., Taub, E., et al. (2005). "Reliability and validity of the upper-extremity Motor Activity Log-14 for measuring real-world arm use." <i>Stroke</i> 36(11): 2493-2496. <a href="#">Find it on PubMed</a></li> <li>3. Van der Lee, J., Beckerman, H., et al. (2004). "Clinimetric properties of the motor activity log for the assessment of arm use in hemiparetic patients." <i>Stroke</i> 35(6): 1410-1414. <a href="#">Find it on PubMed</a></li> <li>4. Simpson LA, Eng JJ Functional recovery following stroke: Capturing changes in upper extremity function <i>Neurorehabil Neural Repair</i> 2013: 240-250. <a href="#">Find it on PubMed</a></li> <li>5. Hammer AM, Lindmark B. Responsiveness and validity of the Motor Activity log in patients during the subacute phase after stroke <i>Disability and Rehabilitation</i> 2010; 32 (14):1184-1193 <a href="#">Find it on PubMed</a></li> <li>6. Lin K-c, Chuang L-l, Wu C-y, Hsieh Y-w. Responsiveness and validity of three dexterous function measures in stroke rehabilitation. <i>J of Rehabilitation Research and Development</i>: 2010;47 (4): 563-572 <a href="#">Find it on PubMed</a></li> <li>7. Lin K-C, Fu T Wu C-Y, Hsieh Y-W, Chen C-L, Lee P-C. Psychometric comparisons of the Stroke Impact Scale 3.0 and Stroke-Specific Quality of Liv Scale. <i>Research</i> 2010; 29 (3):435-443 <a href="#">Find it on PubMed</a></li> <li>8. Wu C-y, Chuang L-l Lin K-c, Horng Y-s. Responsiveness and validity of two outcome measures of instrumental activities of daily living in stroke survivors receiving rehabilitative therapies. <i>Clinical Rehabilitation</i> 2011; 26:176-183 <a href="#">Find it on PubMed</a></li> </ol> |    |     |     |                                                                   |

|                                 |          |
|---------------------------------|----------|
|                                 |          |
| <b>Year published</b>           | 2013     |
| <b>Instrument in PDF Format</b> | Yes      |
| <b>Approval Status</b>          | Approved |

## 19: REHAB MEASURES DATABASE: MOTRICITY INDEX

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to Instrument     | <a href="http://depts.washington.edu/yqol/IQOL">http://depts.washington.edu/yqol/IQOL</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Title of Assessment    | Motricity Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Acronym                | MI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Instrument Reviewer(s) | Initial review completed by Maggie Bland, PT, DPT, NCS and Nancy Byl, PT, MPH, PhD, FAPTA and the StrokEdge II Task Force of the Academy of Neurologic Physical Therapy - a component of APTA 2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Summary Date(s)        | 4/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Purpose                | The Motricity Index (MI) is an ordinal method of measuring limb strength developed by Demeurisse et al in 1980.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Description            | In the original study, numerous arm and leg movements were analyzed in the first six months post stroke. One movement at the proximal, middle and distal joints from the arm and leg was selected to represent strength at each joint. Based on an analysis of early stroke recovery in the first 6 months post stroke, weighted scores were developed to represent the difficulty of progressing from one muscle grade to the next. Maximum total arm score is 99+ (range 0-99) and the same for the leg score. Guidelines for administering the MI were developed by Collin and Wade 1990.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Area of Assessment     | <p>Upper and Lower limbs</p> <p>UE tests: <i>shoulder abduction, elbow flexion, pinch grip</i></p> <p>LE tests: <i>hip flexion, knee extension, dorsiflexion</i><br/>(Tests administered in the sitting position)</p> <p>Scoring for all movements except grip:</p> <ul style="list-style-type: none"> <li>0 - No movement</li> <li>9 - Palpable contraction in muscle, but no movement</li> <li>14 - Visible movement, but not full range and not against gravity</li> <li>19 - Full range of movement against gravity, but not resistance</li> <li>25 - Full movement against gravity but weaker than the other side</li> <li>33 - Normal power</li> </ul> <p>Grip scoring</p> <ul style="list-style-type: none"> <li>0 - No movement</li> <li>11 - Beginnings of prehension</li> <li>19 - Able to grip cube, but not hold it against gravity<br/>examiner may need to lift the wrist)</li> <li>22 - Able to grip and hold the cube against gravity</li> <li>26 - Able to grip and hold the cube against a weak pull, but weaker<br/>than the other side</li> <li>33 - Normal power</li> </ul> |

|                                                         |                                                                                                                                                                                                          |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Body Part</b>                                        | Shoulder, elbow and wrist in the arm and hip, knee and ankle of the leg.                                                                                                                                 |
| <b>ICF Domain</b>                                       | Body function and structure                                                                                                                                                                              |
| <b>Domain</b>                                           | Strength as measured on a weighted, ordinal scale.                                                                                                                                                       |
| <b>Assessment Type</b>                                  | Examiner assessment (including observation and palpation following instructions to move the limb in the desired directions)                                                                              |
| <b>Length of Test</b>                                   | 20 minutes or less                                                                                                                                                                                       |
| <b>Time to Administer</b>                               | 5 minutes for experienced examiners working with patients who are cognitively intact                                                                                                                     |
| <b>Number of Items</b>                                  | 6 items on each side (3 for the arm; 3 for the leg)                                                                                                                                                      |
| <b>Equipment Required</b>                               | 2.5 cm x 2.5 cm cube                                                                                                                                                                                     |
| <b>Training Required</b>                                | No                                                                                                                                                                                                       |
| <b>Type of Training Required</b>                        | None; fast and easy to learn                                                                                                                                                                             |
| <b>Cost</b>                                             | None                                                                                                                                                                                                     |
| <b>Actual Cost</b>                                      | None                                                                                                                                                                                                     |
| <b>Age Range</b>                                        | 20-80 years                                                                                                                                                                                              |
| <b>Administration Mode</b>                              | Patient asked to voluntarily perform a movement task                                                                                                                                                     |
| <b>Diagnosis</b>                                        | Acute, subacute and chronic stroke (Moderate and Severe)                                                                                                                                                 |
| <b>Populations Tested</b>                               | Adults post stroke (inpatients and outpatients)                                                                                                                                                          |
| <b>Standard Error of Measurements (SEM)</b>             | n/a                                                                                                                                                                                                      |
| <b>Minimal Detectable Change (MCD)</b>                  | n/a                                                                                                                                                                                                      |
| <b>Minimally Clinically Important Difference (MCID)</b> | n/a                                                                                                                                                                                                      |
| <b>Cut-Off Scores</b>                                   | n/a                                                                                                                                                                                                      |
| <b>Normative Data</b>                                   |                                                                                                                                                                                                          |
| <b>Test-Retest Reliability</b>                          | n/a unknown                                                                                                                                                                                              |
| <b>Interrater / Intrarater Reliability</b>              | (Collin and Wade; 1990) 40 subjects sub acute post stroke measured at 6, 12 and 18 weeks with two raters. <ul style="list-style-type: none"> <li>• Excellent inter-rater reliability (r=0.88)</li> </ul> |

|                                                 | <p>MI arm      0.88<br/>MI leg      0.87<br/>MI Total    0.88</p> <p>(Fayazi, et al, 2012) Twenty participants, average of 55.58 (<math>\pm 13.45</math>) years old and an average of 19.41 (<math>\pm 17.37</math>) months post-stroke were administered the MI for the lower extremity on two occasions, one week apart.</p> <ul style="list-style-type: none"> <li>• Intra-rater reliability was excellent (ICC = 0.93, 95% CI = 0.84-0.97, <math>p = 0.000</math>)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                      |                |                       |       |     |       |      |       |                  |       |            |       |              |       |           |       |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------|-----------------------|-------|-----|-------|------|-------|------------------|-------|------------|-------|--------------|-------|-----------|-------|
| Internal Consistency                            | <p>(Cameron and Bohannon, 2000) Fifteen patients with stroke</p> <ul style="list-style-type: none"> <li>• Excellent ; Cronbach alpha=0.77</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                      |                |                       |       |     |       |      |       |                  |       |            |       |              |       |           |       |
| Criterion Validity<br>(Predictive / Concurrent) | <p>Criterion Validity</p> <p>Collin and Wade, 1990</p> <ul style="list-style-type: none"> <li>• Excellent predictive correlation of MI score at 6 weeks and walking ability at 18 weeks</li> <li>• Excellent criterion validity with correlation between dynamometer measurements and the arm and the leg MI scores (<math>r=0.78</math> and <math>0.91</math> respectively)</li> </ul> <p><i>Congruent Validity</i></p> <p>(Arwert HJ et al, 2016) The purpose of the study was to establish the validity of the Michigan Hand Outcomes Questionnaire in 51 patients up to 5 years post stroke (average 8 months post stroke) who had participated in stroke rehabilitation.</p> <ul style="list-style-type: none"> <li>• A significant, excellent correlation was documented between the MHQ and the Arm MI for all patients (<math>0.78</math>)</li> <li>• A significant moderate correlation was documented between the MHQ and the Arm MI for patients with less than 100 on the Arm MI (<math>0.65</math>)</li> <li>• The Arm MI had moderate to excellent correlations with the functional sub scales of the MHQ</li> </ul> <table border="1"> <thead> <tr> <th>Subscales of the MHQ</th><th>MI correlation</th></tr> </thead> <tbody> <tr> <td>Overall Hand Function</td><td>0.797</td></tr> <tr> <td>ADL</td><td>0.669</td></tr> <tr> <td>Pain</td><td>0.431</td></tr> <tr> <td>Work Performance</td><td>0.590</td></tr> <tr> <td>Aesthetics</td><td>0.674</td></tr> <tr> <td>Satisfaction</td><td>0.715</td></tr> <tr> <td>MHQ total</td><td>0.780</td></tr> </tbody> </table> <p><i>Concurrent Validity</i></p> <p>(Sunderland et al 1989) Patients acute post stroke. When comparing the 9 Hole Peg Test, Motor Club Impairment, Frenchay Arm Test and Mtricity Index Arm Score:</p> | Subscales of the MHQ | MI correlation | Overall Hand Function | 0.797 | ADL | 0.669 | Pain | 0.431 | Work Performance | 0.590 | Aesthetics | 0.674 | Satisfaction | 0.715 | MHQ total | 0.780 |
| Subscales of the MHQ                            | MI correlation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |                |                       |       |     |       |      |       |                  |       |            |       |              |       |           |       |
| Overall Hand Function                           | 0.797                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                |                       |       |     |       |      |       |                  |       |            |       |              |       |           |       |
| ADL                                             | 0.669                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                |                       |       |     |       |      |       |                  |       |            |       |              |       |           |       |
| Pain                                            | 0.431                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                |                       |       |     |       |      |       |                  |       |            |       |              |       |           |       |
| Work Performance                                | 0.590                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                |                       |       |     |       |      |       |                  |       |            |       |              |       |           |       |
| Aesthetics                                      | 0.674                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                |                       |       |     |       |      |       |                  |       |            |       |              |       |           |       |
| Satisfaction                                    | 0.715                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                |                       |       |     |       |      |       |                  |       |            |       |              |       |           |       |
| MHQ total                                       | 0.780                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                |                       |       |     |       |      |       |                  |       |            |       |              |       |           |       |

- The Motricity Index Arm test was the most sensitive measure in detecting early change

(Bohannon et al, 1999)

- There was an excellent correlation between dynamometry measurements of the upper extremity and the Motricity Index Arm Score ( $r=0.89$ ;  $p<0.001$ )

(Cameron and Bohannon, 2000)

- There was an excellent correlation between dynamometry measurements and the Leg Motricity Index ( $r=-.77$ ;  $p<0.001$ )

(Collin and Wade, 1980)

- There was a good correlation between the Rivermead Motor Assessment and the Motricity Index

| Time   | RMA/MI-arm | RMA/MI-leg |
|--------|------------|------------|
| 6 wks  | 0.76*      | 0.81*      |
| 12 wks | 0.73*      | 0.81*      |
| 18 wks | 0.74**     | 0.75**     |

\*  $p<0.001$ ; \*\*  $p<0.010$

(Lu et al, 2015) Establish concurrent validity of the Wisconsin Gait Scale (WGS) and Gait Abnormality Rating Scale (GARS) for Chinese subjects with hemiplegia post first stroke ( $n=22$ ; mean age 54.8 [8.5 years]) who could walk independently.

- Mean lower extremity MI score was 70.4 (21.5)
- Adequate correlation of the WGS with the MI ( $r=0.687$ ;  $p<0.01$ )
- Excellent correlation of the GARS with the MI ( $r=0.742$ ;  $p<0.01$ )

(Meyer et al, 2015) 122 subjects (77 males), within 6 months post stroke (mean of 82 days) averaging 67 years of age, with 82% in acute rehabilitation centers were evaluated for the presence of sensory and motor deficits.

- Upper limb somatosensory impairments were common, with prevalence rates 21%- 54%
- Poor to adequate correlations were found between somatosensory and motor deficits ( $r=0.22-0.61$ )
- Visual spatial neglect was present in 27 patients (22%)
- There were consistently stronger correlations between motor and somatosensory deficits in patients with visuospatial neglect ( $r=0.44-0.78$ ) compared to patients without neglect ( $r=0.08-0.59$ )
- The MI median (interquartile range) was 67.5 for patients overall and 23 (0-83) for those with Neglect and 76 for patients without neglect ( $p<0.016$ )

- The correlations of somatosensory deficits and MI scores for the UE were adequate (ranging from -0.564 to 0.348)

| Somatosensation          | Association with MI |
|--------------------------|---------------------|
| Exteroceptive            |                     |
| Em-NSA light touch       | 0.318               |
| Em-NSA pressure          | 0.337               |
| Em NSA pinprick          | 0.348               |
| PTT light touch          | -0.564              |
| Proprioceptive           |                     |
| Em-NSA movement sense    | 0.394               |
| TFT position sense       | -0.354              |
| Higher Cortical          |                     |
| Em-NSA sharp/dull        | 0.220               |
| NSA stereognosis         | 0.535               |
| Two point discrimination | -0.316              |

Em-NSA (Erasmus MC modification of the revised Nottingham Sensory Assessment, TFT (Thumb finding test)

\* Statistically significant adequate correlations

(Bertrand et al, 2015; n = 34)

Participants were recruited from an acute neurology ward after their first stroke, and were administered the MI Arm, Chedoke Arm and Hand Activity Inventory (CAHAI), and the ABILHAND questionnaire.

- Excellent correlations were found between the MI Arm and the CAHAI at weeks 2, 4, 8, and 12 (0.87-0.94) and between the MI Arm at weeks 1, 2, 4, 8, and 12 and the ABILHAND at week 12 (0.69-0.82)

#### *Predictive Validity*

(Sunderland et al, 1989)

Patients acute post stroke were measured at admission, 1,3, and 6 months post stroke with multiple measures of hand structure and function (grip strength, the 9-Hole Peg Test, MI arm, Motor Club Impairment and Frenchay Arm Test)

- The Motricity Index for the arm was able to best predict outcomes

(Collin and Wade, 1980)

- At 6 weeks post stroke, lower scores on the MI-Leg combined with the Trunk Control Test predicted failure to walk by 18 weeks.

(Kong K-H et al, 2011) Motor outcomes measures (Motor Assessment Scale (MAS), Upper Extremity Motricity Index (UEMI), Lower Extremity Motricity Index (LEMI) and the Modified Barthel Index (MBI) were administered to 140

patients (61.0 years [13.3 years]) more than one year post stroke (41.7 months [35.1 months]).

- Only 28.3% gained upper limb dexterity post stroke
- Sensory impairment, severe spasticity and low scores on MAS, UEMI and LEMI were significantly correlated to poor dexterous function
- Severe spasticity was correlated with low UEMI score and poor dexterity
- Poor dexterous function was predicted by a severe stroke, neglect, sensory impairment, total/partial anterior circulation stroke and low MBI, UEMI and LEMI scores on rehabilitation admission
- The most important predictor of dexterity was the UEMI score on admission to rehabilitation
- The ability to do a pin grip at admission to acute rehabilitation was a predictor of recovering UE dexterity (e.g. the probability of regaining dexterity was 3.4% in patients with absent pinch grip but 80% in those with MI scores of 22 or higher)

#### Factors correlating MI scores to Upper Limb Dexterity

| Factors            | Upper Limb Dexterity |             | P Value |
|--------------------|----------------------|-------------|---------|
|                    | Yes                  | No          |         |
| Upper Extremity MI | 82.5 (10.8)          | 44.9 (24.6) | <0.0001 |
| Lower Extremity MI | 81.7 (12.6)          | 55.4 (17.6) | <0.0001 |

#### MI Scores Predicting Upper Limb Dexterity

| Variable                         | Upper Limb Dexterity |             | P Value |
|----------------------------------|----------------------|-------------|---------|
|                                  | Yes                  | No          |         |
| Upper Extremity MI score (Rehab) | 48.7 (20.7)          | 11.2 (19.1) | <0.001  |
| Lower Extremity MI score (Rehab) | 55.0 (17.6)          | 19.8 (23.7) | <0.001  |

(Bland et al, 2012) Two samples of patients in an inpatient rehabilitation facility unit (n=110 and 159; mean age 62 (±14) and 63 (±15) respectively) were evaluated at admission and discharge to determine which clinical assessments at admission most simply predicted discharge walking ability and what differentiated household versus community ambulators.

- Admission Lower extremity MI was 65 (26) and 59 (30) respectively in patients subacute post stroke

|                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                       | <ul style="list-style-type: none"> <li>• The Lower extremity MI at admission was adequately (0.47) correlated with the speed of the 10 meter walk at discharge</li> <li>• The lower extremity MI did not explain a significant amount of the variance in walking speed at discharge nor differentiate household versus community.</li> </ul> <p>(Aufman et al, 2013) N = 143 participants, mean age broken down by group: non-drivers = 64.1 (<math>\pm</math> 14.0), non-returned = 59.9 (<math>\pm</math>13), and returners = 61.5 (<math>\pm</math> 13.7) years old admitted to an IRF were assessed at admission (additional measures were taken from their acute care stay).</p> <ul style="list-style-type: none"> <li>• A logistic regression was run and the final model selected used the LEMI and the Functional Independence Measure, Cognition (FIM-C).</li> <li>• LEMI and FIM-C explained 30% of the variance in patients who returned to driving at six months post-stroke.</li> </ul> |
| <b>Construct Validity (Convergent / Discriminant)</b> | <p><i>Construct Validity</i><br/>(Bohannon et al 1999)</p> <ul style="list-style-type: none"> <li>• Found excellent construct validity of the MI arm as measured with Cronbach alpha (0.968)</li> </ul> <p>(Collin and Wade, 1990)</p> <ul style="list-style-type: none"> <li>• Excellent Convergent validity of the MI arm score and the MI leg score with the Rivermead Motor Assessment (r=0.71 and 0.81 respectively)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Content Validity</b>                               | na                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Face Validity</b>                                  | na                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Floor / Ceiling Effects</b>                        | <p>(Sunderland et al, 1989) Group strength was compared to four established UE measures.</p> <ul style="list-style-type: none"> <li>• The Frenchay and 9-hole peg test showed floor effects on admission</li> <li>• The Motricity Index showed that 57% of patients had measureable pinch grip within the first 3 weeks of a stroke.</li> <li>• Only 2% had normal grip.</li> </ul> <p>(Arwert, 2016)</p> <ul style="list-style-type: none"> <li>• When all patients were examined 0% showed a floor effect and 28% showed a ceiling effect with respect to the MI Arm.</li> <li>• In the subgroup with MI Arm score &lt;100, 0% of patients had a floor or ceiling effect.</li> </ul>                                                                                                                                                                                                                                                                                                                |
| <b>Responsiveness</b>                                 | <p>(Collin and Wade, 1990)</p> <ul style="list-style-type: none"> <li>• Reported the MI for the arm and leg improved in patients post stroke when measured 6 weeks apart.</li> <li>• The standard response mean ranged from 0.51-1.20.</li> </ul> <p>(Vos-Vroman et al 2005) Responsiveness was measured with the 10 M Walk, BBS and MI in 19 patients acute post stroke:</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

- The effect size was poor and the SRM adequate for the MI -Leg

|           | Effect Size | SRM  |
|-----------|-------------|------|
| 10 M Walk | 1.17        | 1.68 |
| BBS       | 0.59        | 0.99 |
| MI        | 0.27        | 0.96 |

#### Professional Association Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Stroke Taskforce (StrokEDGE II) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

#### Abbreviations:

|         |                                                                            |
|---------|----------------------------------------------------------------------------|
| HR      | Highly Recommend                                                           |
| R       | Recommend                                                                  |
| LS / UR | Reasonable to use, but limited study in target group / Unable to Recommend |
| NR      | Not Recommended                                                            |

#### Recommendations for use based on acuity level of the patient:

|              | Acute<br>(CVA < 2 months post) | Subacute<br>(CVA 2 to 6 months) | Chronic<br>(> 6 months) |
|--------------|--------------------------------|---------------------------------|-------------------------|
| StrokEDGE II | HR                             | HR                              | HR                      |

Recommendations based on level of care in which the assessment is taken:

|           | Acute Care | Inpatient<br>Rehabilitation | Skilled<br>Nursing<br>Facility | Outpatient<br>Rehabilitation | Home<br>Health |
|-----------|------------|-----------------------------|--------------------------------|------------------------------|----------------|
| StrokEDGE | R          | R                           | R                              | R                            | R              |

Recommendations for entry-level physical therapy education and use in research:

|           | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|-----------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| StrokEDGE | No                                                   | Yes                                       | Yes                                                         | No                                                   |

#### Considerations

This test is fast and easy to learn and administer, but as with other measures attempting to grade strength in the stroke population, it is only one piece of the puzzle. The ability to generate force and power in a muscle is necessary for movement, but in the presence of increased tone or without the ability to coordinate and grade the movement, full function is not restored.

Although test procedures are vague on patient position for testing,, the test is usually administered with the patient sitting. Shoulder abduction begins with the arm at the side and elbow flexed to 90 o.

The test has excellent reliability and excellent reported construct, concurrent validity particularly relative to and predictive validity correlating admission levels of limb strength and recovery of upper limb function and walking ability.

(Gor-Garcia-Fogeda et al,2014) In this systematic review of 2b level studies, six measurement scales for gross motor function were included: (Motor Assessment Scale, Fugl-Meyers Assessment,, Sodring Motor Evaluation for Stroke Patients, Stroke Rehabilitation Assessment of Movement, Motricity Index and Rivermead Motor Assessment. All six scales ( including the MI) were found to be useful for

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | <p>clinical research and clinical practice, but the scales for which the most psychometric properties have been established in clinical trials were the Fugl Meyer Assessment (FMA) and the Stroke Rehabilitation Assessment of Movement (STREAM)</p> <p>(Geroian et al, 2013) performed a systematic review of outcome measures used following motor training using electromechanical and robotic devices in patients post stroke. A total of 45 scales were identified from 27 studies involving 966 subjects. The most commonly used outcome measures were: Functional Ambulation Category (18 studies) , 10- Meter Walking Test (13 studies), Motricity Index (12 studies), 6- Minute Walking Test (11 studies), Rivermead Mobility Index (8 studies) and the Berg Balance Scale (8 studies). All of the outcome measures belonged to the activity domain of the ICF except the MI which was classified as a measurement of body function and structure. No scales belonged to the participation category. For the MI, Inter-rater reliability and Construct validity were excellent.</p>                                                                 |
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|                          |      |
|--------------------------|------|
|                          |      |
| Year Published           | 1980 |
| Instrument in PDF Format | No   |
| Approval Status          |      |

## 20. REHAB MEASURES DATABASE: NIH STROKE SCALE

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | <a href="#">Measure available at Strokecenter.org (external link)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Title of Assessment    | National Institutes of Health Stroke Scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Acronym                | NIHSS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Instrument Reviewer(s) | Updated by Carmen Capo-Lugo, PT, PhD and Dorian Rose PT, PhD and the Stroke Edge II task force in 2016.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Summary Date           | 3/9/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Purpose                | <ul style="list-style-type: none"> <li>Measures the severity of symptoms associated with cerebral infarcts; used as a quantitative measure of neurological deficit post stroke.</li> <li>A retrospective scoring algorithm has been found to be reliable for research purposes (Williams et al, 2000).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Description            | <ul style="list-style-type: none"> <li>A composite scale derived from the Toronto Stroke Scale, the Oxbury Initial Severity Scale, the Cincinnati Stroke Scale and the Edinburgh-2 Coma Scale</li> <li>15 items assessing severity of impairment in LOC, ability to respond to questions and obey simple commands, pupillary response, deviation of gaze, extent of hemianopsia, facial palsy, resistance to gravity in the weaker limb, plantar reflexes, limb ataxia, sensory loss, visual neglect, dysarthria and aphasia severity</li> <li>Items are graded on a 3 or 4 point ordinal scale; 0 equates no impairment</li> <li>Scores range from 0 – 42. Higher scores indicate greater severity.</li> <li>Stroke severity may be stratified on the basis of NIHSS scores as follows (Brott et al, 1989): <ul style="list-style-type: none"> <li>o <b>Very Severe:</b> &gt;25</li> <li>o <b>Severe:</b> 15 – 24</li> </ul> </li> </ul> |

|                                  |                                                                                                                                                              |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>o <b>Mild to Moderately Severe:</b> 5 – 14</li> <li>o <b>Mild:</b> 1 – 5</li> </ul>                                   |
| <b>Area of Assessment</b>        | Aphasia; Behavior; Cognition; Dysarthria; Vision & Perception                                                                                                |
| <b>Body Part</b>                 | Not Applicable                                                                                                                                               |
| <b>ICF Domain</b>                | Body Function                                                                                                                                                |
| <b>Domain</b>                    | Cognition; Motor                                                                                                                                             |
| <b>Assessment Type</b>           | Observer                                                                                                                                                     |
| <b>Length of Test</b>            | 05 Minutes or Less                                                                                                                                           |
| <b>Time to Administer</b>        | 6 minutes                                                                                                                                                    |
| <b>Number of Items</b>           | 15                                                                                                                                                           |
| <b>Equipment Required</b>        | None                                                                                                                                                         |
| <b>Training Required</b>         | Yes: Training and Certification DVD available through the American Academy of Neurology, the American Heart Association and the National Stroke Association. |
| <b>Type of training required</b> | Training Course                                                                                                                                              |
| <b>Cost</b>                      | Free                                                                                                                                                         |
| <b>Actual Cost</b>               | None                                                                                                                                                         |
| <b>Age Range</b>                 | Adult: 18-64 years                                                                                                                                           |
| <b>Administration Mode</b>       | Paper/Pencil                                                                                                                                                 |
| <b>Diagnosis</b>                 | Stroke                                                                                                                                                       |
| <b>Populations Tested</b>        | Stroke                                                                                                                                                       |

| Standard Error of Measurement (SEM)                | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                    |      |             |                |      |  |  |  |         |  |  |          |  |  |  |             |                |      |             |                |      |       |     |     |     |     |     |     |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------|-------------|----------------|------|--|--|--|---------|--|--|----------|--|--|--|-------------|----------------|------|-------------|----------------|------|-------|-----|-----|-----|-----|-----|-----|
| Minimal Detectable Change (MDC)                    | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                    |      |             |                |      |  |  |  |         |  |  |          |  |  |  |             |                |      |             |                |      |       |     |     |     |     |     |     |
| Minimally Clinically Important Difference (MCID)   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                    |      |             |                |      |  |  |  |         |  |  |          |  |  |  |             |                |      |             |                |      |       |     |     |     |     |     |     |
| Cut-Off Scores                                     | <p>Stroke severity may be stratified on the basis of NIHSS scores as follows (Brott et al, 1989):</p> <ul style="list-style-type: none"><li>o <b>Very Severe:</b> &gt;25</li><li>o <b>Severe:</b> 15 – 24</li><li>o <b>Mild to Moderately Severe:</b> 5 – 14</li><li>o <b>Mild:</b> 1 – 5</li></ul> <p><b>Acute Stroke:</b> (Schlegel et al, 2003; Rundek et al, 2000)</p> <p>Outcomes related to NIHSS scores at admission:</p> <ul style="list-style-type: none"><li>• <b>Scores of &lt;5;</b> 80% of stroke survivors will be discharged to home</li><li>• <b>Score between 6 and 13</b> typically require acute inpatient rehabilitation</li><li>• <b>Scores of &gt;14</b> frequently require long-term skilled care</li></ul> |                                                    |      |             |                |      |  |  |  |         |  |  |          |  |  |  |             |                |      |             |                |      |       |     |     |     |     |     |     |
| Normative Data                                     | <p><b>Acute Stroke:</b> (Williams et al, 1999; <i>n</i> = 34, first stroke, patients assessed 1 and 3 months (+/- 1 week) after stroke)</p> <table><tr><th colspan="7">Health-Related Quality of Life (NIHSS mean scores)</th></tr><tr><th></th><th colspan="3">1 Month</th><th colspan="3">3 Months</th></tr><tr><th></th><th>A Lot Worse</th><th>A Little Worse</th><th>Same</th><th>A Lot Worse</th><th>A Little Worse</th><th>Same</th></tr><tr><th>NIHSS</th><td>3.4</td><td>3.2</td><td>1.5</td><td>2.4</td><td>1.1</td><td>1.1</td></tr></table>                                                                                                                                                                            | Health-Related Quality of Life (NIHSS mean scores) |      |             |                |      |  |  |  | 1 Month |  |  | 3 Months |  |  |  | A Lot Worse | A Little Worse | Same | A Lot Worse | A Little Worse | Same | NIHSS | 3.4 | 3.2 | 1.5 | 2.4 | 1.1 | 1.1 |
| Health-Related Quality of Life (NIHSS mean scores) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                    |      |             |                |      |  |  |  |         |  |  |          |  |  |  |             |                |      |             |                |      |       |     |     |     |     |     |     |
|                                                    | 1 Month                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                    |      | 3 Months    |                |      |  |  |  |         |  |  |          |  |  |  |             |                |      |             |                |      |       |     |     |     |     |     |     |
|                                                    | A Lot Worse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | A Little Worse                                     | Same | A Lot Worse | A Little Worse | Same |  |  |  |         |  |  |          |  |  |  |             |                |      |             |                |      |       |     |     |     |     |     |     |
| NIHSS                                              | 3.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3.2                                                | 1.5  | 2.4         | 1.1            | 1.1  |  |  |  |         |  |  |          |  |  |  |             |                |      |             |                |      |       |     |     |     |     |     |     |

|                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test-retest Reliability</b>                        | <p><b>Acute Stroke:</b> (Goldstein &amp; Samsa, 1997; 4 patients assessed by 30 physicians and 29 study coordinators; 3 months between assessments)</p> <ul style="list-style-type: none"> <li><b>Excellent</b> test-retest reliability; ICC = 0.93</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Interrater/Intrarater Reliability</b>              | <p><b>Acute Stroke:</b> (Goldstein &amp; Samsa, 1997)</p> <ul style="list-style-type: none"> <li><b>Excellent</b> interrater reliability; ICC = 0.95</li> </ul> <p><b>Acute Stroke:</b> Interrater Agreement (Goldstein et al, 1989; <math>n = 20</math> with 2 independent observers)</p> <ul style="list-style-type: none"> <li><b>Adequate to Excellent</b> agreement was found for 9 of the 13 items on the NIHSS (Kappa = 0.32 to 0.79); lowest levels of agreement were found for the Facial palsy (Kappa = 0.22) and limb ataxia (Kappa = -0.16) items.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Internal Consistency</b>                           | Not established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Criterion Validity<br/>(Predictive/Concurrent)</b> | <p><b>Acute Stroke:</b> Predictive validity (Adams et al, 1999; <math>n = 1268</math>)</p> <ul style="list-style-type: none"> <li>NIHSS scores at baseline predicted outcome at 7 and 90 days</li> <li>An excellent outcome was achieved by nearly two-thirds of the survivors who scored 3 or less at day 7</li> <li>Only a few patients who scored more than 15 at baseline achieved excellent outcomes after 90 days</li> </ul> <p><b>Acute Stroke:</b> Predictive validity (Baird et al, 2001; <math>n = 66</math>; &lt;48 hours post-stroke)</p> <ul style="list-style-type: none"> <li>NIHSS combined with Magnetic Resonance Diffusion-Weighted imaging (MR DWI) and volume of ischaemic brain tissue on MR DWI significantly predicted stroke recovery</li> </ul> <p><b>Acute Stroke:</b> (Bohannon et al, 2002; <math>n = 92</math>, mean age = 70.0 (12.4) years; NIHSS was administered while patients were still in the emergency department, prior to admission)</p> <ul style="list-style-type: none"> <li><b>Poor*</b> (but significant) correlation with length of stay (<math>r = 0.276</math>)</li> </ul> |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <ul style="list-style-type: none"> <li>• <b>Adequate*</b> correlation with hospital charges (<math>r = 0.320</math>)</li> <li>• <b>Adequate*</b> correlation with discharge destination (home or elsewhere) (<math>r = -0.355</math>)</li> </ul> <p>*Significant at <math>p &lt; 0.05</math></p> <p><b>Acute Stroke:</b> Concurrent Validity (Fink et al, 2002)</p> <ul style="list-style-type: none"> <li>• <b>Adequate to Excellent</b> correlations with diffusion weighted MRI lesion volumes (<math>r = 0.48</math> right, <math>r = 0.58</math> left); and perfusion-weight hypoperfusion volumes (<math>r = 0.62</math> right, <math>r = 0.60</math> left)</li> </ul> <p><b>Chronic Stroke:</b> Concurrent Validity (Peters, et al., 2015)</p> <p>Examined the concurrent validity of the NIHSS with the Stroke Impact Scale. No association between NIHSS and SIS-physical dimension (Spearman's <math>\rho = -.036</math>; <math>p = .666</math>). SIS-overall perception of recovery (Spearman's <math>\rho = -.039</math>; <math>p = .640</math>) nor SIS ADL/IADL score (Spearman's <math>\rho = -.054</math>; <math>p = .520</math>).</p> |
| <b>Construct Validity<br/>(Convergent/Discriminant)</b> | <p><b>Acute Stroke:</b> (Schlegel et al, 2003; Rundek et al, 2000)</p> <p>Outcomes related to NIHSS scores at admission:</p> <ul style="list-style-type: none"> <li>• <b>Scores of &lt;5;</b> 80% of stroke survivors will be discharged to home</li> <li>• <b>Score between 6 and 13</b> typically require acute inpatient rehabilitation</li> <li>• <b>Scores of &gt;14</b> frequently require long-term skilled care</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Content Validity</b>                                 | <p>Items are based on components of a standard neurological examination (Kasner, 2006)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Face Validity</b>                                    | <p>Not statistically established</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Floor/Ceiling Effects</b>                            | <p><b>Acute Stroke:</b></p> <ul style="list-style-type: none"> <li>• <b>Floor effects</b> are less commonly reported in the literature to date</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                  |          |           |                |                                                                            |           |                 |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|----------|-----------|----------------|----------------------------------------------------------------------------|-----------|-----------------|
|                                                 | <ul style="list-style-type: none"> <li>• <b>Ceiling effects</b> (Pickard et al, 2005) A ceiling effect was observed at 6 months with the NIHSS effecting 20% of patients who completed the measure</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |                  |          |           |                |                                                                            |           |                 |
| <b>Responsiveness</b>                           | <p><b><u>Acute Stroke:</u></b> (Brott et al, 1989)</p> <p>NIHSS scores were compared to infarction size (measured by computed tomography) on 65 patients at 1 week post stroke. 10 items demonstrated an average of 25% change over 7 days. However, changes in limb ataxia and best gaze may have been overstated.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                  |          |           |                |                                                                            |           |                 |
| <b>Professional Association Recommendations</b> | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD Edge), Spinal Cord Injury Taskforce (PD Edge), Stroke Taskforce (StrokeEdge II), Traumatic Brain Injury Taskforce (TBI Edge), and Vestibular Taskforce (VEEdge) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> <div style="border: 1px solid black; padding: 10px; margin-top: 20px;"> <p><b>Abbreviations:</b></p> <table> <tr> <td><b>HR</b></td><td>Highly Recommend</td></tr> <tr> <td><b>R</b></td><td>Recommend</td></tr> <tr> <td><b>LS / UR</b></td><td>Reasonable to use, but limited study in target group / Unable to Recommend</td></tr> <tr> <td><b>NR</b></td><td>Not Recommended</td></tr> </table> </div> <p>Recommendations for use based on acuity level of the patient:</p> | <b>HR</b> | Highly Recommend | <b>R</b> | Recommend | <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend | <b>NR</b> | Not Recommended |
| <b>HR</b>                                       | Highly Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                  |          |           |                |                                                                            |           |                 |
| <b>R</b>                                        | Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                  |          |           |                |                                                                            |           |                 |
| <b>LS / UR</b>                                  | Reasonable to use, but limited study in target group / Unable to Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                  |          |           |                |                                                                            |           |                 |
| <b>NR</b>                                       | Not Recommended                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                  |          |           |                |                                                                            |           |                 |

|                         | Acute<br>(CVA < 2<br>months post)<br><br>(SCI < 1 month<br>post)<br><br>(Vestibular < 6<br>weeks post) | Subacute<br>(CVA 2 to 6<br>months)<br><br>(SCI 3 to 6<br>months) | Chronic<br>(> 6<br>months) |
|-------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------|
| <b>StrokEDGE<br/>II</b> | <i>R</i>                                                                                               | <i>NR</i>                                                        | <i>NR</i>                  |

Recommendations based on level of care in which the assessment is taken:

|                     | Acute<br>Care | Inpatient<br>Rehabilitation | Skilled<br>Nursing<br>Facility | Outpatient<br>Rehabilitation | Home<br>Health |
|---------------------|---------------|-----------------------------|--------------------------------|------------------------------|----------------|
| <b>StrokEDGE II</b> | <i>R</i>      | <i>NR</i>                   | <i>NR</i>                      | <i>NR</i>                    | <i>NR</i>      |

Recommendations for entry-level physical therapy education and use in research:

|                     | Students<br>should<br>learn to<br>administer this<br>tool?<br>(Y/N) | Students<br>should<br>be<br>exposed to<br>this tool?<br>(Y/N) | Appropriate for use in<br>intervention research<br>studies?<br>(Y/N) | Is<br>additional<br>research<br>warranted for this<br>tool<br>(Y/N) |
|---------------------|---------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>StrokEDGE II</b> | <i>No</i>                                                           | <i>Yes</i>                                                    | <i>Yes</i>                                                           | <i>Not<br/>reported</i>                                             |

## Considerations

- The NIHSS may be most useful for early prognostication assessment, whereas the Barthel

Index may be more useful for planning rehabilitation interventions (Kasner, 2006)

- The NIHSS was originally designed to assess differences among clinical trial interventions. However, the NIHSS is increasingly used as an initial assessment tool and for planning post-acute care (Kasner, 2006).
- 4 items have poorly reliability or are redundant (level of consciousness, facial weakness, ataxia, and dysarthria (Kasner, 2006)
- The following information is provided on the Korean NIHSS and the Hindi NIHSS:

#### **Content Validity**

- Korean Version of the NIHSS (K-NIHSS) (Oh et al., 2012)

Used the Content Validity Index (CVI) which is the proportion of expert raters (n=11) rating an item higher than 3 points on a 4-point ordinal rating scale; a rating of 1 denotes an irrelevant item, and a rating of 4 denotes an extremely relevant item. Ten of the NIHSS items received a 1.0 meaning that all of the expert raters, rated that item higher than a 3. The visual fields item received a CVI of 0.91 as one rater, rated that item a "2" in terms of relevancy. Items with a CVI of at least 0.78 are accepted as valid (Lynn; 1986). The means scores of the CVI for each item ranged from 3.46-3.73.

#### **Construct Validity**

- Korean Version of the NIHSS (K-NIHSS) (Oh et al., 2012).

Construct Validity determined by comparison with the Glasgow Coma Scale (Spearman rho=-6.71;  $p<0.001$ )

#### **Predictive Validity**

- K-NIHSS at baseline (within 7 days of stroke onset) and modified Rankin Scale at 90-days post-onset was significantly positively correlated (Spearman's rho=0.600;  $p<0.001$ ).

- K-NIHSS significantly negatively correlated with the Barthel Index for the same time period (Spearman's  $\rho = -0.647$ ;  $p < 0.001$ ).
- Hindi version (HV\_NIHSS; Prasad et al., 2012) and Glasgow Coma Scale at 3 months (Spearman's  $\rho = -0.863$ ,  $p < 0.001$ )
- HV\_NIHSS and Barthel Index at 3 months (Spearman's  $\rho = -0.829$ ,  $p < 0.001$ )
- HV\_NIHSS and Modified Rankin Scale at 3 months (Spearman's  $\rho = 0.851$ ,  $p < 0.001$ )

#### **Inter-rater/Intra-rater Reliability**

Korean version of the NIHSS (K-NIHSS) (Oh et al., 2012; n=19 with 21 raters).

- Excellent interrater reliability; ICC=0.998. Lowest levels of agreement were found for Facial paresis (Kappa = 0.439) and dysarthria (Kappa = 0.465).
- Excellent intrarater reliability; ICC=0.969

Hindi version of NIHSS (Prasad et al, 2012; n=107 with 2 raters)

- Excellent interrater reliability; ICC=0.995

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>Prasad, K., et al. (2012). "Validation of the Hindi version of National Institute of Health Stroke Scale." <i>Neurol India</i> 60(1): 40-44.</p> <p>Rundek, T., Mast, H., et al. (2000). "Predictors of resource use after acute hospitalization: the Northern Manhattan Stroke Study." <i>Neurology</i> 55: 1180-1187. <a href="#">Find it on PubMed</a></p> <p>Schlegel, D., Kolb, S. J., et al. (2003). "Utility of the NIH Stroke Scale as a predictor of hospital disposition." <i>Stroke</i> 34: 134-137. <a href="#">Find it on PubMed</a></p> <p>Williams, L. S., Yilmaz, E. Y., et al. (2000). "Retrospective assessment of initial stroke severity with the NIH Stroke Scale." <i>Stroke</i> 31: 858-862. <a href="#">Find it on PubMed</a></p> |
| <b>Year published</b>           | 1989                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

21.

## **22. REHAB MEASURES DATABASE: NOTTINGHAM ASSESSMENT OF SOMATOSENSATION**

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Title of Assessment    | Nottingham Assessment of Somato-Sensation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Acronym                | NSA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Instrument Reviewer(s) | Initially reviewed by Jane Sullivan, MPT, DHS and the Stroke EDGE task force in 2011. Updated by Dorian Rose, PhD, PT and the StrokEdge II task force in 2017.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Summary Date           | 1/21/2017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Purpose                | This tool has been used in clinical trials following stroke to test interventions such as electrical stimulation and task specific training.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Description            | <p>Multi-modal sensory examination includes tests of: 1) Tactile sensation (light, touch, touch localization, temperature discrimination, pinprick sensation, bilateral simultaneous stimulation) 2) Kinesthesia 3) Stereognosis.</p> <p>Scoring of instrument:</p> <p><u>Tactile sensation:</u></p> <p>0 – Absent – fails to identify the test sensations on 3 trials</p> <p>1 – Impaired – identifies the test sensation, but not on all 3 trials in each region of the body or feels duller</p> <p>2 – Normal – correctly identifies the test sensation on 3 trials</p> <p><u>For Stereognosis:</u></p> <p>2 – Normal – item is correctly named or matched</p> <p>1 – Impaired – some features of object identified or attempts descriptions of objects</p> <p>0 – Absent – unable to identify the object in any manner</p> <p><u>For Kinesthesia:</u></p> |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <p>0 – Absent – no appreciation of movement taking place</p> <p>1 – Appreciation of movement taking place – indicates on each movement that a movement takes place but the movement direction is incorrect</p> <p>2 – Direction of movement sense – able to appreciate and mirror the direction of the test movement, but is inaccurate in its new position</p> <p>3 – Joint Position Sense – accurately mirrors the test movement to within 10 degrees of the new test position</p> |
| <b>Area of Assessment</b>        | Sensation                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Body Part</b>                 | Upper Extremity and Lower Extremity                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>ICF Domain</b>                | Body Structure; Body Function                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Domain</b>                    | Sensory                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Assessment Type</b>           | Performance Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Length of Test</b>            | 60 Minutes or More                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Time to Administer</b>        | Entire test can take up to 60 minutes, depending on client's sensory impairment. Kenesthesia and Sterognosis tests take approximately 15 minutes each                                                                                                                                                                                                                                                                                                                                |
| <b>Number of Items</b>           | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Equipment Required</b>        | <p>For tactile sensation: blindfold, cotton ball, Neurotip, 2 test tubes for hot and cold water, talcum powder.</p> <p>For stereognosis assessment: blindfold, 2 different coins, pen, pencil, comb, scissors, sponge, piece of flannel cloth, cup, glass.</p>                                                                                                                                                                                                                       |
| <b>Training Required</b>         | Methods of sensory examination taught in most entry-level curricula are not as rigorous as this one. The NSA might be included in an examination course as an example of a standardized sensory examination.                                                                                                                                                                                                                                                                         |
| <b>Type of training required</b> | training course; Reading an Article/Manual                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Cost</b>                      | Not Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Actual Cost                                      | < £100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Age Range                                        | Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Administration Mode                              | Paper/Pencil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Diagnosis                                        | Stroke                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Populations Tested                               | <ul style="list-style-type: none"> <li>Stroke</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Standard Error of Measurement (SEM)              | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Minimal Detectable Change (MDC)                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Minimally Clinically Important Difference (MCID) | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Cut-Off Scores                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Normative Data                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Test-retest Reliability                          | <p>(Lincoln NB et al, 1991; <math>n = 20</math> chronic stroke patients)</p> <ul style="list-style-type: none"> <li>One physical therapist tested patients on two occasions between 2-52 days apart. Kappa coefficients = -0.13-0.92; <math>k &gt; 0.7</math> for 17/54 items</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Interrater / Intrarater Reliability              | <p><b><u>Stroke:</u></b></p> <p>(Lincoln NB et al, 1991; <math>n = 20</math> acute stroke patients)</p> <ul style="list-style-type: none"> <li>Assessed by two physical therapists within 2-52 days of each other. Kappa coefficients = 0.01-0.89; only 1 item <math>k &gt; 0.7</math></li> </ul> <p>(Lincoln NB et al, 1998; <math>n = 27</math> stroke patients)</p> <ul style="list-style-type: none"> <li>Kappa coefficients showed acceptable agreement on 12 out of the 86 items for inter rater reliability. Light touch and pressure scales were most reliable and pin-prick and temperature scales were least reliable</li> <li>For inter rater reliability of the stereognosis subtest reported kappa coefficients 0.38 to 1.0. Coefficients were higher on the unaffected side and for certain items (scissors, sponge, cup) Intracranial Disorders:</li> </ul> |

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                 | <p>(Stolk-Hornsveld F et al, 2006; <math>n = 18</math> inpatients; mean age = 57.7 years; diagnosed with intracranial disorder)</p> <ul style="list-style-type: none"> <li>Intra rater and inter rater reliability of the Erasmus MC modifications to the Nottingham Sensory Assessment (EmNSA), kappa coefficients 0.58 to 1.00. Two-point discrimination was less reliable 0.11 to 0.63. Inter rater reliability of EmNSA, kappa coefficients of 0.46 to 1.00. Two-point discrimination was less reliable of 0.10 to 0.66</li> </ul> <p><b><u>Stroke: Stereognosis Assessment</u></b></p> <p>(Gaubert CS and Mockett SP; 2000, <math>n = 20</math> stroke patients ( <math>3.85 \pm 2.78</math> weeks post-stroke)</p> <ul style="list-style-type: none"> <li>The stereognostic ability of the subjects was assessed using the NSA procedures by 2 of 3 examiners within a 24-hour period.</li> <li>Kappa values ranged from 0.42 (moderate) to 0.85 (almost perfect) between Examiners 1 and 2</li> <li>Kappa values ranged from 0.38 (fair) to 0.84 (almost perfect) between Examiners 1 and 3</li> <li>Kappa values ranged from 0.40 (fair) to 0.80 (substantial) between Examiners 1 with Examiners 2 and 3.</li> <li>For all 3 levels of comparison, the lowest Kappa value was for the pencil item.</li> </ul> |
| Internal Consistency                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Criterion Validity<br>(Predictive / Concurrent) | <p><b><u>Stroke:</u></b></p> <p>(Connell LA et al, 2008; <math>n = 70</math> stroke patients)</p> <ul style="list-style-type: none"> <li>Upper limb tactile sensation at rehab admission (within 6 wks of stroke onset) predictive of upper limb tactile sensation at 6-months post-stroke (<math>R^2 = 0.56</math>; <math>p &lt; 0.001</math>)</li> <li>Lower limb tactile sensation at rehab admission (within 6 wks of stroke onset) predictive of lower limb</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                   | <p>tactile sensation at 6-months post-stroke (<math>R^2 = 0.46</math>; <math>p &lt; 0.001</math>)</p> <ul style="list-style-type: none"> <li>• Stereognosis and proprioception at rehab admission (within 6 wks of stroke onset) predictive of stereognosis at 6-months post-stroke (<math>R^2 = 0.71</math>; <math>p &lt; 0.001</math>)</li> <li>• Proprioception and upper limb tactile sensation at rehab admission (within 6 wks of stroke onset) predictive of proprioception at 6-months post-stroke (<math>R^2 = 0.51</math>; <math>p &lt; 0.001</math>)</li> </ul> <p>(Meyer et al, 2016; <math>n = 32</math> acute stroke patients)</p> <ul style="list-style-type: none"> <li>• Proprioception (movement sense) as measured by the Erasmus MC (revised) NSA at one week post-stroke, moderately predicted motor ability at 6-months post-stroke as measured by the UE Fugl-Meyer (Spearman <math>p = 0.27</math>), the Motricity Index (Spearman <math>p = 0.27</math>) and the Action Research Arm Test (Spearman <math>p = 0.26</math>).</li> <li>• Stereognosis measured by the NSA at one week post-stroke moderately predicted motor ability at 6-months post-stroke as measured by the UE Fugl-Meyer (Spearman <math>p = 0.41</math>), the Motricity Index (Spearman <math>p = 0.37</math>) and the Action Research Arm Test (Spearman <math>p = 0.56</math>).</li> <li>•</li> </ul> |
| Construct Validity<br>(Convergent / Discriminant) | <p><b><u>Stroke:</u></b></p> <p>(Scalha et al, 2011; <math>n = 20</math> stroke patients (&gt; 2 yrs post-stroke))</p> <ul style="list-style-type: none"> <li>• Total Fugl-Meyer (FM) UE Sensation (proprioception and light touch) correlated with UE Nottingham Stroke Assessment (NSA) score; Spearman's <math>r = 0.69</math>; <math>p &lt; 0.001</math>)</li> <li>• UE FM arm light touch correlated with NSA tactile sensation subscale (<math>p &lt; 0.005</math>)</li> <li>• UE FM palm light touch correlated with NSA tactile sensation subscale (<math>p &lt; 0.005</math>)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                                          | <ul style="list-style-type: none"><li>• UE FM shoulder/elbow proprioception correlated with NSA proprioception subscale (r=0.59; p=0.007)</li><li>• UE FM wrist/hand proprioception correlated with NSA proprioception subscale (r=0.75; p &lt; 0.001).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|-----------|------------------|----------|-----------|----------------|----------------------------------------------------------------------------|-----------|-----------------|--|----------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|--|--|--|--|
| Content Validity                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
| Face Validity                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
| Floor / Ceiling Effects                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
| Responsiveness                           | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
| Professional Association Recommendations | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> <table><tr><th colspan="2">Abbreviations:</th></tr><tr><td><b>HR</b></td><td>Highly Recommend</td></tr><tr><td><b>R</b></td><td>Recommend</td></tr><tr><td><b>LS / UR</b></td><td>Reasonable to use, but limited study in target group / Unable to Recommend</td></tr><tr><td><b>NR</b></td><td>Not Recommended</td></tr></table> <p>Recommendations for use based on acuity level of the patient:</p> <table><tr><th></th><th><b>Acute</b><br/>(CVA &lt; 2 months post)<br/>(SCI &lt; 1 month post)<br/>(Vestibular &lt; 6 weeks post)</th><th><b>Subacute</b><br/>(CVA 2 to 6 months)<br/>(SCI 3 to 6 months)</th><th><b>Chronic</b><br/>(&gt; 6 months)</th></tr><tr><td></td><td></td><td></td><td></td></tr></table> | Abbreviations:                                                |                                | <b>HR</b> | Highly Recommend | <b>R</b> | Recommend | <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend | <b>NR</b> | Not Recommended |  | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post) | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months) |  |  |  |  |
| Abbreviations:                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
| <b>HR</b>                                | Highly Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
| <b>R</b>                                 | Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
| <b>LS / UR</b>                           | Reasonable to use, but limited study in target group / Unable to Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
| <b>NR</b>                                | Not Recommended                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
|                                          | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months) |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |
|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                               |                                |           |                  |          |           |                |                                                                            |           |                 |  |                                                                                              |                                                               |                                |  |  |  |  |

|                     |           |           |           |
|---------------------|-----------|-----------|-----------|
| <b>StrokEDGE II</b> | <i>UR</i> | <i>UR</i> | <i>UR</i> |
|---------------------|-----------|-----------|-----------|

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>MS EDGE</b>      | <i>NR</i>         | <i>NR</i>                       | <i>NR</i>                       | <i>NR</i>                        | <i>NR</i>          |
| <b>StrokEDGE II</b> | <i>NR</i>         | <i>UR</i>                       | <i>UR</i>                       | <i>UR</i>                        | <i>UR</i>          |

Recommendations based on EDSS Classification:

|                | <b>EDSS 0.0 – 3.5</b> | <b>EDSS 4.0 – 5.5</b> | <b>EDSS 6.0 – 7.5</b> | <b>EDSS 8.0 – 9.5</b> |
|----------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <b>MS EDGE</b> | <i>NR</i>             | <i>NR</i>             | <i>NR</i>             | <i>NR</i>             |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|---------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>MS EDGE</b>      | <i>No</i>                                                   | <i>No</i>                                        | <i>No</i>                                                          | <i>Yes</i>                                                  |
| <b>StrokEDGE II</b> | <i>No</i>                                                   | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Yes</i>                                                  |

#### Considerations

It is unlikely that the entire test will be performed in any of these practice settings, however components of the test may be appropriate if the systems review/screening exam indicates sensory loss and/or if sensory loss is hypothesized to underlie the patient's movement dysfunction.

Clinical utility is poor due to the time to complete the entire test and the need for specific equipment that may not be available in the clinic (e.g. neurotip). The stereognosis and kinesthesia subscales have better clinical utility (equipment and time). Those two tests may be more appropriate for use in the clinic

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | <p>that they use standardized equipment procedures and have some acceptable psychometric data available.</p> <p>The inclusion of sensory outcome measure in clinical trials could advance knowledge by identifying those intervention that are associated with sensory improvement as well as helping to determine those client characteristics (beyond motor and functional status) that are associated with improvement following selected interventions. This information would assist clinicians to target appropriate interventions based on client baseline characteristics.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Bibliography</b> | <p>Meyer S, De Bruyn N et al. (2016). Associations Between Sensorimotor Impairments in the Upper Limb at 1 Week and 6 Months Post-Stroke. JNPT 40:186-195. "Find it on PubMed"</p> <p>Scalha TB, Miyasaki E et al. (2011). Correlations between motor and sensory functions in upper limb chronic hemiparetics after stroke. Arq Neuropsiquiatr 69(4): 624-629. "Find it on PubMed"</p> <p>Connell LA, Lincoln NB, Radford KA (2008). Somatosensory impairment after stroke: frequency of different deficits and their recovery. Clin Rehab 22: 758-767, "Find it on PubMed"</p> <p>Stolk-Hornsveld, F., Crow, J. L., et al. (2006). "The Erasmus MC modifications to the (revised) Nottingham Sensory Assessment: a reliable somatosensory assessment measure for patients with intracranial disorders." Clin Rehabil 20(2): 160-172. <a href="#">Find it on PubMed</a></p> <p><a href="#">Gaubert CS and Mockett SP (2000). Inter-rater reliability of the Nottingham method of stereognosis assessment. 14: 153-159. "Find it on PubMed"</a></p> |

|                                 |                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>Lincoln, N., Jackson, J., et al. (1998). "Reliability and revision of the Nottingham Sensory Assessment for stroke patients." <i>Physiotherapy</i> 84(8): 358-365. <a href="#">Find it on PubMed</a></p> <p>Lincoln, N. B., Crow, J., et al. (1991). "The unreliability of sensory assessments." <i>Clinical rehabilitation</i> 5(4): 273-282. <a href="#">Find it on PubMed</a></p> |
| <b>Year published</b>           | 2011                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                |

## 22. REHAB MEASURES DATABASE: ORPINGTON PROGNOSTIC SCALE

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                   |               |                                |                    |                  |               |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------|---------------|--------------------------------|--------------------|------------------|---------------|
| Link to instrument             | <a href="#">Can be found on the Stroke Center Website (external link)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |                   |               |                                |                    |                  |               |
| Title of Assessment            | Orpington Prognostic Scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                   |               |                                |                    |                  |               |
| Acronym                        | OPS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                   |               |                                |                    |                  |               |
| Instrument Reviewer(s)         | Updated by Carmen Capo-Lugo, PT, PhD and Dorian Rose PT, PhD of the Stroke Edge II Task Force in 2016.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                   |               |                                |                    |                  |               |
| Summary Date                   | 3/7/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                   |               |                                |                    |                  |               |
| Purpose                        | Assessment of stroke severity (e.g., motor deficits, proprioception, balance and cognition)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                   |               |                                |                    |                  |               |
| Description                    | <p>The OPS assessment includes measures of motor deficit (arm), proprioception, balance and cognition.</p> <p>The OPS is based on an earlier prognostic tool, the Edinburgh Prognostic Score (Prescott et al, 1982) but adds an assessment of cognitive dysfunction (Kalra &amp; Crome, 1993).</p> <p>OPS scores range from 1.6 to 6.8 such that higher scores indicate greater deficit (Kalra &amp; Crome, 1993; Kalra et al, 1994; Lai et al, 1998).</p> <p>Deficits can be categorized as (Kalra and Crome, 1993; Lai et al, 1998):</p> <table><tr><td>Mild to moderate:</td><td>(scores &lt;3.2)</td></tr><tr><td>Moderate to moderately severe:</td><td>(scores 3.2 – 5.2)</td></tr><tr><td>Severe or major:</td><td>(scores &gt;5.2)</td></tr></table> |  | Mild to moderate: | (scores <3.2) | Moderate to moderately severe: | (scores 3.2 – 5.2) | Severe or major: | (scores >5.2) |
| Mild to moderate:              | (scores <3.2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                   |               |                                |                    |                  |               |
| Moderate to moderately severe: | (scores 3.2 – 5.2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |                   |               |                                |                    |                  |               |
| Severe or major:               | (scores >5.2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                   |               |                                |                    |                  |               |
| Area of Assessment             | Activities of Daily Living                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                   |               |                                |                    |                  |               |
| Body Part                      | Not Applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                   |               |                                |                    |                  |               |
| ICF Domain                     | Body Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                   |               |                                |                    |                  |               |
| Domain                         | Motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                   |               |                                |                    |                  |               |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Assessment Type</b>                                  | Observer                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Length of Test</b>                                   | 05 Minutes or Less                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Time to Administer</b>                               | 5 minutes                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Number of Items</b>                                  | Not applicable                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Equipment Required</b>                               | None Necessary                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Training Required</b>                                | None Necessary                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Type of training required</b>                        | No Training                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Cost</b>                                             | Free                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Actual Cost</b>                                      | Free                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Age Range</b>                                        | Adult: 18-64 years                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Administration Mode</b>                              | Paper/Pencil                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Diagnosis</b>                                        | Stroke                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Populations Tested</b>                               | Stroke                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Standard Error of Measurement (SEM)</b>              | Not Established                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Minimal Detectable Change (MDC)</b>                  | Not Established                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Minimally Clinically Important Difference (MCID)</b> | Not Established                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Cut-Off Scores</b>                                   | <p><b><u>Acute Stroke:</u></b> (Kalra &amp; Crome, 1993; <math>n = 96</math>; assessed 1, 2, and 4 and 16 weeks post stroke; Kalra &amp; Eade, 1995; <math>n = 71</math>)</p> <ul style="list-style-type: none"> <li>• Scores &lt; 3.2 indicate a high likelihood of returning home.</li> <li>• Scores that fall between 3.2 and 5.2 generally respond better to rehabilitation.</li> </ul> |

- Patients with scores > 5.2 are typically dependent with an increased risk of institutionalization.

## Normative Data

**Chronic & Acute Stroke:** (Rieck & Moreland, 2005;  $n = 65$ ; mean age = 77 (9.0) years; 41% had a previous stroke)

### OPS total scores by discharge location\*

|                                                                  | Day 7 OPS total |          | Day 14 OPS total |          |
|------------------------------------------------------------------|-----------------|----------|------------------|----------|
| <b>Home:</b>                                                     | 3.2 (1.6 – 6.4) | $n = 45$ | 3.2 (1.6 – 5.2)  | $n = 34$ |
| <b>Family's Home:</b>                                            | 3.6 (2.4 – 4.4) | $n = 4$  | .6 (2.4 – 4.0)   | $n = 3$  |
| <b>Retirement Home:</b>                                          | 3.0 (2.0 – 4.4) | $n = 8$  | 2.8 (2.0 – 5.2)  | $n = 6$  |
| <b>Nursing Home:</b>                                             | 4.8 (3.2 – 6.4) | $n = 14$ | 5.0 (2.8 – 6.8)  | $n = 16$ |
| <b>Expired:</b>                                                  | 6.0 (4.8 – 6.4) | $n = 5$  | 6.4 (6.0 – 6.8)  | $n = 3$  |
| <b>Transferred out of hospital to other rehabilitation unit:</b> | 4.0 (2.8 – 6.8) | $n = 5$  | 4.4 (3.2 – 6.4)  | $n = 6$  |

\*median (minimum–maximum)

### Comparison of findings at day 14:

|                                    | Rieck (2005) | Kalra (1993) |
|------------------------------------|--------------|--------------|
| <b>Discharge home</b>              | < 4.8        | 1.6 – 5.2    |
| <b>Discharge to Long Term Care</b> | 5.4 – 6.8    | 2.8 – 6.8    |

## Test-retest Reliability

**Chronic & Acute Stroke:** (Rieck & Moreland, 2005;  $n = 27$ ; mean age 76 (12.2) years; sample included patients with prior stroke)

|                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                   | <ul style="list-style-type: none"> <li>• <b>Excellent</b> test-retested reliability (ICC = 0.95)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Interrater/Intrarater Reliability</b>          | <p><b>Chronic &amp; Acute Stroke:</b> (Rieck &amp; Moreland, 2005; <math>n = 65</math>; mean age 77 (9) years; assessed 7 and 14 days post stroke by two physiotherapists; sample included patients with prior stroke)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> inter-rater reliability (ICC = 0.99)</li> <li>• <b>Excellent</b> inter-rater reliability (weighted kappa = 0.84 - balance)</li> </ul> <p><b>Acute Stroke:</b> (Weir et al, 2003; prospectively <math>n = 2</math> clinicians and 92 patients / retrospectively <math>n = 2</math> auditors &amp; 200 patients)</p> <ul style="list-style-type: none"> <li>• <b>Adequate</b> inter-rater reliability (weighted kappa = 0.53-proprioception; 0.64-cognition; 0.72 motor deficit)</li> </ul>                                                                                                                                                                                                                                                                                             |
| <b>Internal Consistency</b>                       | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Criterion Validity (Predictive/Concurrent)</b> | <p><b>Acute Stroke:</b> (Brott et al, 1989; Wright, Swinton &amp; Green, 2004; Celik, Aksel &amp; Karaoglan, 2006)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> concurrent validity with NIHSS (see below for specific values by study):</li> </ul> <p>Study 1: NIHSS (<math>\rho = 0.83</math>)<br/> Study 2: NIHSS (<math>\rho = 0.60</math>)<br/> Study 3: NIHSS (<math>\rho = 0.76</math>)</p> <p><b>Acute Stroke:</b> (Kalra &amp; Crome, 1993; Studenski et al, 2001; <math>n = 413</math>; 3 to 14 days post stroke)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> predictive validity:</li> </ul> <p>Predicts Barthel Index ADL scores at discharge.</p> <p>A better predictor of Barthel Index scores (<math>R\text{-sqr} = 0.89</math>) when compared to Edinburgh Prognostic Score (<math>R\text{-sqr} = 0.57</math>)</p> <p>Predicts Barthel Index ADL and Sf-36 Physical Function scores at 1, 3, and 6 months post-stroke</p> <ul style="list-style-type: none"> <li>• <b>Adequate</b> predictive validity with:</li> </ul> |

Functional Recovery Rate (OPS cut-offs <2.4 and >4.4 at 3 months)

**Chronic Stroke** (Alghwiri, 2015; n=61; mean 3.3 months post-stroke. All assessments were conducted in Arabic.)

| OPS Level | BDI Score | DGI Score | SIS-16 Score |
|-----------|-----------|-----------|--------------|
| Mild      | 22.7      | 35.2      | 35.6         |
| Moderate  | 37.3      | 22.2      | 23.1         |
| Severe    | 38.7      | 7.2       | 25.6         |

The non-parametric Kruskal-Wallis H test was used to assess any differences between participant's depression, balance, and self-reported physical performance measurements among OPS levels of stroke severity. Beck Depression Scores (BDI) revealed higher depressive symptoms with increasing severity of stroke as measured by the OPS. Similarly more severe stroke levels showed lower balance ability (DGI Score) and lower self-reported physical functioning (Stroke Impact Scale -16).

#### Construct Validity (Convergent/Discriminant)

##### Convergent validity:

**Acute Stroke:** (Meldrum et al, 2004; OPS performed within 48 hours of admission; Pittock et al. 2003; n = 117; assessed 48 hours post stroke and again 6 and 24 months later)

- OPS administered 2 days post-stroke demonstrated adequate predictive validity of upper limb function at 6 and 24 months post stroke
- OPS administered within 2 days of stroke predicted Rivermead Motor Assessment, Oxford Handicap Scale, Barthel Index and length of stay at 6 and 24 months. Results suggest significant convergence in predicted motor performance, disability level, ADL and length of stay (particularly at month 6).

| Content Validity                                 | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                          |  |  |  |              |              |             |     |                   |             |     |                   |          |     |                   |                                                  |      |                   |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--|--|--|--------------|--------------|-------------|-----|-------------------|-------------|-----|-------------------|----------|-----|-------------------|--------------------------------------------------|------|-------------------|
| Face Validity                                    | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                          |  |  |  |              |              |             |     |                   |             |     |                   |          |     |                   |                                                  |      |                   |
| Floor/Ceiling Effects                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                          |  |  |  |              |              |             |     |                   |             |     |                   |          |     |                   |                                                  |      |                   |
| Responsiveness                                   | <p><b><u>Comparison of Results across studies:</u></b> (Rieck &amp; Moreland, 2005)</p> <table><tr><th colspan="3">Predictive statistics comparing results:</th></tr><tr><th></th><th>Kalra (1994)</th><th>Rieck (2005)</th></tr><tr><td>Sensitivity</td><td>96%</td><td>82% (0.68 – 0.93)</td></tr><tr><td>Specificity</td><td>36%</td><td>42% (0.25 – 0.61)</td></tr><tr><td>Accuracy</td><td>75%</td><td>65% (0.52 – 0.76)</td></tr><tr><td>Positive Predictive Value (going home) OPS &lt; 3.0</td><td>100%</td><td>81% (0.58 – 0.95)</td></tr></table>                                                                                                                                                                                                                                                                     | Predictive statistics comparing results: |  |  |  | Kalra (1994) | Rieck (2005) | Sensitivity | 96% | 82% (0.68 – 0.93) | Specificity | 36% | 42% (0.25 – 0.61) | Accuracy | 75% | 65% (0.52 – 0.76) | Positive Predictive Value (going home) OPS < 3.0 | 100% | 81% (0.58 – 0.95) |
| Predictive statistics comparing results:         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                          |  |  |  |              |              |             |     |                   |             |     |                   |          |     |                   |                                                  |      |                   |
|                                                  | Kalra (1994)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Rieck (2005)                             |  |  |  |              |              |             |     |                   |             |     |                   |          |     |                   |                                                  |      |                   |
| Sensitivity                                      | 96%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 82% (0.68 – 0.93)                        |  |  |  |              |              |             |     |                   |             |     |                   |          |     |                   |                                                  |      |                   |
| Specificity                                      | 36%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 42% (0.25 – 0.61)                        |  |  |  |              |              |             |     |                   |             |     |                   |          |     |                   |                                                  |      |                   |
| Accuracy                                         | 75%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 65% (0.52 – 0.76)                        |  |  |  |              |              |             |     |                   |             |     |                   |          |     |                   |                                                  |      |                   |
| Positive Predictive Value (going home) OPS < 3.0 | 100%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 81% (0.58 – 0.95)                        |  |  |  |              |              |             |     |                   |             |     |                   |          |     |                   |                                                  |      |                   |
| Professional Association Recommendations         | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association’s Multiple Sclerosis Taskforce (MSEdge), Parkinson’s Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> |                                          |  |  |  |              |              |             |     |                   |             |     |                   |          |     |                   |                                                  |      |                   |

#### Abbreviations:

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post) | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months) |
|---------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|
| <b>StrokEDGE II</b> | <i>HR</i>                                                                                    | <i>NR</i>                                                     | <i>NR</i>                      |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>StrokEDGE II</b> | <i>HR</i>         | <i>HR*</i>                      | <i>NR</i>                       | <i>NR</i>                        | <i>NR</i>          |

\*If within 2 weeks post-stroke

Recommendations for entry-level physical therapy education and use in research:

|                                            |                           |                                             |                               |
|--------------------------------------------|---------------------------|---------------------------------------------|-------------------------------|
| <b>Students should learn to administer</b> | <b>Students should be</b> | <b>Appropriate for use in interventions</b> | <b>Is additional research</b> |
|--------------------------------------------|---------------------------|---------------------------------------------|-------------------------------|

|                          | er this<br>tool?<br>(Y/N)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | expose<br>d to<br>tool?<br>(Y/N) | on<br>research<br>studies?<br>(Y/N) | warrant<br>ed for<br>this tool<br>(Y/N) |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------------------|-----------------------------------------|
| <b>StrokED<br/>GE II</b> | <i>No</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <i>Yes</i>                       | <i>Yes</i>                          | <i>Not<br/>reported</i>                 |
| <b>Considerations</b>    | <ul style="list-style-type: none"> <li>• Should not be used for acute prognosis (Kalra et al, 1994).</li> <li>• Scale should only be used when the patient's neurological condition has stabilized</li> <li>• Optimal predictive power was observed when administered 2 weeks post stroke (Kalra et al, 1994)</li> </ul> <p>Do you see an error or have a suggestion for this instrument summary? Please <a href="#">e-mail us</a>!</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                  |                                     |                                         |
| <b>Bibliography</b>      | <p>Alghwiri AA. The correlation between depression, balance, and physical functioning post stroke. Journal of Stroke and Cerebrovascular Diseases. 2015. <a href="#">Find it on PubMed</a></p> <p>Brott, T., Adams, H. P., Jr., et al. (1989). "Measurements of acute cerebral infarction: a clinical examination scale." Stroke 20(7): 864-870. <a href="#">Find it on PubMed</a></p> <p>Celik, C., Aksel, J., et al. (2006). "Comparison of the Orpington Prognostic Scale (OPS) and the National Institutes of Health Stroke Scale (NIHSS) for the prediction of the functional status of patients with stroke." Disabil Rehabil 28: 609-612. <a href="#">Find it on PubMed</a></p> <p>Kalra, L. and Crome, P. (1993). "The role of prognostic scores in targeting stroke rehabilitation in elderly patients." J Am Geriatr Soc 41(4): 396-400. <a href="#">Find it on PubMed</a></p> <p>Kalra, L., Dale, P., et al. (1994). "Evaluation of a clinical score for prognostic stratification of elderly stroke patients." Age Ageing 23: 492-498. <a href="#">Find it on PubMed</a></p> <p>Lai, S. M., Duncan, P. W., et al. (1998). "Prediction of functional outcome after stroke: comparison of the</p> |                                  |                                     |                                         |

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|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>Orpington Prognostic Scale and the NIH Stroke Scale." Stroke 29: 1838-1842. <a href="#">Find it on PubMed</a></p> <p>Mahoney, F. (1965). "The Barthel Index." Maryland State Med J 14: 61-65. <a href="#">Find it on PubMed</a></p> <p>Meldrum, D., Pittock, S. J., et al. (2004). "Recovery of the upper limb post ischaemic stroke and the predictive value of the Orpington Prognostic Score." Clin Rehabil 18: 694-702. <a href="#">Find it on PubMed</a></p> <p>Prescott, R. J., Garraway, W. M., et al. (1982). "Predicting functional outcome following acute stroke using a standard clinical examination." Stroke 13: 641-647. <a href="#">Find it on PubMed</a></p> <p>Rieck, M. and Moreland, J. (2005). "The Orpington Prognostic Scale for patients with stroke: reliability and pilot predictive data for discharge destination and therapeutic services." Disabil Rehabil 27: 1425-1433. <a href="#">Find it on PubMed</a></p> <p>Studenski, S. A., Wallace, D., et al. (2001). "Predicting stroke recovery: three- and six-month rates of patient-centered functional outcomes based on the orpington prognostic scale." J Am Geriatr Soc 49(3): 308-312. <a href="#">Find it on PubMed</a></p> <p>Weir, N. U., Counsell, C. E., et al. (2003). "Reliability of the variables in a new set of models that predict outcome after stroke." J Neurol Neurosurg Psychiatry 74: 447-451. <a href="#">Find it on PubMed</a></p> <p>Wright, C. J., Swinton, L. C., et al. (2004). "Predicting final disposition after stroke using the Orpington Prognostic Score." Can J Neurol Sci 31(4): 494-498. <a href="#">Find it on PubMed</a></p> |
| <b>Year published</b>           | 1993                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

### 23. REHAB MEASURES DATABASE: POSTURAL ASSESSMENT SCALE FOR STROKE

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of Assessment</b>    | Postural Assessment Scale for Stroke                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Acronym</b>                | PASS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Instrument Reviewer(s)</b> | <p>Reviewed by the StrokEDGE Task Force, Neurology Section, APTA , 2011</p> <p>Reviewed by Shweta Subramani on 12/04/2014</p> <p>Updated by Heather Anderson and Rie Yoshida from the StrokEdge II Task Force, Neurology Section, APTA on 4/11/16.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Summary Date</b>           | 4/11/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Purpose</b>                | It is a 12 item performance-based scale used for assessing and monitoring postural control following stroke.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b>            | <p>It is specially designed for individuals with stroke regardless of their postural competence.</p> <p>It is especially sensitive for assessment of postural control in the first 3 months and can discriminate between right and left brain damage in individuals with stroke.</p> <p>It measures the ability of an individual with stroke to maintain stable postures and equilibrium during positional changes</p> <p>The scale comprises of 12 items with increasing difficulty which measure balance and functional ability. Each item is scored on a 4 point scale where the items are scored from 0 to 3 and the total scoring ranges from 0 to 36. Test activities include:</p> <ol style="list-style-type: none"> <li>1. Sitting without support (sitting on the edge of an 50-cm-high examination with the feet touching the floor)</li> <li>2. Standing with support (feet position free, no other constraints)</li> <li>3. Standing without support (feet position free, no other constraints)</li> <li>4. Standing on non-paretic leg (no other constraints)</li> </ol> |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <p>5. Standing on paretic leg (no other constraints)</p> <p>6. Supine to affected side lateral</p> <p>7. Supine to non-affected side lateral</p> <p>8. Supine to sitting up on the edge of the table</p> <p>9. Sitting on the edge of the table to supine</p> <p>10. Sitting to standing up</p> <p>11. Standing up to sitting down</p> <p>12. Standing, picking up a pencil from the floor</p> <p>Modified versions of the PASS include the PASS trunk control items (PASS-TC) and the Short-Form PASS (SFPASS). Both have 5 items instead of the original 12 included with the PASS.</p> |
| <b>Area of Assessment</b>        | Functional balance in supine, sitting and standing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Body Part</b>                 | Trunk and Lower extremity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>ICF Domain</b>                | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Domain</b>                    | Motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Assessment Type</b>           | Performance measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Length of Test</b>            | 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Time to Administer</b>        | 10 minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Number of Items</b>           | 12 items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Equipment Required</b>        | <p>50cm-high examination table (e.g. Bobath plane)</p> <p>Stop watch</p> <p>Pen</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Training Required</b>         | No specific manual or training required, but it is essential that the clinician using the scale must be aware of balance impairments and safety issues following stroke                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Type of training required</b> | No Training                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Cost</b>                                             | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Actual Cost</b>                                      | Cost of equipment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Age Range</b>                                        | Adults                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Administration Mode</b>                              | Paper/pencil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Diagnosis</b>                                        | Stroke                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Populations Tested</b>                               | Stroke patients                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Standard Error of Measurement (SEM)</b>              | <p><b><u>Chronic Stroke:</u></b> (Liaw et al, 2008; n=52; mean age= 60.4(13.4);time since stroke onset = 6 to 292 months; Liaw et al, 2012; n = 52; mean age = 60.4 (13.4) years; time since stroke onset = 13.3-53.5 months)</p> <ul style="list-style-type: none"> <li>• 1.14 points for PASS (Liaw et al, 2008)</li> <li>• 0.78 point for SFPASS (Liaw et al, 2012)</li> </ul> <p><b><u>Acute Stroke:</u></b> (Chien et al, 2007b; n=287; mean age= 65.5(11.3); 14 days post stroke)</p> <ul style="list-style-type: none"> <li>• 2.4 points (<math>\pm</math> 4.7 points, 95% CI)</li> </ul>                                                                           |
| <b>Minimal Detectable Change (MDC)</b>                  | <p><b><u>Sub-acute Stroke:</u></b> (Chien et al, 2007a; n=40; mean age=58.6+/-12.0)</p> <ul style="list-style-type: none"> <li>• MDC at an individual score level: 2.22 points (95% CI)</li> <li>• MDC at a group score level: 0.50 points (95% CI)</li> </ul> <p><b><u>Chronic Stroke:</u></b></p> <ul style="list-style-type: none"> <li>• MDC of PASS: 3.2 points (Liaw et al, 2008)</li> <li>• MDC of SFPASS: 2.2 points (Liaw et al, 2012)</li> </ul> <p>Acute Stroke: (Hsuen et al, 2013; n = 251; mean age 67.3 + 10.9; 14 and 30 days post stroke)</p> <ul style="list-style-type: none"> <li>• MDC mean individual ratio of PASS 1.8; SD= 1.7 (95% CI)</li> </ul> |
| <b>Minimally Clinically Important Difference (MCID)</b> | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Cut-Off Scores</b>                                   | <p><b><u>Acute Stroke:</u></b> (Huang et al, 2016; n = 341; mean age = 63 (13.28) for ambulatory group and 69 (13.83) for non-ambulatory group; mean time since stroke = 26.22 (30.30) days for ambulatory group and 31.05 (39.42) days for non-ambulatory group; Taiwanese study)</p> <ul style="list-style-type: none"> <li>• 3.5 points for static PASS (sensitivity 77.9%, specificity 82.1%)</li> </ul>                                                                                                                                                                                                                                                               |

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          | <ul style="list-style-type: none"> <li>• 8.5 points for dynamic PASS (sensitivity 77.9%, specificity 82.5%)</li> <li>• 12.5 points for total PASS (sensitivity 78.9%, specificity 83.7%)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Normative Data</b>                    | <p><b><u>Healthy older adults:</u></b> (Benaim et al, 1999; n=30; mean age= 63.3+/- 1.5 years)</p> <ul style="list-style-type: none"> <li>• Mean PASS score =35.7 points, range= 32 to 36 points</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Test-retest Reliability</b>           | <p><b><u>Chronic Stroke:</u></b></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> test-retest reliability (Intra Class Coefficient (ICC)=0.84) (Chien et al, 2007a)</li> <li>• <b>Excellent</b> relative test-retest reliability (ICC=0.97) over 7 days (Liaw et al, 2008)</li> <li>• <b>Excellent</b> test-retest reliability in SFPASS (ICC = 0.93) (Liaw et al, 2012)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Interrater/Intrarater Reliability</b> | <p><b><u>Interrater reliability:</u></b></p> <p><b><u>Acute/Subacute Stroke:</u></b> (Benaim et al, 1999; n=12; 30 and 90 days post stroke)</p> <ul style="list-style-type: none"> <li>• <b>Adequate to excellent</b> inter-rater reliability for individual items (average alpha=0.88, range 0.64-1)</li> <li>• <b>Excellent</b> inter-rater reliability for total score (r=0.99, p&lt;0.001)</li> </ul> <p><b><u>Acute Stroke:</u></b> (Mao et al, 2002; n=112; mean age=69.3+/-11.2; 14 days post stroke)</p> <ul style="list-style-type: none"> <li>• <b>Adequate to excellent</b> inter-rater reliability for individual items (median alpha=0.88, range 0.61-0.96)</li> <li>• <b>Excellent</b> inter-rater reliability (ICC=0.97, 95% confidence interval (CI 0.95-0.98)) for total score.</li> </ul> <p><b><u>Acute Stroke:</u></b> (Hsieh et al, 2002; n=169; mean age= 66.8(11.3))</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> inter-rater reliability of the trunk control items (PASS-TC: items 1,6,7,8,9 ICC =0.97)</li> </ul> <p><b><u>Intrarater reliability:</u></b></p> <p><b><u>Acute/Subacute Stroke:</u></b> (Benaim et al, 1999)</p> <ul style="list-style-type: none"> <li>• <b>Good</b> intrarater reliability for individual items (average k=0.72, range 0.45-1)</li> </ul> |

|                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                               | <ul style="list-style-type: none"> <li>• <b>Excellent</b> intrarater reliability for total score (<math>r=0.98</math>, <math>p&lt;0.001</math>)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Internal Consistency                          | <p><b><u>Stroke:</u></b></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> internal consistency <ul style="list-style-type: none"> <li>o Cronbach's <math>\alpha=0.95</math> (Benaïm et al, 1999-acute/subacute)</li> <li>o Cronbach's <math>\alpha=0.94-0.96</math> at 14, 30, 90 and 180 days post stroke (Mao et al, 2002)</li> <li>o Cronbach's <math>\alpha=0.93-0.94</math> (Hsieh et al, 2002-acute)</li> <li>o Cronbach's <math>\alpha=0.96</math> (Chien et al, 2007b-acute)</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Criterion Validity<br>(Predictive/Concurrent) | <p><b>Concurrent validity:</b></p> <p><b><u>Acute Stroke:</u></b> (Mao et al, 2002)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> relationship with Fugl-Meyer Assessment modified balance scale (FMA-B) (<math>p=0.95-0.97</math>) and Berg Balance Scale (BBS) (<math>p=0.92-0.95</math>)</li> </ul> <p><b><u>Acute/Subacute Stroke:</u></b> (Wang et al, 2004; <math>n=77</math>; mean age= 59.8(11.9); 14, 30 and 90 days post stroke)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> relationship between all measures (PASS, PASS-3P, BBS and BBS-3P) (<math>\rho \geq 0.91</math>, <math>P&lt;0.0001</math>)</li> <li>• <b>Excellent</b> relationship with BBS (<math>p=0.94</math>, <math>P&lt;0.0001</math>) and with PASS-3P (<math>p=0.94</math>, <math>P&lt;0.0001</math>; ICC=0.97, 95%CI 0.96-0.98)</li> </ul> <p><b><u>Acute Stroke:</u></b> (Chien et al, 2007b)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> relationship with the SFPASS (ICC=0.98; 96% variance) in 287 individuals at 14 days post stroke</li> <li>• <b>Excellent</b> relationship with the SFPASS (ICC=0.98) in 179 individuals with stroke</li> </ul> <p><b><u>Acute Stroke:</u></b> (Di Monaco et al, 2010; <math>n=60</math>; mean age= 68.0(12.2); mean time post stroke= 21.4 (13.3) days)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> relationship with the Trunk Impairment Scale (TIS) (<math>p=0.849</math>, <math>P&lt;0.001</math>)</li> </ul> <p><b>Predictive validity:</b></p> <p><b><u>Acute/Subacute Stroke:</u></b> (Benaïm et al, 1999)</p> |

- **Good** predictive validity of PASS total score ( $r=0.75, p<0.001$ ), transfer items ( $r=0.74, p<0.006$ ) and locomotion items ( $r=0.71, p<0.001$ ) at 30 days post stroke when compared with Functional Independence measure (FIM) scores at 90 days post stroke

**Acute Stroke:** (Mao et al, 2002)

- **Excellent** predictive validity of PASS ( $p=0.86-0.90$ ) at 14, 30 and 90 days post stroke when compared with the walking subscale of the Motor Assessment Scale at 180 days post stroke

**Acute Stroke:** (Hsieh et al, 2002)

- **Excellent** predictive validity of the trunk control items of PASS (PASS-TC: items 1,6,7,8,9) ( $r=0.68, p<0.001$ ) at 14 days post stroke when compared with Barthel Index (BI) and Frenchay Activities Index (FAI) at 6 months post stroke

**Stroke:** (Wang et al, 2004;  $n=226$  and  $n=202$ ; 14 and 30 days post stroke)

- **Excellent** predictive validity of PASS and modified PASS that used 3-level scale (12-item PASS-3P) at 14 days ( $p=0.78$ ) and 30 days ( $p=0.82$ ) post-stroke when compared with BI scores at 90 days post-stroke

**Acute Stroke:** (Chien et al, 2007b)

- **Adequate** predictive validity of PASS ( $r=0.49$ ) and SFPASS ( $r=0.48$ ) at 14 days post-stroke when compared with BI scores at 90 days post-stroke
- **Excellent** predictive validity of PASS ( $r=0.83$ ) and SFPASS ( $0.82$ ) on replication of the process in 179 individuals following stroke on admission to rehabilitation with BI scores on discharge from hospital

**Acute Stroke:** (Di Monaco et al, 2010)

- **Excellent** predictive validity of PASS ( $p=0.687, p<0.001$ ) on admission to inpatient rehabilitation when compared with FIM discharge scores

**Acute Stroke:** (Yu et al, 2012;  $n=85$ ; mean age = 65 (11.6) years, mean time since stroke onset = 19 (5-79) days)

- **Sufficient** predictive validity of PASS, when compared with BI ( $r^2=0.39, p<0.001$ ) and Stroke Rehabilitation Assessment of

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                              | <p>Movement mobility subscale (MO-STREAM) (<math>r^2=0.63, p&lt;0.001</math>) discharge scores</p> <p><b><u>Acute Stroke (Yu et al., 2013); n=66; mean age: 63.1 yrs (12.2); 18 days (6-64) post stroke</u></b></p> <ul style="list-style-type: none"> <li>• Predictive validity of PASS at rehab admission compared to Barthel Index at Discharge (mean = 31 days (6-76); <math>r=0.69</math> (<math>p&lt;0.001</math>))</li> <li>• Predictive validity of PASS at rehab admission compared to MO-STREAM at Discharge (mean = 31 days (6-76); <math>r=0.80</math> (<math>p&lt;0.001</math>))</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Construct Validity (Convergent/Discriminant) | <p><b><u>Acute/Subacute Stroke:</u></b> (Benaïm et al, 1999)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> correlations between PASS and FIM total score (<math>r=0.73</math>), transfer tasks (<math>r=0.82</math>) and locomotor tasks (<math>r=0.73</math>); and motricity scores of lower limb (<math>r=0.78</math>) and upper limb (<math>r=0.63</math>)</li> <li>• <b>Adequate</b> negative correlations with the star cancellation test of spatial inattention (<math>r=0.53</math>) and lower limb pressure sensitivity (<math>r=0.45</math>) as well as upper limb pressure sensitivity (<math>r=0.42</math>)</li> <li>• <b>Adequate</b> negative correlations with measurement of postural stabilization (<math>r=0.48</math>) and postural orientation with respect to gravity (<math>r=0.36</math>) (Benaïm et al, 1999; <math>n=31</math>; 90 days post stroke)</li> </ul> <p><b><u>Acute Stroke:</u></b> (Mao et al, 2002)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> convergent validity between PASS and BI (<math>p=0.88-0.92</math>)</li> </ul> <p><b><u>Acute Stroke:</u></b> (Hsieh et al, 2002)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> convergent validity of PASS-TC with BI (<math>r=0.89</math>) and with the Fugl-Meyer balance test (FM-B) (<math>r=0.73</math>)</li> </ul> <p><b><u>Stroke:</u></b> (Wang et al, 2004)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> convergent validity of the PASS and PASS 3P with BI (<math>p=0.84, p=0.82</math> respectively)</li> </ul> <p><b><u>Acute Stroke:</u></b> (Chien et al, 2007b)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> correlations between the PASS, SF PASS and BI, (PASS <math>R=0.87</math>; SFPASS <math>r=0.86</math>) and between the PASS, SFPASS and FIM (PASS <math>r=0.75</math>; SFPASS <math>r=0.75</math>)</li> </ul> |

**Acute stroke:** (Chinsongkram et al, 2014;  $n = 70$ , mean age = 57 (12.24) years; mean time since stroke = 1.11 (2.00) month; Thai study)

- **Excellent** convergent validity with BESTest ( $r = 0.96$ )

**Chronic stroke:** (Lin et al, 2010;  $n = 45$ , mean age =  $60 \pm 12.6$  years; mean time since stroke = 9 (3-22) months; tested after 1 week, 2 months and 5 months of outpatient therapy; Taiwanese study)

- **Moderate to high** convergent validity ( $\rho$ ) with DGI, DGI-4, and FGA

| Time point of assessment      | PASS vs DGI | PASS vs DGI-4 | PASS vs FGA |
|-------------------------------|-------------|---------------|-------------|
| 1 <sup>st</sup> wk of therapy | 0.85        | 0.75          | 0.83        |
| 2 mos after therapy           | 0.76        | 0.74          | 0.75        |
| 5 mos after therapy           | 0.83        | 0.78          | 0.83        |

**Subacute Stroke:** Huang et al., 2016;  $n=341$ ; mean days post stroke = 34.40; retrospective study completed in Taiwan

**PASS cut-off scores predictive of patient ambulation at discharge:**

| Scale               | Cut-off points      | Non-Ambulatory n, %     | Ambulatory n, %       | Sensitivity/ Specificity | ROC curve AUC | PPV   |
|---------------------|---------------------|-------------------------|-----------------------|--------------------------|---------------|-------|
| <b>Static PASS</b>  | < 3.5<br>$\geq 3.5$ | 202; 59.2%<br>44; 12.9% | 21; 6.2%<br>74; 21.7% | 77.9%/<br>82.1%          | 0.860         | 0.627 |
| <b>Dynamic PASS</b> | < 8.5<br>> 8.5      | 203; 59.5%<br>43; 12.6% | 21; 6.2%<br>74; 21.7% | 77.9%/<br>82.5%          | 0.876         | 0.632 |
| <b>Total PASS</b>   | < 12.5<br>> 12.5    | 206; 60.4%<br>40; 11.7% | 20; 5.9%<br>75; 22%   | 78.9%/<br>83.7%          | 0.884         | 0.652 |

p-value for all < 0.001

AUC = Area Under Curve

PPV = positive predictive value

**Content Validity**

Not established

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Face Validity         | Not established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Floor/Ceiling Effects | <p><b><u>Acute/Subacute Stroke:</u></b> (Benaim et al, 1999; n=58; 30 and 90 days post stroke )</p> <ul style="list-style-type: none"> <li>• <b>Large</b> ceiling effects at 90 days post stroke (38%)</li> </ul> <p><b><u>Acute Stroke:</u></b> (Mao et al, 2002;14, 30, 90 and 180 days post stroke)</p> <ul style="list-style-type: none"> <li>• <b>Adequate</b> floor and ceiling effects at all time points (floor effect range 2.2-3.8%; ceiling effect range 3.3-17.5%)</li> </ul> <p><b><u>Acute stroke:</u></b> (Chinsongkram et al, 2014)</p> <ul style="list-style-type: none"> <li>• <b>Significant</b> ceiling effect (37.1% of patients received a score within the top 10% of the PASS)</li> </ul> <p><b><u>Acute Stroke:</u></b> (Hsueh et al, 2013; n = 251; mean age = 68.4 (10.4) years; assessed at 14 and 30 days after stroke onset on PASS and SFPASS; Taiwanese study)</p> <ul style="list-style-type: none"> <li>• No floor/ceiling effects for PASS (0-7.2%)</li> <li>• <b>Notable</b> floor effect (21.9%) for SFPASS at 14 days after stroke onset (but not at 30 days after stroke onset-12.7%)</li> <li>• No ceiling effect (0-14.3%) for SFPASS</li> </ul> <p><b><u>Acute Stroke</u></b> (Yu et al., 2013); n=66; mean age: 63.1 yrs (12.2); 18 days (6-64) post stroke</p> <ul style="list-style-type: none"> <li>• <b><u>Negligible to small ceiling effect at rehabilitation admission (1.5%) and at rehabilitation discharge (6.1%)</u></b></li> <li>• <b><u>No floor effect at rehabilitation admission (0%) or discharge (0%)</u></b></li> </ul> <p><b><u>Acute Stroke:</u></b> (Yu et al, 2012)</p> <ul style="list-style-type: none"> <li>• No notable floor or ceiling effect at admission (&lt; 15%)</li> </ul> |
| Responsiveness        | <p><b><u>Acute Stroke:</u></b> (Mao et al, 2002)</p> <ul style="list-style-type: none"> <li>• <b>Large</b> responsiveness of PASS from 14-30 days (Effect Size (ES)=0.89)</li> <li>• <b>Moderate</b> responsiveness from 30-90 days (ES=0.64)</li> <li>• <b>Low</b> responsiveness from 90-180 days (ES=0.31)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

- **Large** overall responsiveness from 14-180 days (ES=1.12)
- **Large** responsiveness from 14-180 days (ES=1.54) in severe stroke **Acute Stroke (Yu et al., 2013); n=66; mean age: 63.1 yrs (12.2); 18 days (6-64) post stroke**

- **Large responsiveness between rehab admission and discharge (mean = 31 days (6-76); ES=0.86; SRM=1.23**

**Stroke:** (Wang et al, 2004; n=202 and n=167; 14,30 and 90 days post stroke)

- **Large** responsiveness of the PASS and PASS-3P from 14-30 days post stroke (Standard Response Mean (SRM) =0.84 and 0.86 respectively) and from 14-90 days post stroke (SRM=1.02 and 1.04 respectively)
- **Moderate** responsiveness from 30-90 days post stroke (SRM=0.65 and 0.67 respectively)
- **Moderate** responsiveness of PASS and PASS-3P (PASS SRM range 0.43-0.78; PASS-3P SRM range 0.46-0.78) in individuals with mild stroke (Fugl Meyer motor assessment (FM) score of 80 or greater)
- **Moderate to large** responsiveness (PASS SRM range 0.52-1.12; PASS -3P SRM range 0.56-1.19) in individuals with moderate stroke (FM score 36 to 79)
- **Large** responsiveness (PASS SRM range 0.92-1.35; PASS-3P SRM range 0.92-1.34) in individuals with severe stroke (FM score 0 to 35)
- **Large** responsiveness of both measures in the period of 14-30 days and 14-90 days post stroke as compared to 30-90 days post stroke.

**Sub-acute Stroke:** (Chien et al, 2007a)

- **Small responsiveness** of the PASS (d=0.41) over an interval of 2 weeks

**Acute Stroke:** (Chien et al, 2007b)

- **Small responsiveness** of the PASS (ES=0.42)
- **Small responsiveness** of the PASS (ES=0.43) (Chien et al, 2007b; n=179 ; admission to rehabilitation to discharge from hospital)

**Acute Stroke:** (Yu et al, 2012)

- **Adequate internal responsiveness** of PASS(d=0.87)

- **Sufficient external responsiveness** (ic=0.44, r2=0.20, p<0.001), (ic=0.77, r2=0.59, p<0.001) to changes in function (BI changes scores) and changes in mobility (MO-STREAM change scores)

**Acute Stroke:** (Hsueh et al, 2013)

- Group level responsiveness: **moderate to large** responsiveness (0.46-0.91) for both PASS and SFPASS
- Individual patient-level responsiveness: **PASS more responsive than SFPASS** in that PASS detected significantly greater proportion of participants showing significant improvement than SFPASS (53% versus 43% respectively)

**Professional Association Recommendations**

American Physical Therapy Association (APTA) Neurology section's Stroke Taskforce (StrokEDGE II) recommendations on a 4 point scale-

4= highly recommended; the outcome has excellent psychometric properties and clinical utility

3= recommended; the outcome measure has good psychometric properties and good clinical utility

2= unable to recommend at this time; there is insufficient information to support a recommendation of this outcome measure

1= not recommended; the outcome measure has poor psychometric properties and/or poor clinical utility

**Practice setting**

|              | Acute | IP Rehab | Home | SNF | OP |
|--------------|-------|----------|------|-----|----|
| StrokEDGE II | 4     | 4        | 4    | 4   | 4  |

**Patient Acuity**

|              | Acute | Sub-acute                             | Chronic |
|--------------|-------|---------------------------------------|---------|
| StrokEDGE II | 4     | 1-3 (most appropriate within 90 days) | 1       |

**Education**

|  |              |                                          |                                       |                  |
|--|--------------|------------------------------------------|---------------------------------------|------------------|
|  |              | Students should learn to administer tool | Students should be exposed to tool    | Do not recommend |
|  | StrokEDGE II |                                          | x                                     |                  |
|  | Research Use |                                          |                                       |                  |
|  |              | Appropriate for research purposes        | Not appropriate for research purposes |                  |
|  | StrokEDGE II | X (acute stroke only)                    |                                       |                  |

|                |                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Considerations | <p>This scale is easy to administer with no special requirement.</p> <p>Any clinician can easily, rapidly and confidently administer the scale.</p> <p>However, the clinician must have the understanding of balance impairments and safety issues that are seen following stroke.</p> <p>It is more sensitive for assessment of stroke in the first 3 months.</p> |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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## **24.REHAB MEASURES: RPE**

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Title of Assessment</b>    | Borg Rating Scale of Perceived Exertion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Acronym</b>                | RPE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Instrument Reviewer(s)</b> | Developed by: Gayatri Mathur, PT; Updated by: Jill Smiley, MPH<br><br>Reviewed by Patricia Kluding, PhD, PT of the StrokEdge task force, Neurology Section, APTA in 2010; Updated by Dorian Rose, PhD, PT of the StrokEdge II task force, Neurology Section, APTA in 2017                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Summary Date</b>           | 7/13/2012; 1/28/17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Purpose</b>                | Used as a means to determine intensity of exercise                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b>            | <ul style="list-style-type: none"> <li>• A 15-point category scale with verbal descriptors to standardize perceived exertion across tasks and individuals.</li> <li>• Instructions for use: scale used to rate how hard person is working, explain 6=rest, 20=absolute maximum, grade effort using numbers and/or words.</li> <li>• Used as a measure for training intensity and outcomes for exercise - parallels physiological variables.</li> <li>• Many authors suggest carrying afferent input to RPE but as yet there is no consensus in the literature as to what they are/what their effects may be (Hampson et al '01)</li> <li>• For any individual capable of exercising</li> </ul> |
| <b>Area of Assessment</b>     | Aerobic Capacity; Gait                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Body Part</b>              | Not Applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>ICF Domain</b>             | Body Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Domain</b>                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Assessment Type</b>        | Physiological                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Length of Test</b>         | 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|                                            |                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Time to Administer</b>                  | Time for initial explanation, instant feedback from patient                                                                                                                                                                                                                                                                                |
| <b>Number of Items</b>                     | 15-point category scale                                                                                                                                                                                                                                                                                                                    |
| <b>Equipment Required</b>                  | Printed copy of 6-20 scale with numbers and words for descriptors                                                                                                                                                                                                                                                                          |
| <b>Training Required</b>                   | Read American College or Sports Medicine guidelines, textbook or article.                                                                                                                                                                                                                                                                  |
| <b>Type of training required</b>           | Read American College or Sports Medicine guidelines, textbook or article.                                                                                                                                                                                                                                                                  |
| <b>Cost</b>                                | Free                                                                                                                                                                                                                                                                                                                                       |
| <b>Actual Cost</b>                         | Free                                                                                                                                                                                                                                                                                                                                       |
| <b>Age Range</b>                           | Preschool Child: 2-5 years; Child: 6-12 years; Adolescent: 13-17 years; Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                                                             |
| <b>Administration Mode</b>                 | Verbal Response by looking at available numerical range with corresponding definition of “how hard are you working” scorecard                                                                                                                                                                                                              |
| <b>Diagnosis</b>                           | Cardiac Conditions; Geriatrics; Multiple Sclerosis; Spinal Cord Injury; Stroke                                                                                                                                                                                                                                                             |
| <b>Populations Tested</b>                  | <ul style="list-style-type: none"> <li>• Healthy</li> <li>• Blind</li> <li>• Active and sedentary</li> <li>• Adolescents</li> <li>• Cardiac</li> <li>• Neurological</li> <li>• Elderly</li> </ul>                                                                                                                                          |
| <b>Standard Error of Measurement (SEM)</b> | <p><b><u>Well-trained Males:</u></b> (Doherty, 2001; n=15; 30s of the subpraximal run for each test)</p> <ul style="list-style-type: none"> <li>• 30 seconds: SEM = 0.79 (0.49-1.16)</li> <li>• 60 seconds: SEM = 0.78 (0.50-1.12)</li> <li>• 90 seconds: SEM = 0.80 (0.51-0.99)</li> <li>• 120 seconds: SEM = 0.76 (0.47-0.93)</li> </ul> |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Minimal Detectable Change (MDC)</b>                  | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Minimally Clinically Important Difference (MCID)</b> | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Cut-Off Scores</b>                                   | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Normative Data</b>                                   | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Test-retest Reliability</b>                          | <p><b><u>Frail older adults:</u></b></p> <ul style="list-style-type: none"> <li>• (Mendelssohn et al, 2008) <ul style="list-style-type: none"> <li>◦ HR &amp; METs ICC=0.85-0.91</li> </ul> </li> </ul> <p><b><u>Healthy adults:</u></b></p> <ul style="list-style-type: none"> <li>• (Lamb et al., 1999) Test-retest reliability is variable in studies of healthy subjects, with ICC values of 0.75-0.82</li> </ul> <p><b><u>Stroke:</u></b></p> <p>Not reported in stroke, however, one study (Eng et al, 2002; n=25; 4.4±3.0 yrs) assessed RPE in people with stroke at minute 6 during a 6-minute walk test and a 12-minute walk test in the same subjects, with almost identical mean values (11.6 and 11.7) for the 2 assessments, as would be expected if test-retest reliability was high</p> |
| <b>Interrater/Intrarater Reliability</b>                | <p>Interrater Reliability:</p> <p><b><u>In Braille:</u></b></p> <ul style="list-style-type: none"> <li>• (Buckley et al, 2000) <ul style="list-style-type: none"> <li>◦ interrater reliability: good</li> </ul> </li> </ul> <p><b><u>Adolescent females:</u></b></p> <ul style="list-style-type: none"> <li>• (Pfeiffer, 2002) <ul style="list-style-type: none"> <li>◦ ICC=0.78</li> </ul> </li> </ul> <p>Intrarater Reliability:</p>                                                                                                                                                                                                                                                                                                                                                                 |

|                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                       | <p><b><u>Healthy subjects:</u></b></p> <ul style="list-style-type: none"> <li>• (Eston et al, 2006) <ul style="list-style-type: none"> <li>o Predicted VO2 max from RPE ICC 0.66-0.95</li> <li>o No gender differences</li> </ul> </li> <li>• (Lamb et al, 1999) <ul style="list-style-type: none"> <li>o ICC = 0.75-0.82</li> </ul> </li> <li>• (Eston and Williams, 1988) <ul style="list-style-type: none"> <li>o Between trials ICC=0.83 or higher</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Internal Consistency</b>                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Criterion Validity<br/>(Predictive/Concurrent)</b> | <p><b><u>Concurrent Validity:</u></b></p> <p>(Eng et al., 2002; n=25; 4.4±3.0 yrs)</p> <ul style="list-style-type: none"> <li>• RPE poorly correlated with 6 MWT and 12 MWT distance in people with stroke.</li> </ul> <p>(Tseng et al., 2010; n=21; 4.1±3.5 yrs)</p> <ul style="list-style-type: none"> <li>• Strong correlation between RPE and ratings of exertion fatigue on a visual analog scale following exercise (<math>r=0.8</math>, <math>p=0.00</math>) in people with stroke.</li> </ul> <p><b><u>RPE accross the Lifespan:</u></b></p> <p>(Gros Lambert and Mahon, 2006)</p> <ul style="list-style-type: none"> <li>• Children 3-7 years; poor</li> <li>• 8-12 years; variable</li> <li>• 13+ years similar to adults - good to excellent</li> <li>• 50-65, &gt;65 no significant age effect on validity</li> </ul> <p><b><u>Criterion Validity:</u></b></p> |

- Chen, et al 2002)

A meta-analysis of criterion-related validity between RPE and physiological measures in healthy individuals (mean age of subjects in studies was 32.7; range 9 to 75 years).

Range of mean validity coefficients with RPE:

| Heart rate | Blood lactate | VO <sub>2max</sub> or VO <sub>2</sub> | Ventilation | Resp rate |
|------------|---------------|---------------------------------------|-------------|-----------|
| 0.47-0.61  | 0.42-0.69     | 0.31-0.76                             | 0.53        | 0.67      |

Strongest relationships were noted in highly fit male participants at high (maximal) exertion.

#### **Predictive Validity**

The RPE scale (with rating of 6 to 20) was developed so heart rate could be predicted by multiplying the RPE by 10 (Borg, 1982).

(Eng et al., 2002; n=25; 4.4±3.0 yrs)

In stroke, predicted HR based on RPE was significantly higher than the actual HR during 6 minute and 12 minute walk tests, and predicted and actual HR were not correlated

#### **Construct Validity (Convergent/Discriminant)**

Not reported

#### **Content Validity**

Sage et al., 2013. 37 patients post-stroke (14.5±10.2 days post-stroke). Respiratory gas exchange was monitored for analysis of VO<sub>2</sub> while completing a graded maximal exercise test, while HR and RPE (Borg CR10 Scale) were measured at the end of each minute. 76.2%, 69.0%, and 38.9% of participants fell into the expected RPE range at each intensity. RPE appears to be a reasonable indicator of exercise intensity after stroke at moderate (60%-70% VO<sub>2peak</sub>) but not high intensity exercise (80% VO<sub>2peak</sub>).

#### **Face Validity**

Not reported

|                                                 |                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Floor/Ceiling Effects</b>                    | Not reported                                                                                                                                                                                                                                                                                                  |
| <b>Responsiveness</b>                           | Not reported                                                                                                                                                                                                                                                                                                  |
| <b>Professional Association Recommendations</b> | Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Stroke Taskforce (StrokEDGE II), are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process. |

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

**Abbreviations:**

|                    |                                                                      |
|--------------------|----------------------------------------------------------------------|
| <b>HR</b>          | Highly Recommend                                                     |
| <b>R</b>           | Recommend                                                            |
| <b>LS /<br/>UR</b> | Reasonable to use, but limited study in target group / Unable to Rec |
| <b>NR</b>          | Not Recommended                                                      |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute<br/>(CVA &lt; 2<br/>months post)</b> | <b>Subacute<br/>(CVA 2 to 6<br/>months)</b> | <b>Chronic<br/>(&gt; 6 months)</b> |
|---------------------|-----------------------------------------------|---------------------------------------------|------------------------------------|
| <b>StrokEDGE II</b> | <i>NR</i>                                     | <i>R</i>                                    | <i>R</i>                           |

See considerations below.

Recommendations based on level of care in which the assessment is taken:

|  | <b>Acute<br/>Care</b> | <b>Inpatient<br/>Rehabilitat<br/>ion</b> | <b>Skilled<br/>Nursing<br/>Facility</b> | <b>Outpatient<br/>Rehabilitat<br/>ion</b> | <b>Home Health</b> |
|--|-----------------------|------------------------------------------|-----------------------------------------|-------------------------------------------|--------------------|
|  |                       |                                          |                                         |                                           |                    |

|                          |          |          |          |          |          |
|--------------------------|----------|----------|----------|----------|----------|
| <b>StrokED<br/>GE II</b> | <i>R</i> | <i>R</i> | <i>R</i> | <i>R</i> | <i>R</i> |
|--------------------------|----------|----------|----------|----------|----------|

See considerations below.

Recommendations for entry-level physical therapy education and use in research:

|                          | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|--------------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>StrokED<br/>GE II</b> | <i>No</i>                                                   | <i>Yes</i>                                       | <i>No</i>                                                          | <i>Yes</i>                                                  |

See considerations below.

## Considerations

This test of perceived exertion may give useful information about fatigue during an activity, but lack of established research on test-retest reliability and low validity to physiologic measures are significant concerns. The research indicates that this scale may not be appropriate as an outcome measure, may not be useful as a substitute for other measures of endurance, and may not be appropriate to guide exercise prescription in people with stroke.

Not recommended except as a measure of perceived fatigue during an activity

Do you see an error or have a suggestion for this instrument summary? Please [e-mail us!](#)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>people with chronic stroke: A preliminary study. <i>Stroke Res Treat.</i> 2010;2010:7 pages. Find it on PubMed</p> <p>Chen M, Fan X, Moe S. Criterion-related validity of the Borg ratings of perceived exertion scale in healthy individuals: a meta-analysis. <i>J Sports Sci.</i> 2002;20:873-899. Find it on PubMed</p> <p>Borg G. Pyschophysical bases of perceived exertion. <i>Med Sci Sports Exerc.</i> 1982;14(5):377-381. Find it on PubMed</p> <p>Sage et al., 2013. Validity of Rating of Perceived Exertion Ranges in Individuals in the Subacute Stage of Stroke Recovery. <i>Top Stroke Rehabil</i> 20(6): 519-527. Find it on PubMed</p> |
| <b>Year published</b>           | 1982                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Approval Status</b>          | Pending                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

## 25. REHAB MEASURES: RIVERMEAD Somatosensory Performance Assessment

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to Instrument     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Title of Assessment    | Rivermead Assessment of Somatosensory Performance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Acronym                | RASP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Instrument Reviewer(s) | Initial review completed by Jane Sullivan, Co-Chair of the Neurology Section's StrokEdge Task Force; Updated by Dorian Rose, Co-Chair of the Neurology Section's StrokEdge II Task Force                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Summary Date(s)        | 9/29/2015; 1/21/17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Purpose                | The RASP is a multi-modal sensory tool that tests 6 sensations (sharp/dull discrimination, surface pressure, tactile localization, temperature discrimination, joint movement and joint movement direction discrimination), and 2 secondary sensations (sensory extinction and two-point discrimination).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Description            | <ol style="list-style-type: none"> <li>1. Sharp/dull discrimination: each Neurometer (one with sharp; one with dull Neurotip end showing) is applied to the test area in a pseudo-randomized order. A total of 60 trials are administered to 10 test regions. Twenty sham trials are given, two for each area. (The sham consists of the examiner moving the Neurometer to within 6 in of the patients' skin surface and making the same audible sound with the instrument by applying it to his/her own hand.</li> <li>2. Surface pressure touch: One Neurometer is set to Level 1 (15.5 g pressure) and is applied to designated testing areas for a total of 60 trials. Twenty sham trials are also included.</li> <li>3. Surface localization: Using one Neurometer (Level 1; 15.5 g), the subject is requested to identify designated areas on their body where they have been touched.</li> <li>4. Temperature discrimination: The Neurotemps are prepared prior to testing to ensure that the temperature settings are at the warmest of coolest end of the designated temperature window for each instrument. The patient indicates "warm" or "cold" when touched.</li> <li>5. Joint movement: Examiner moves the following joints up and down in a random sequence: elbow, thumb or finger, ankle, toe. Each joint is moved six times. The examiner first evaluates subject's appreciation of limb position movement by asking the patient to indicate if a passive movement to</li> <li>6. Joint movement discrimination: Then the patient is asked to indicate "up" or "down."</li> <li>7. Bilateral touch discrimination (sensory extinction): Two Neurometers (Setting 2; 67.5 g) are applied simultaneously and then separately to homologous testing areas on the hand or face. The patient is told they may feel either both areas touched together or a touch on the left or a touch on the right. They are requested to indicate what they feel.</li> <li>8. Two-point discrimination: The Neurodisc is applied to the apds of the fingertips, perpendicular to the skin surface and depressed by approximately 1 mm briefly, before being released. The Neurodisc has three fixed distances of 3, 4, 5 mm and a single point.</li> </ol> |
| Area of Assessment     | Sensation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Body Part              | Sensation is tested on the face, hand and foot (10 test regions, 5 of left; 5 on right side of body).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| ICF Domain             | Body Structure/Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Domain                 | Sensation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Assessment Type        | Performance Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Length of Test</b>                                   | 20-45 minutes depending on the client's level on sensory deficit                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Time to Administer</b>                               | 20-45 minutes depending on the client's level on sensory deficit                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Number of Items</b>                                  | Eight items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Equipment Required</b>                               | <p>In an effort to improve reliability of sensory testing, custom equipment were developed for the test:</p> <ol style="list-style-type: none"> <li>1. "Neurometer" – a pen shaped device that allows consistent amount of pressure to be applied to an area,</li> <li>2. "Neurotemp" which has temperature displays standardization of temperature stimuli, and the</li> <li>3. "Two-point neurodiscriminator" - a 4-pointed fixed distance discriminator used to test 2-point discrimination on the finger pads</li> </ol> |
| <b>Training Required</b>                                | No training                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Type of Training Required</b>                        | No training                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Cost</b>                                             | £199.75 (Thames Valley Test Company)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Actual Cost</b>                                      | £199.75                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Age Range</b>                                        | Adult                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Administration Mode</b>                              | Paper & Pencil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Diagnosis</b>                                        | Stroke                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Populations Tested</b>                               | Stroke                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Standard Error of Measurements (SEM)</b>             | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Minimal Detectable Change (MCD)</b>                  | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Minimally Clinically Important Difference (MCID)</b> | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Cut-Off Scores</b>                                   | <p>Winward et al 2002: Suggested impairment cut-off determined from testing 50 control participants.</p> <ul style="list-style-type: none"> <li>• Sharp/dull discrimination: less than 22</li> <li>• Surface touch: less than 29</li> <li>• Surface localization: less than 28</li> <li>• Two-point discrimination: N/A</li> <li>• Temperature discrimination: less than 25</li> <li>• Proprioceptive Movement discrimination: less than 28</li> <li>• Proprioceptive direction discrimination: less than 28</li> </ul>      |
| <b>Normative Data</b>                                   | Winward et al 2002: Data from 50 control participants                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                | <p>Mean±SD (Range) provided</p> <ul style="list-style-type: none"> <li>• Sharp/dull discrimination: Left Side (26.6±2.6;18-30) Right Side (26.5±2.5; 21-30)</li> <li>• Surface touch: Left Side (29.9±0.3;28-30) Right Side (29.9±0.7; 25-30)</li> <li>• Surface localization: Left Side (29.9±0.4;18-30) Right Side (29.8±1.1; 22-30)</li> <li>• Two-point discrimination:<br/>Right Hand – 3mm: n=16, 4mm: n=18, 5mm: n=14;<br/>Left Hand – 3mm: n=18, 4mm: n=15, 5mm: n=16</li> <li>• Temperature discrimination: Left Side (28.4±1.7;24-30) Right Side (28.6±1.8; 23-30)</li> <li>• Proprioceptive Movement discrimination: Left Side (29.9±0.8;24-30) Right Side (30±0.1; 29-30)</li> <li>• Proprioceptive direction discrimination: Left Side (29.8±0.9;24-30) Right Side (29.8±0.9; 24-30)</li> </ul> |
| Test-Retest Reliability                        | <p><b>Sub-Acute Stroke:</b> (Winward et al 2002; n=100; 4-6 weeks post-stroke)</p> <ul style="list-style-type: none"> <li>• Total RASP score: Pearson correlation, r=0.92</li> <li>• Sharp/dull subtest: Pearson correlation, r=0.84</li> <li>• Surface pressure touch subtest: Pearson correlation, r=0.90</li> <li>• Surface localization subtest: Pearson correlation, r=0.96</li> <li>• Temperature subtest: Pearson correlation, r=0.84</li> <li>• Proprioceptive movement subtest: Pearson correlation, r=0.83</li> <li>• Proprioceptive direction subtest: Pearson correlation, r=0.50</li> </ul>                                                                                                                                                                                                     |
| Interrater / Intratester Reliability           | <p><b>Sub-Acute Stroke:</b> (Winward et al 2002; n=100; 4-6 weeks post-stroke)</p> <ul style="list-style-type: none"> <li>• Total RASP score: Pearson correlation, r=0.92</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Internal Consistency                           | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Criterion Validity (Predictive / Concurrent)   | <p><b>Sub-Acute Stroke:</b> (Winward et al 2002; n=100; 4-6 weeks post-stroke)</p> <p>Motricity Index and proprioception movement: Spearman r=0.31; (p&lt;0.01)</p> <p>Motricity Index and proprioception direction detection: Spearman r=0.36; (p&lt;0.01)</p> <p>Barthel Index and proprioception movement: Spearman r=0.35; (p&lt;0.01)</p> <p>Barthel Index and proprioception direction detection: Spearman r=0.41; (p&lt;0.01)</p>                                                                                                                                                                                                                                                                                                                                                                     |
| Construct Validity (Convergent / Discriminant) | <p><b>Sub-Acute Stroke:</b> Winward et al 2002</p> <p>Discriminated significantly between people with (n=100; 4-6 weeks post-stroke) and without (n=50) brain damage (p &lt; 0.001).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Content Validity                               | Not statistically established; all sub-tests are drawn from traditional clinical tests.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Face Validity                                  | Not statistically established; all sub-tests are drawn from traditional clinical tests.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Floor / Ceiling Effects                        | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Responsiveness                                 | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Professional Association                       | Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Stroke Taskforce (StrokEDGE, StrokEDGE II), These                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## Recommendations

recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

### Abbreviations:

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post) | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months) |
|---------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|
| <b>StrokEDGE II</b> | <i>NR</i>                                                                                    | <i>NR</i>                                                     | <i>NR</i>                      |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>StrokEDGE II</b> | <i>NR</i>         | <i>NR</i>                       | <i>NR</i>                       | <i>NR</i>                        | <i>NR</i>          |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|---------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>StrokEDGE II</b> | <i>No</i>                                                   | <i>No</i>                                        | <i>Yes</i>                                                         | <i>Yes</i>                                                  |

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Considerations</b>           | The need for customized equipment and its length limits the clinical utility of this test.                                                                                                                                                                                                                                                                                                                                      |
| <b>Bibliography</b>             | <ol style="list-style-type: none"> <li>1. Winward CE, Halligan PW, Wade DT. The Rivermead Assessment of Somatosensory Performance (RASP): standardization and reliability data. <i>Clinical Rehabilitation</i>. 2002;16(5):523-533. "Find it on PubMed"</li> <li>2. Winward CE, Halligan PW, Wade DT. Rivermead Assessment of Somatosensory Performance. Suffolk, England: Thames Valley Test Company Limited; 2000.</li> </ol> |
| <b>Year Published</b>           | 2002                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Instrument in PDF Format</b> | No                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Approval Status</b>          |                                                                                                                                                                                                                                                                                                                                                                                                                                 |

## 26. REHAB MEASURES: RIVERMEAD Motor Assessment

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Title of Assessment</b>    | Rivermead Motor Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Acronym</b>                | RMA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Instrument Reviewer(s)</b> | Originally reviewed by the StrokEDGE Task Force<br>Updated by Heather Anderson and Rie Yoshida of the StrokEdge II Task Force.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Summary Date</b>           | 4/11/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Purpose</b>                | Assesses functional mobility following stroke (e.g., gait, balance, and transfers).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b>            | <ul style="list-style-type: none"> <li>• RMA is a performance-based measure developed specifically for the stroke population with the intent to be used for both the clinic and research purposes.</li> <li>• Consists of 3 sections: gross function (RMA-gf), leg and trunk (RMA-lt), and the arm (RMA-a).</li> <li>• Each item is scored either yes '1' or no '0'. It is based on Guttman scaling, which presumes that each subsequent item is of a more difficult nature. To advance to the next question, one must score "1" on an item, otherwise the test is stopped.</li> </ul> |
| <b>Area of Assessment</b>     | Gross function, leg and trunk, arm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Body Part</b>              | Upper extremity, trunk, lower extremity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>ICF Domain</b>             | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Domain</b>                 | Motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                                  |                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Assessment Type</b>           | Observer                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Length of Test</b>            |                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Time to Administer</b>        | 45 minutes, less with more involved patients                                                                                                                                                                                                                                                                                                                              |
| <b>Number of Items</b>           | RMA-gf consists of 13 items, RMA-lt 10 items, and RMA-a 15 items.                                                                                                                                                                                                                                                                                                         |
| <b>Equipment Required</b>        | <ul style="list-style-type: none"> <li>• Block of 20 cm height</li> <li>• Pencil</li> <li>• Volleyball</li> <li>• Tennis ball</li> <li>• Piece of paper</li> <li>• Fork and knife</li> <li>• Plate and container (use box of putty as container)</li> <li>• Beanbag</li> <li>• Cord</li> <li>• Putty</li> <li>• Watch with chronometer</li> <li>• Non-slip mat</li> </ul> |
| <b>Training Required</b>         | None Necessary                                                                                                                                                                                                                                                                                                                                                            |
| <b>Type of training required</b> | No Training                                                                                                                                                                                                                                                                                                                                                               |
| <b>Cost</b>                      |                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Actual Cost</b>               | Cost of equipment                                                                                                                                                                                                                                                                                                                                                         |
| <b>Age Range</b>                 | Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                                                                                                                                                                    |
| <b>Administration Mode</b>       | Paper/Pencil                                                                                                                                                                                                                                                                                                                                                              |
| <b>Diagnosis</b>                 | Stroke                                                                                                                                                                                                                                                                                                                                                                    |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Populations Tested</b>                               | Stroke                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Standard Error of Measurement (SEM)</b>              | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Minimal Detectable Change (MDC)</b>                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Minimally Clinically Important Difference (MCID)</b> | Collen et al. (1990) found that a 3 point change in the total RMA score represented a clinically meaningful change.                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Cut-Off Scores</b>                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Normative Data</b>                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Test-retest Reliability</b>                          | <p><b><u>Stroke:</u></b> (Lincoln and Leadbitter 1979)</p> <p><b>Adequate</b> test-retest reliability</p> <ul style="list-style-type: none"> <li>• RMA-gf <math>r=0.66</math></li> <li>• RMA-It <math>r=0.93</math></li> <li>• RMA-a <math>r=0.88</math></li> </ul>                                                                                                                                                                                                                                                  |
| <b>Interrater/Intrater Reliability</b>                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Internal Consistency</b>                             | <p><b><u>Subacute Stroke:</u></b> (Kurtais et al. 2009; <math>n = 107</math>; mean age = 62.4 (12.8) years; mean time since onset = 5.6 (SD = 11.2, range = 0.5-78) months; patients in inpatient rehabilitation unit)</p> <p><b>Good</b> internal consistency</p> <ul style="list-style-type: none"> <li>• RMA-gf - Cronbach's <math>\alpha = 0.93</math>, ICC=0.88</li> <li>• RMA-It - Cronbach's <math>\alpha = 0.88</math>, ICC=0.84</li> <li>• RMA-a - Cronbach <math>\alpha = 0.95</math>, ICC=0.93</li> </ul> |

**Criterion  
Validity  
(Predictive/  
Concurrent)**

**Concurrent Validity**

Brain Injury: (Endres, et al. 1990)

- RMA has **excellent** correlation with BI across each assessment period initial ( $r=0.84$ ), one month ( $0.78$ ), and one year ( $0.63$ ).

Chronic Stroke: (Rousseaux et al, 2012;  $n = 46$ ;  $14.1 \pm 25.9$  mo after stroke)

**Excellent validity** with Upper Limb Assessment in Daily Living (ULADL): correlation of Global Questionnaire (Q) and Test scores (T) with Rivermead Gross Motor Assessment (RMA score) ( $r = 0.80$  and  $0.88$ , respectively;  $p < 10^{-4}$ )

**Predictive Validity**

Collin and Wade (1990): low RMA scores at 6 weeks post stroke predicted poor prognosis to ambulate.

**Construct  
Validity  
(Convergent/  
Discriminant)**

Acute to Subacute Stroke: (Soyuer and Soyuer 2005)

**High** convergent validity between total RMA and FIM

- 7-10 days post stroke:  $r = 0.87$  for total FIM,  $r = 0.90$  for motor FIM
- 3 months post stroke:  $r = 0.88$  for total FIM,  $r = 0.89$  for motor FIM

Subacute Stroke: (Kurtais et al. 2009;  $n = 107$ ; mean age =  $62.4 (12.8)$  years; mean time since onset =  $5.6 (SD = 11.2, \text{range} = 0.5-78)$  months; patients in inpatient rehabilitation unit)

**Moderate to high** external construct validity when compared to FIM score

|        | Admission |               |              | Discharge |               |              |
|--------|-----------|---------------|--------------|-----------|---------------|--------------|
|        | FIM Motor | FIM Self-Care | FIM Mobility | FIM Motor | FIM Self-Care | FIM Mobility |
| RMA-gf | 0.865     | 0.815         | 0.844        | 0.820     | 0.757         | 0.817        |
| RMA-It | 0.784     | 0.726         | 0.782        | 0.747     | 0.702         | 0.764        |
| RMA-a  | 0.386     | 0.390         | 0.386        | 0.467     | 0.480         | 0.483        |

Spearman  $r$ ,  $p < 0.001$

Chronic Stroke: (Van de Winckel et al. 2007; mean time since stroke onset ; 8 months; RMA-a only)

Investigated the construct validity and unidimensionality of the RMA-a. Four items were removed from the scale and 2 subsets were identified through statistical analysis to create a scale that fit the Rasch model. The revised RMA-arm section met criteria for validity and unidimensionality.

Acute-Subacute Stroke: (Houwink et al. 2011;  $n = 21$ ; mean age =  $61.7 \pm 7.9$  years; time since stroke onset = within 4 months; only used RMA-a)

|                                                 | <ul style="list-style-type: none"> <li>• <b>Strong</b> cross-sectional correlation of RMA-a with SULCS (Stroke Upper Limb Capacity Scale) with <math>p = 0.85</math></li> <li>• <b>Moderate</b> longitudinal correlation of RMA-a with SULCS (<math>p = 0.48</math>)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |  |           |                  |          |           |                |                                                                            |           |                 |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--|-----------|------------------|----------|-----------|----------------|----------------------------------------------------------------------------|-----------|-----------------|
| <b>Content Validity</b>                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |  |           |                  |          |           |                |                                                                            |           |                 |
| <b>Face Validity</b>                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |  |           |                  |          |           |                |                                                                            |           |                 |
| <b>Floor/Ceiling Effects</b>                    | <p><b>TBI:</b> Williams et al. 2006</p> <p>A large ceiling effect was noted on the Gross Motor Function Subscale of the RMA when compared to HIMAT</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |  |           |                  |          |           |                |                                                                            |           |                 |
| <b>Responsiveness</b>                           | <p><b>Subacute Stroke:</b> (Kurtais et al. 2009; <math>n = 107</math>; mean age = 62.4 (12.8) years; mean time since onset = 5.6 (SD = 11.2, range = 0.5-78) months; patients in inpatient rehabilitation unit)</p> <p><b>Good</b> sensitivity</p> <ul style="list-style-type: none"> <li>• RMA-gf ES = 0.51, SRM = 0.83</li> <li>• RMA-lt ES = 0.45, SRM = 0.86</li> <li>• RMA-a ES = 0.61, SRM = 1.20</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |  |           |                  |          |           |                |                                                                            |           |                 |
| <b>Professional Association Recommendations</b> | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Stroke Taskforce (StrokEDGE II) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> <table border="1"> <thead> <tr> <th colspan="2">Abbreviations:</th></tr> </thead> <tbody> <tr> <td><b>HR</b></td><td>Highly Recommend</td></tr> <tr> <td><b>R</b></td><td>Recommend</td></tr> <tr> <td><b>LS / UR</b></td><td>Reasonable to use, but limited study in target group / Unable to Recommend</td></tr> <tr> <td><b>NR</b></td><td>Not Recommended</td></tr> </tbody> </table> | Abbreviations: |  | <b>HR</b> | Highly Recommend | <b>R</b> | Recommend | <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend | <b>NR</b> | Not Recommended |
| Abbreviations:                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |  |           |                  |          |           |                |                                                                            |           |                 |
| <b>HR</b>                                       | Highly Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |  |           |                  |          |           |                |                                                                            |           |                 |
| <b>R</b>                                        | Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |  |           |                  |          |           |                |                                                                            |           |                 |
| <b>LS / UR</b>                                  | Reasonable to use, but limited study in target group / Unable to Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |  |           |                  |          |           |                |                                                                            |           |                 |
| <b>NR</b>                                       | Not Recommended                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |  |           |                  |          |           |                |                                                                            |           |                 |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute<br/>(CVA &lt; 2<br/>months post)</b> | <b>Subacute<br/>(CVA 2 to 6<br/>months)</b> | <b>Chronic<br/>(&gt; 6 months)</b> |
|---------------------|-----------------------------------------------|---------------------------------------------|------------------------------------|
| <b>StrokEDGE II</b> | <i>R</i>                                      | <i>R</i>                                    | <i>R</i>                           |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute<br/>Care</b> | <b>Inpatient<br/>Rehabilita<br/>tion</b> | <b>Skilled<br/>Nursing<br/>Facility</b> | <b>Outpatient<br/>Rehabilitat<br/>ion</b> | <b>Home<br/>Health</b> |
|---------------------|-----------------------|------------------------------------------|-----------------------------------------|-------------------------------------------|------------------------|
| <b>StrokEDGE II</b> | <i>NR</i>             | <i>R</i>                                 | <i>R</i>                                | <i>R</i>                                  | <i>NR</i>              |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students<br/>should<br/>learn to<br/>administer<br/>this tool?<br/>(Y/N)</b> | <b>Students<br/>should be<br/>exposed<br/>to tool?<br/>(Y/N)</b> | <b>Appropriate<br/>for use in<br/>intervention<br/>research<br/>studies? (Y/N)</b> | <b>Is additional<br/>research<br/>warranted<br/>for this tool<br/>(Y/N)</b> |
|---------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| <b>StrokEDGE II</b> | <i>No</i>                                                                       | <i>Yes</i>                                                       | <i>Yes</i>                                                                         | <i>Yes</i>                                                                  |

#### Considerations

- Used extensively in research and clinic, primarily in Europe.

- Designed for the stroke population and used primarily with that population. Gross motor section has been used with TBI and the elderly to a lesser extent.
- Several studies have noted that their results show the actual hierarchy of the test items to be different from the original test. Therefore, when administering the test, it is recommended that all items be tested rather than stopping the arm or gross functions test when 3 consecutive items are scored a “0”, as originally instructed.

Do you see an error or have a suggestion for this instrument summary? Please [e-mail us!](#)

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Williams, G., Robertson, V., Greenwood, K., Goldie, P., Morris, M. E. The concurrent validity and responsiveness of the high-level mobility assessment tool for measuring

|                                 |                                                                                                                                        |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
|                                 | the mobility limitations of people with traumatic brain injury. Archives of Physical Medicine and Rehabilitation 2006; 87(3), 437-442. |
| <b>Year published</b>           | 1991                                                                                                                                   |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                    |
| <b>Approval Status</b>          | Approved                                                                                                                               |

## 27. REHAB MEASURES DATABASE—SATISFACTION WITH LIFE SCALE

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | <a href="#">SWLS is available on Dr. Ed Diener's website</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Title of Assessment    | Satisfaction With Life Scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Acronym                | SWLS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Instrument Reviewer(s) | Initially reviewed by Susan Deems-Dluhy, PT, NCS in 7/2011; Updated by Anna de Joya, PT, MS, NCS and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 5/2012; reviewed by Rie Yoshida and Heather D Anderson 4/11/16 and the Stroke Edge II Task Force                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Summary Date           | 4/11/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Purpose                | A subjective quality of life measure designed to measure global life satisfaction, a subjective cognitive assessment, in contrast to an objective quality of life survey (e.g. Sickness Impact Profile, Short Form-36).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Description            | <ul style="list-style-type: none"> <li>The SWLS contains five statements about life satisfaction: three set in the present, one in the past, and one in the future</li> <li>Can be self-administered or completed by interview</li> <li>7-point Likert scale from “strongly disagree” to “strongly agree”, 5 items: <ul style="list-style-type: none"> <li>In most ways my life is close to my ideal</li> <li>The conditions of my life are excellent</li> <li>I am satisfied with my life</li> <li>So far I am getting the important things I want in life</li> <li>If I could live my life over, I would change almost nothing</li> </ul> </li> <li>Translated in a number of languages.</li> <li>Scoring: <ul style="list-style-type: none"> <li>Global score is computed</li> <li>Higher scores indicate better health</li> <li>Scores range from 5 to 35</li> <li>A score of 20 represents a neutral point at which the respondent is equally satisfied and dissatisfied</li> </ul> </li> </ul> |
| Area of Assessment     | Life Participation; Quality of Life                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Body Part              | Not Applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| ICF Domain             | Participation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Domain</b>                                           |                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Assessment Type</b>                                  | Performance Measure                                                                                                                                                                                                                                                                                                                                                         |
| <b>Length of Test</b>                                   | 05 Minutes or Less                                                                                                                                                                                                                                                                                                                                                          |
| <b>Time to Administer</b>                               | Less than 5 minutes                                                                                                                                                                                                                                                                                                                                                         |
| <b>Number of Items</b>                                  | 5                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Equipment Required</b>                               | Survey form                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Training Required</b>                                | No training                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Type of training required</b>                        | no training                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Cost</b>                                             | Free                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Actual Cost</b>                                      | Free                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Age Range</b>                                        | Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                                                                                                                                                                      |
| <b>Administration Mode</b>                              | Paper/Pencil                                                                                                                                                                                                                                                                                                                                                                |
| <b>Diagnosis</b>                                        | Geriatrics; Spinal Cord Injury; Traumatic Brain Injury                                                                                                                                                                                                                                                                                                                      |
| <b>Populations Tested</b>                               | <ul style="list-style-type: none"> <li>• General and student populations</li> <li>• Patients with: spinal cord injury, traumatic brain injury</li> </ul>                                                                                                                                                                                                                    |
| <b>Standard Error of Measurement (SEM)</b>              | Not Established                                                                                                                                                                                                                                                                                                                                                             |
| <b>Minimal Detectable Change (MDC)</b>                  | Not Established                                                                                                                                                                                                                                                                                                                                                             |
| <b>Minimally Clinically Important Difference (MCID)</b> | Not Established                                                                                                                                                                                                                                                                                                                                                             |
| <b>Cut-Off Scores</b>                                   | Not Established                                                                                                                                                                                                                                                                                                                                                             |
| <b>Normative Data</b>                                   | <p><b><u>Traumatic Brain Injury</u></b>: (Corrigan et al, 1998; <math>n = 95</math> adults with traumatic brain injuries, 6 months to 5 years after inpatient rehabilitation; mean age = 32.4 years)</p> <ul style="list-style-type: none"> <li>• Mean score of 19.0 (7.6)</li> <li>• Time post-injury was significantly associated with higher SWLS total score</li> </ul> |

**Undergraduate students:** (Diener et al, 1985;  $n = 176$  undergraduates at University of Illinois who were enrolled in psychology classes)

- Mean score of 23.5 (6.43)

**Cross-sectional assessment of the SWLS:** (Durak et al, 2010; study assessed difference in life satisfaction between three groups;  $n = 547$  university students,  $n = 166$  correctional officers,  $n = 123$  elderly persons; mean age = 68.18 (5.10) years; for the elderly population 2 reported their health as "very poor", 10 as "poor", 51 as "average", 46 as "well" and 14 as "very well"; Turkish sample)

| SWLS Item Level Norms        |      |      |      |
|------------------------------|------|------|------|
| Item #                       | Mean | SD   | ITC* |
| 1                            | 4.77 | 1.80 | 0.68 |
| 2                            | 4.82 | 1.72 | 0.78 |
| 3                            | 5.18 | 1.58 | 0.70 |
| 4                            | 4.91 | 1.70 | 0.78 |
| 5                            | 4.14 | 2.11 | 0.72 |
| All Items                    | 23.8 | 7.44 |      |
| * ITC item total correlation |      |      |      |

**SWLS and Other Major Life Outcomes:**

| Scale                           | Range    | Mean  | SD   |
|---------------------------------|----------|-------|------|
| SWLS                            | 5 to 35  | 23.82 | 7.44 |
| Self esteem                     | 10 to 50 | 36.94 | 6.84 |
| Perceived current health status | 1 to 5   | 3.49  | 0.86 |
| Late-life depression            | 0 to 30  | 11.13 | 5.70 |

**Test-retest  
Reliability**

**Undergraduate Students:**(Diener et al, 1985)

- **Adequate** two month test-retest reliability (ICC = 0.82)

**Elderly and College Students:** (Pavot et al, 1991; Study 1:  $n = 39$  older members of the Champaign-Urbana community; mean age = 74 (8.97); sex = 16 males, 23 females; Study 2:  $n = 125$  University of Illinois at Champaign-Urbana students; sex = 51 males, 85 females)

- **Excellent** overall test-retest reliability (ICC = 0.83)
- Study 2: **Excellent** test-retest reliability (ICC = 0.84)

**Spinal Cord Injury:** (Hill et al, 2010;  $n = 14$  articles reporting on 13 QOL measures)

|                                                                         | <ul style="list-style-type: none"><li>• <b>Poor</b> two week test-retest reliability (ICC = 0.39 - 0.65)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                         |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--|--|--|----------------------------|----------------------------|-----------|--------------------------|--------------------------|-------------|--------------------------|---------------------------|-----|---------------------------|-------|---------|---------------------------|---------------------------|-------|--------------------------|--------------------------|--------------------|---------------------------|---------------------------|----------|---------------------------|--------------------------|--------------|--------------------------|--------------------------|--------------|--------------------------|---------------------------|----------------------------|-------|--------------------------|-----|----------------------|-------|
| Interrater / Intrarater Reliability                                     | <p><b>General population:</b> (Pavot et al, 1993; A review of the SWLS)</p> <ul style="list-style-type: none"><li>• <b>Adequate to Excellent</b> item total correlations (0.51 - 0.8)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                         |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Internal Consistency                                                    | <p><b>Undergraduate students:</b> (Diener et al, 1985)</p> <ul style="list-style-type: none"><li>• <b>Adequate to Excellent</b> internal consistency (Chronbach's alpha = 0.61 - 0.89)</li></ul> <p><b>Cross-sectional assessment of the SWLS:</b> (Durak et al, 2010; only assessing internal consistency for elderly respondents)</p> <ul style="list-style-type: none"><li>• <b>Adequate</b> internal consistency (Chronbach's alpha = 0.72)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                         |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Criterion Validity (Predictive / Concurrent)                            | <p><b>Traumatic Brain Injury:</b> (Hanks et al, 2008; <i>n</i> =174 who met criteria for admission to inpatient brain injury rehabilitation; mean age = 38.15 (18.07) years)</p> <ul style="list-style-type: none"><li>• <b>Poor</b> predictive validity for quality of life 1 year post-injury</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                         |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Construct Validity (Convergent / Discriminant)                          | <p><b>Undergraduate students:</b> (Diener et al, 1985)</p> <ul style="list-style-type: none"><li>• <b>Adequate</b> correlation with Life Satisfaction Index (<i>r</i> = 0.46)</li><li>• <b>Adequate</b> correlation with interviewer (<i>r</i> = 0.43)</li></ul> <table><tr><th colspan="3">Correlations between the SWLS and other measures of subject well-being:</th></tr><tr><th></th><th>Sample 1 (<i>n</i> = 176)</th><th>Sample 2 (<i>n</i> = 163)</th></tr><tr><td>Fordyce 1</td><td>0.58 (<b>Adequate</b>)</td><td>0.57 (<b>Adequate</b>)</td></tr><tr><td>Fordyce (%)</td><td>0.58 (<b>Adequate</b>)</td><td>0.62 (<b>Excellent</b>)</td></tr><tr><td>DPQ</td><td>0.68 (<b>Excellent</b>)</td><td>-----</td></tr><tr><td>Cantril</td><td>0.62 (<b>Excellent</b>)</td><td>0.66 (<b>Excellent</b>)</td></tr><tr><td>Gurin</td><td>0.59 (<b>Adequate</b>)</td><td>0.47 (<b>Adequate</b>)</td></tr><tr><td>Andrews and Withey</td><td>0.68 (<b>Excellent</b>)</td><td>0.62 (<b>Excellent</b>)</td></tr><tr><td>Campbell</td><td>0.75 (<b>Excellent</b>)</td><td>0.59 (<b>Adequate</b>)</td></tr><tr><td>Bradburn-PAS</td><td>0.50 (<b>Adequate</b>)</td><td>0.51 (<b>Adequate</b>)</td></tr><tr><td>Bradburn-NAS</td><td>0.37 (<b>Adequate</b>)</td><td>-0.32 (<b>Adequate</b>)</td></tr><tr><td>Summed Domain Satisfaction</td><td>-----</td><td>0.57 (<b>Adequate</b>)</td></tr><tr><td>AIM</td><td>0.09 (<b>Poor</b>)</td><td>-----</td></tr></table> | Correlations between the SWLS and other measures of subject well-being: |  |  |  | Sample 1 ( <i>n</i> = 176) | Sample 2 ( <i>n</i> = 163) | Fordyce 1 | 0.58 ( <b>Adequate</b> ) | 0.57 ( <b>Adequate</b> ) | Fordyce (%) | 0.58 ( <b>Adequate</b> ) | 0.62 ( <b>Excellent</b> ) | DPQ | 0.68 ( <b>Excellent</b> ) | ----- | Cantril | 0.62 ( <b>Excellent</b> ) | 0.66 ( <b>Excellent</b> ) | Gurin | 0.59 ( <b>Adequate</b> ) | 0.47 ( <b>Adequate</b> ) | Andrews and Withey | 0.68 ( <b>Excellent</b> ) | 0.62 ( <b>Excellent</b> ) | Campbell | 0.75 ( <b>Excellent</b> ) | 0.59 ( <b>Adequate</b> ) | Bradburn-PAS | 0.50 ( <b>Adequate</b> ) | 0.51 ( <b>Adequate</b> ) | Bradburn-NAS | 0.37 ( <b>Adequate</b> ) | -0.32 ( <b>Adequate</b> ) | Summed Domain Satisfaction | ----- | 0.57 ( <b>Adequate</b> ) | AIM | 0.09 ( <b>Poor</b> ) | ----- |
| Correlations between the SWLS and other measures of subject well-being: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                         |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
|                                                                         | Sample 1 ( <i>n</i> = 176)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Sample 2 ( <i>n</i> = 163)                                              |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Fordyce 1                                                               | 0.58 ( <b>Adequate</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.57 ( <b>Adequate</b> )                                                |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Fordyce (%)                                                             | 0.58 ( <b>Adequate</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.62 ( <b>Excellent</b> )                                               |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| DPQ                                                                     | 0.68 ( <b>Excellent</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -----                                                                   |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Cantril                                                                 | 0.62 ( <b>Excellent</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.66 ( <b>Excellent</b> )                                               |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Gurin                                                                   | 0.59 ( <b>Adequate</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.47 ( <b>Adequate</b> )                                                |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Andrews and Withey                                                      | 0.68 ( <b>Excellent</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.62 ( <b>Excellent</b> )                                               |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Campbell                                                                | 0.75 ( <b>Excellent</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.59 ( <b>Adequate</b> )                                                |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Bradburn-PAS                                                            | 0.50 ( <b>Adequate</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.51 ( <b>Adequate</b> )                                                |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Bradburn-NAS                                                            | 0.37 ( <b>Adequate</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -0.32 ( <b>Adequate</b> )                                               |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| Summed Domain Satisfaction                                              | -----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.57 ( <b>Adequate</b> )                                                |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |
| AIM                                                                     | 0.09 ( <b>Poor</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | -----                                                                   |  |  |  |                            |                            |           |                          |                          |             |                          |                           |     |                           |       |         |                           |                           |       |                          |                          |                    |                           |                           |          |                           |                          |              |                          |                          |              |                          |                           |                            |       |                          |     |                      |       |

|                                          | <p>DPQ= Differential Personality Questionnaire. PAS = Positive Affect Scale. NAS = Negative Affect Scale. AIM = Affect Intensity Measure. Sample 2 was not administered to the the DPQ or AIM, and Sample1 did not complete the domain satisfaction items</p> <p><b><u>Elderly:</u></b> (Pavot et al, 1991)</p> <ul style="list-style-type: none"> <li><b>Adequate</b> convergent validity with Life Satisfaction Index (<math>r = 0.81</math>)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |  |           |                  |          |           |                |                                                                            |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--|-----------|------------------|----------|-----------|----------------|----------------------------------------------------------------------------|
| Content Validity                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |  |           |                  |          |           |                |                                                                            |
| Face Validity                            | <p><b><u>Spinal Cord Injury:</u></b> (Hill et al, 2010)</p> <ul style="list-style-type: none"> <li>Level of injury, number of hospitalizations and number of pressure ulcers related to life satisfaction (<math>p &lt; 0.05</math>), but completeness of injury did not</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |  |           |                  |          |           |                |                                                                            |
| Floor / Ceiling Effects                  | <p><b><u>Traumatic Brain Injury:</u></b> (Corrigan et al, 1998)</p> <ul style="list-style-type: none"> <li>Mean score declines at year 1 post injury with a subsequent gradual increase over five years post injury</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                |  |           |                  |          |           |                |                                                                            |
| Responsiveness                           | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |  |           |                  |          |           |                |                                                                            |
| Professional Association Recommendations | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StroKEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> <table border="1"> <thead> <tr> <th colspan="2">Abbreviations:</th></tr> </thead> <tbody> <tr> <td><b>HR</b></td><td>Highly Recommend</td></tr> <tr> <td><b>R</b></td><td>Recommend</td></tr> <tr> <td><b>LS / UR</b></td><td>Reasonable to use, but limited study in target group / Unable to Recommend</td></tr> </tbody> </table> | Abbreviations: |  | <b>HR</b> | Highly Recommend | <b>R</b> | Recommend | <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| Abbreviations:                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |  |           |                  |          |           |                |                                                                            |
| <b>HR</b>                                | Highly Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |  |           |                  |          |           |                |                                                                            |
| <b>R</b>                                 | Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |  |           |                  |          |           |                |                                                                            |
| <b>LS / UR</b>                           | Reasonable to use, but limited study in target group / Unable to Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |  |           |                  |          |           |                |                                                                            |

|           |                 |
|-----------|-----------------|
| <b>NR</b> | Not Recommended |
|-----------|-----------------|

Recommendations for use based on acuity level of the patient:

|                         | <b>Acute<br/>(CVA &lt; 2 months<br/>post)<br/>(SCI &lt; 1 month post)<br/>(Vestibular &lt; 6<br/>weeks post)</b> | <b>Subacute<br/>(CVA 2 to 6<br/>months)<br/>(SCI 3 to 6<br/>months)</b> | <b>Chronic<br/>(&gt; 6 months)</b> |
|-------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------|
| <b>SCI EDGE</b>         | <i>LS</i>                                                                                                        | <i>LS</i>                                                               | <i>R</i>                           |
| <b>StrokEDGE<br/>II</b> | <i>UR</i>                                                                                                        | <i>UR</i>                                                               | <i>UR</i>                          |

Recommendations based on level of care in which the assessment is taken:

|                         | <b>Acute<br/>Care</b> | <b>Inpatient<br/>Rehabilitation</b> | <b>Skilled<br/>Nursing<br/>Facility</b> | <b>Outpatient<br/>Rehabilitation</b> | <b>Home<br/>Health</b> |
|-------------------------|-----------------------|-------------------------------------|-----------------------------------------|--------------------------------------|------------------------|
| <b>StrokEDGE<br/>II</b> | <i>UR</i>             | <i>UR</i>                           | <i>UR</i>                               | <i>UR</i>                            | <i>UR</i>              |
| <b>TBI EDGE</b>         | <i>NR</i>             | <i>NR</i>                           | <i>NR</i>                               | <i>LS</i>                            | <i>LS</i>              |

Recommendations based on SCI AIS Classification:

|                 | <b>AIS A/B</b> | <b>AIS C/D</b> |
|-----------------|----------------|----------------|
| <b>SCI EDGE</b> | <i>R</i>       | <i>R</i>       |

Recommendations for use based on ambulatory status after brain injury:

|                 | <b>Completely<br/>Independent</b> | <b>Mildly dependant</b> | <b>Moderately<br/>Dependant</b> |
|-----------------|-----------------------------------|-------------------------|---------------------------------|
| <b>TBI EDGE</b> | <i>N/A</i>                        | <i>N/A</i>              | <i>N/A</i>                      |

Recommendations for entry-level physical therapy education and use in research:

|                         | <b>Students<br/>should learn<br/>to<br/>administer<br/>this tool?<br/>(Y/N)</b> | <b>Students<br/>should be<br/>exposed to<br/>tool? (Y/N)</b> | <b>Appropriate<br/>for use in<br/>intervention<br/>research<br/>studies? (Y/N)</b> | <b>Is additional<br/>research<br/>warranted<br/>for this tool<br/>(Y/N)</b> |
|-------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| <b>SCI EDGE</b>         | <i>No</i>                                                                       | <i>Yes</i>                                                   | <i>Yes</i>                                                                         | <i>Not reported</i>                                                         |
| <b>StrokEDGE<br/>II</b> | <i>No</i>                                                                       | <i>No</i>                                                    | <i>No</i>                                                                          | <i>Not reported</i>                                                         |
| <b>TBI EDGE</b>         | <i>No</i>                                                                       | <i>Yes</i>                                                   | <i>Yes</i>                                                                         | <i>Not reported</i>                                                         |

#### Considerations

- Not recommended for use as a physical therapy outcome measure at this time; may be useful as a team screening tool
- Studied mainly in general population
- Some questions may be inappropriate in rehab population

Do you see an error or have a suggestion for this instrument summary? Please [e-mail us!](#)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bibliography</b>             | <p>Corrigan, J. D., Smith-Knapp, K., et al. (1998). "Outcomes in the first 5 years after traumatic brain injury." Arch Phys Med Rehabil 79(3): 298-305. <a href="#">Find it on PubMed</a></p> <p>Diener, E., Emmons, R. A., et al. (1985). "The Satisfaction With Life Scale." J Pers Assess 49(1): 71-75. <a href="#">Find it on PubMed</a></p> <p>Durak, M., Senol-Durak, E., et al. (2010). "Psychometric properties of the Satisfaction with Life Scale among Turkish university students, correctional officers, and elderly adults." Social indicators research 99(3): 413-429.</p> <p>Hanks, R. A., Millis, S. R., et al. (2008). "The predictive validity of a brief inpatient neuropsychologic battery for persons with traumatic brain injury." Arch Phys Med Rehabil 89(5): 950-957. <a href="#">Find it on PubMed</a></p> <p>Hill, M. R., Noonan, V. K., et al. (2010). "Quality of life instruments and definitions in individuals with spinal cord injury: a systematic review." Spinal Cord 48(6): 438-450. <a href="#">Find it on PubMed</a></p> <p>Pavot, W. and Diener, E. (1993). "Review of the satisfaction with life scale." Psychological Assessment 5(2): 164.</p> <p>Pavot, W., Diener, E., et al. (1991). "Further validation of the Satisfaction with Life Scale: evidence for the cross-method convergence of well-being measures." J Pers Assess 57(1): 149-161. <a href="#">Find it on PubMed</a></p> |
| <b>Year published</b>           | 1985                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## 28. REHAB MEASURES DATABASE—SHORT FORM 36

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | Available for purchase at SF-36.org (external link)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Title of Assessment    | Medical Outcomes Study Short Form 36                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Acronym                | SF-36; SF-36v2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Instrument Reviewer(s) | Initially reviewed by the Rehabilitation Measures Team; Updated by Wendy Romney, PT, DPT, NCS, Cara Weisbach, PT, DPT, and the SCI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2012; Updated by Sue Saliga PT, DHSc, CEEAA and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2012. Updated by Erin Hussey, PT, DPT, MS, NCS and Cathy Harro PT, PhD and the PD EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2013. Updated by Melissa Eden, PT, DPT, OCS in 2014. Updated by Carmen Capo-Lugo, PT, PhD and Dorian Rose PT, PhD of the STROKEdge II task force in 2016. |
| Summary Date           | 9/20/2015; 10/2/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Purpose                | The SF-36 is a generic patient-reported outcome measure aimed at quantifying health status, and is often used as a measure of health-related quality of life.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Description            | <p>36 item measure divided into 8 subscales and 2 composite domains</p> <p>The 8 subscales are:</p> <ul style="list-style-type: none"> <li>(1) Physical Functioning</li> <li>(2) Role Limitations due to Physical Problems</li> <li>(3) General Health Perceptions</li> <li>(4) Vitality</li> <li>(5) Social Functioning</li> <li>(6) Role Limitations due to Emotional Problems</li> <li>(7) General Mental Health</li> <li>(8) Health Transition</li> </ul> <p>Respondents are asked to answer items referring to the past 4 weeks</p>                                                                                                                                                                    |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           | <p>Recommended scoring system for the SF-36 is a weighted Likert system for each item</p> <p>Items within subscales are totaled to provide a summed score for each subscale or dimension.</p> <p>Each of the 8 summed scores is linearly transformed onto a scale from 0 (negative health) to 100 (positive health) to provide a score for each subscale. Each subscale can be used independently.</p> <p>For each domain (physical and mental composite) mean score = 50 and standard deviation = 10</p> <p>Version 2 norms are based on the 1998 National Survey of Functional Health Status (NSFHS); more information on version 2 can be found on the SF-36 website: <a href="http://www.sf-36.org/tools/sf36html">http://www.sf-36.org/tools/sf36html</a></p> |
| Area of Assessment        | Activities of Daily Living; Quality of Life                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Body Part                 | Not Applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| ICF Domain                | Body Function; Activity; Participation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Domain                    | ADL; General Health                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Assessment Type           | Patient Reported Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Length of Test            | 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Time to Administer        | 10 minutes; 41 and 47 minutes, respectively, for individuals with paraplegia & tetraplegia (Anderson, et al 1999)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Number of Items           | 36                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Equipment Required        | Suggests enlarged copy of item response options (Steffen & Seney 2008)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Training Required         | Acquire and reading manual needed for item administration and scoring.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Type of training required | No Training                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cost                                | Not Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Actual Cost                         | Contact QualityMetric Incorporated for information regarding licensing fees for your institution.                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Age Range                           | Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Administration Mode                 | Paper/Pencil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Diagnosis                           | Arthritis; Cardiac Conditions; Geriatrics; Multiple Sclerosis; Pain; Spinal Cord Injury; Stroke; Traumatic Brain Injury                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Populations Tested                  | <p>The following conditions each have 50 or more publications (Turner-Bowker et al, 2002):</p> <ul style="list-style-type: none"> <li>Arthritis</li> <li>Back pain</li> <li>Cancer of the Head &amp; Neck</li> <li>Low back pain</li> <li>Multiple sclerosis</li> <li>Musculoskeletal conditions</li> <li>Neuromuscular conditions</li> <li>Osteoarthritis</li> <li>Parkinson Disease</li> <li>Rheumatoid arthritis</li> <li>Spinal injuries</li> <li>Stroke</li> <li>Trauma</li> <li>Traumatic Brain Injury (Nichol et al, 2011)</li> </ul> |
| Standard Error of Measurement (SEM) | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

**Minimal Detectable Change (MDC)**

Parkinsonism (included Parkinson Disease and Parkinson-plus syndromes):  
(Steffen & Seney, 2008; n = 37 (PD n = 35, Parkinson-Plus n = 2); mean age = 71 (12); mean disease duration = 14 (6) years; Hoehn and Yahr stages median score = 2 (range = 1 to 4); Stage 1: n = 3, Stage 2: n = 7, Stage 3: n = 9, Stage 4: n = 8; test-retest by same rater at 1-week interval; Administered SF-36 by direct interview.

MDC-95 for each subscale of SF-36 (V1)

| SF-36 Subscale          | MDC95 |
|-------------------------|-------|
| Physical Functioning    | 28    |
| Role limits - Physical  | 45    |
| Bodily pain             | 25    |
| General health          | 28    |
| Vitality                | 19    |
| Social functioning      | 29    |
| Role limits - emotional | 45    |
| Mental health           | 19    |

**Minimally Clinically Important Difference (MCID)**

Not Established

**Cut-Off Scores**

Not Applicable

**Normative Data**

Parkinson Disease:  
(Banks and Martin, 2009; n = 339 with PD (164 male; 179 female); mean age = 54.6 (range 27-75); Version 2 of SF-36; tested multiple configurations to determine recommended model for use and if this scale useful for PD. Identified 8 subscales and 6 models: physical functioning [1], role-physical [2], bodily pain [3], general health [4], vitality [5], social functioning [6], role-emotional [7] and mental health [8]. Compared various models of subscale combinations and assessments and compared against typical recommendation that summary measures of physical health (scales 1–4) and mental health (scales 5–8) can also be calculated and used independently.)

| SF-36 subscale scores | Mean  | SD    |
|-----------------------|-------|-------|
| Physical functioning  | 44.03 | 26.44 |
| Role–physical         | 25.41 | 34.24 |
| Bodily pain           | 50.22 | 34.24 |
| General health        | 44.08 | 20.89 |
| Vitality              | 36.08 | 20.12 |
| Social functioning    | 57.05 | 25.81 |
| Role–emotional        | 47.81 | 44.03 |
| Mental health         | 61.10 | 19.57 |

(Leonardi et al, 2012. N = 96 (64 male); mean age = 64.1 (11.3; range 24-90); 74% were married; 79.2% were not employed; Hoehn & Yahr stages: 1 = 13, 2 = 55, 3 = 22, 4 = 6. Compared to normative data from general Italian population.)

|                      | Mean score<br>(SD) | Normative<br>data | t-test | P-value   |
|----------------------|--------------------|-------------------|--------|-----------|
| SF-36 (v2)           |                    |                   |        |           |
| Physical Functioning | 72.0 (22.6)        | 84.46             | –5.04  | P < 0.001 |
| Role Physical        | 46.9 (38.9)        | 78.21             | –7.88  | P < 0.001 |
| Bodily Pain          | 58.9 (29.9)        | 73.67             | –4.83  | P < 0.001 |
| General Health       | 41.2 (20.5)        | 65.22             | –11.44 | P < 0.001 |
| Vitality             | 56.7 (20.1)        | 61.89             | –2.52  | P = 0.013 |
| Social Functioning   | 69.2 (27.6)        | 77.43             | –2.93  | P = 0.004 |
| Role Emotional       | 68.4 (40.3)        | 76.16             | –1.88  | P = 0.063 |
| Mental Health        | 64.6 (19.6)        | 66.50             | –0.94  | P = 0.350 |
| PCS                  | 40.0 (8.8)         | 50                | –11.09 | P < 0.001 |

|     |             |    |       |           |
|-----|-------------|----|-------|-----------|
| MCS | 46.7 (11.0) | 50 | -2.90 | P = 0.005 |
|-----|-------------|----|-------|-----------|

#### Chronic Stroke:

(Anderson et al, 1996; n = 90; mean age = 72 (12) years; assessed 1 year post stroke; Australian version)

| SF-36 Domain          | Mean | SD |
|-----------------------|------|----|
| Physical functioning  | 48   | 33 |
| Role limits–physical  | 76   | 34 |
| Bodily pain           | 76   | 28 |
| General health        | 64   | 22 |
| Vitality              | 56   | 20 |
| Social functioning    | 86   | 23 |
| Role limits–emotional | 83   | 31 |
| Mental health         | 77   | 22 |

#### Chronic Spinal Cord Injury:

(Forchheimer et al, 2004; n = 215, mean age = 38.8 years; assessed > 1 year post traumatic SCI)

| SF-36 Domain         | Mean | SD   |
|----------------------|------|------|
| Physical functioning | 26.6 | 11.5 |
| Role Physical        | 40.7 | 10.9 |
| Bodily pain          | 42.2 | 12.4 |
| General Health       | 44.4 | 11.8 |
| Vitality             | 46.8 | 9.6  |
| Social Functioning   | 43.0 | 13.3 |
| Role Emotional       | 49.0 | 10.6 |

|                            |      |      |
|----------------------------|------|------|
| Mental Health              | 48.3 | 11.0 |
| Physical Component Summary | 33.5 | 10.1 |
| Mental Component Summary   | 53.5 | 11.6 |

TBI:

(Colantonio et al., 1998; n = 51; mean age = 18.28 (2.04) years; assessed 5 years post TBI )

|                           | Mild (n = 24) |       | Moderate / Severe (n = 27) |       |
|---------------------------|---------------|-------|----------------------------|-------|
|                           | Mean          | SD    | Mean                       | SD    |
| Physical Functioning      | 84.91         | 22.02 | 75.43                      | 35.43 |
| Role Limits–physical      | 79.17         | 36.94 | 75.32                      | 37.01 |
| Bodily Pain               | 77.40         | 19.29 | 81.44                      | 17.89 |
| General Health            | 63.98         | 26.74 | 68.33                      | 22.74 |
| Vitality                  | 53.54         | 9.83  | 52.90                      | 13.79 |
| Social Functioning        | 72.92         | 27.25 | 73.15                      | 27.23 |
| Mental Health             | 46.50         | 16.42 | 46.67                      | 17.40 |
| Role Limits–mental health | 81.94         | 32.57 | 75.64                      | 38.36 |

Mild Traumatic Brain Injury:

(Emanuelson et al, 2003; n = 117, patients assessed at 3 months post injury and n = 101, patients assessed 1 year post injury; age = 16-60)

| Domain in SF-36 | Patients 3 Months (n = 117) Mean, SEM, median | Patients 1 Year (n = 101) Mean, SEM, median | Mean | SD    | Median | Minimum | Maximum |
|-----------------|-----------------------------------------------|---------------------------------------------|------|-------|--------|---------|---------|
| PF              | 85.4 (1.9), 95                                | 87.5 (2.1), 95                              | 0.85 | 12.93 | 0.00   | -35.00  | 60.00   |

|     |                 |                 |       |       |       |         |        |
|-----|-----------------|-----------------|-------|-------|-------|---------|--------|
| RF  | 72.5 (3.5), 100 | 74.7 (3.8), 100 | -0.42 | 30.07 | 0.00  | -100.00 | 100.00 |
| BP  | 66.7 (3.0), 72  | 72.2 (3.1), 74  | 1.31  | 25.52 | 0.00  | -69.00  | 69.00  |
| GH  | 68.3 (2.4), 72  | 70.9 (2.5), 72  | 0.78  | 17.67 | 0.00  | -52.00  | 48.00  |
| VT  | 59.3 (2.4), 60  | 62.3 (2.6), 65  | 1.86  | 19.97 | 0.00  | -70.00  | 60.00  |
| SF  | 81.6 (2.5), 100 | 83.2 (2.4), 100 | -0.12 | 20.35 | 0.00  | -62.50  | 50.00  |
| RE  | 72.7 (2.4), 80  | 77.2 (3.7), 100 | 3.00  | 33.87 | 0.00  | -100.00 | 100.00 |
| MH  | 71.2 (2.4), 80  | 74.9 (2.2), 84  | 1.74  | 17.87 | 0.00  | -48.00  | 56.00  |
| PCS | 48.4 (1.2), 52  | 49.1 (1.1), 52  | -0.02 | 6.80  | -0.06 | -23.16  | 18.94  |
| MCS | 44.8 (1.2), 48  | 46.5 (1.3), 51  | 1.09  | 10.43 | 0.47  | -36.97  | 36.67  |

PF =physical functioning, RF =role physical, BP =bodily pain, GH =general health, VT =vitality, SF = social functioning, RE =role emotional, MH =mental health, PCS =physical composite score, MCS =mental composite score.

#### Mild Traumatic Brain Injury:

(Emanuelson et al, 2003; n = 117, patients assessed at 3 months post injury and n = 101, patients assessed 1 year post-injury; age = 16-60)

| Domain in SF-36             | Patients 3 Months (n = 117)<br>Mean, SEM, median | Patients 1 Year (n = 101)<br>Mean, SEM, median |
|-----------------------------|--------------------------------------------------|------------------------------------------------|
| Physical Function           | 85.4 (1.9), 95                                   | 87.5 (2.1), 95                                 |
| Role Functioning:Physical   | 72.5 (3.5), 100                                  | 74.7 (3.8), 100                                |
| Bodily Pain                 | 66.7 (3.0), 72                                   | 72.2 (3.1), 74                                 |
| General Health              | 68.3 (2.4), 72                                   | 70.9 (2.5), 72                                 |
| Vitality                    | 59.3 (2.4), 60                                   | 62.3 (2.6), 65                                 |
| Social Functioning          | 81.6 (2.5), 100                                  | 83.2 (2.4), 100                                |
| Role Functioning: Emotional | 72.7 (2.4), 80                                   | 77.2 (3.7), 100                                |
| Mental Health               | 71.2 (2.4), 80                                   | 74.9 (2.2), 84                                 |

|                    |                |                |
|--------------------|----------------|----------------|
| Physical Composite | 48.4 (1.2), 52 | 49.1 (1.1), 52 |
| Mental Composite   | 44.8 (1.2), 48 | 46.5 (1.3), 51 |

Previously untreated, primary HNC:

(Funk G.F., Karnell L.H., Dawson C.J., et al, 1997; n = 180, mean age 58.9 (range, 20-85))

|                         | US Norms | 95% CI      | HNC Pre-Surgery | 95% CI      |
|-------------------------|----------|-------------|-----------------|-------------|
| 45-64 years<br>(n = 39) |          |             |                 |             |
| PCS                     | 49.64    | 49.58-49.70 | 42.64           | 39.00-46.28 |
| MCS                     | 50.53    | 50.47-50.59 | 41.97           | 38.25-45.69 |
| 55-64 years<br>(n = 51) |          |             |                 |             |
| PCS                     | 45.90    | 45.82-45.98 | 43.82           | 40.94-46.70 |
| MCS                     | 51.05    | 50.98-51.12 | 44.68           | 41.52-47.84 |
| 65-74 years<br>(n = 48) |          |             |                 |             |
| PCS                     | 43.33    | 43.28-43.38 | 42.33           | 39.05-45.61 |
| MCS                     | 52.68    | 52.54-52.72 | 49.87           | 46.88-52.86 |

|     | HND pre-surgery(n=180) | SC    | HNC, 6 months post-surgery (n=109) | SD    | P-value |
|-----|------------------------|-------|------------------------------------|-------|---------|
| PCS | 43.61                  | 11.49 | 42.88                              | 10.61 | 0.0470  |
| MCS | 45.05                  | 11.97 | 47.19                              | 11.82 | 0.1463  |

|                         | <p>General Population:</p> <p>(Ware J.E., Kosinski M., Keller S.D., 1994)</p> <p>General population mean for SF-36 component scores (not specific to head and neck cancer) = 50 (SD, 10)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |                               |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------------|----------------------|---------------|---------------|----------------|-------------|----------------|----------------|----------------|----------|----------------|--------------------|---------------|----------------|----------------|---------------|----------------|--------|---------------|-------------|----------------|----------------------|------|------|------|
| Test-retest Reliability | <p>Parkinsonism (included Parkinson Disease and Parkinson-plus syndromes):</p> <p>(Steffen &amp; Seney, 2008; n = 37 (PD n = 35, Parkinson-Plus n = 2); mean age = 71 (12); mean disease duration = 14 (6) years; Hoehn and Yahr stages median score = 2 (range = 1 to 4); Stage 1: n = 3, Stage 2: n = 7, Stage 3: n = 9, Stage 4: n = 8; test-retest by same rater at 1-week interval; mean number of falls in the past 6 months = 7; Administered SF-36 (v1) by direct interview.)</p> <table><tr><th>SF-36 Domain</th><th>Test-Retest reliability (ICC)</th></tr><tr><td>Physical Functioning</td><td>0.80 Adequate</td></tr><tr><td>Role Physical</td><td>0.85 Excellent</td></tr><tr><td>Bodily Pain</td><td>0.89 Excellent</td></tr><tr><td>General Health</td><td>0.85 Excellent</td></tr><tr><td>Vitality</td><td>0.89 Excellent</td></tr><tr><td>Social Functioning</td><td>0.71 Adequate</td></tr><tr><td>Role Emotional</td><td>0.84 Excellent</td></tr><tr><td>Mental Health</td><td>0.83 Excellent</td></tr></table> <p>Chronic Stroke:</p> <p>(Dorman et al, 1998; n = 209; 3 weeks between assessments; mean time since stroke onset 64(30) weeks)</p> <table><tr><th>Domain</th><th>Patient ICC's</th><th>Proxy ICC's</th><th>Combined ICC's</th></tr><tr><td>Physical Functioning</td><td>0.80</td><td>0.59</td><td>0.74</td></tr></table> | SF-36 Domain | Test-Retest reliability (ICC) | Physical Functioning | 0.80 Adequate | Role Physical | 0.85 Excellent | Bodily Pain | 0.89 Excellent | General Health | 0.85 Excellent | Vitality | 0.89 Excellent | Social Functioning | 0.71 Adequate | Role Emotional | 0.84 Excellent | Mental Health | 0.83 Excellent | Domain | Patient ICC's | Proxy ICC's | Combined ICC's | Physical Functioning | 0.80 | 0.59 | 0.74 |
| SF-36 Domain            | Test-Retest reliability (ICC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |                               |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
| Physical Functioning    | 0.80 Adequate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |                               |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
| Role Physical           | 0.85 Excellent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |                               |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
| Bodily Pain             | 0.89 Excellent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |                               |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
| General Health          | 0.85 Excellent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |                               |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
| Vitality                | 0.89 Excellent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |                               |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
| Social Functioning      | 0.71 Adequate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |                               |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
| Role Emotional          | 0.84 Excellent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |                               |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
| Mental Health           | 0.83 Excellent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |                               |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
| Domain                  | Patient ICC's                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Proxy ICC's  | Combined ICC's                |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |
| Physical Functioning    | 0.80                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.59         | 0.74                          |                      |               |               |                |             |                |                |                |          |                |                    |               |                |                |               |                |        |               |             |                |                      |      |      |      |

|                       |      |      |      |
|-----------------------|------|------|------|
| Role Limits–physical  | 0.77 | 0.45 | 0.67 |
| Bodily Pain           | 0.81 | 0.65 | 0.75 |
| General Health        | 0.81 | 0.71 | 0.79 |
| Vitality              | 0.77 | 0.55 | 0.70 |
| Social Functioning    | 0.79 | 0.76 | 0.80 |
| Role Limits–emotional | 0.60 | 0.50 | 0.57 |
| Mental Health         | 0.30 | 0.24 | 0.28 |

#### Chronic Traumatic Spinal Cord Injury:

(Lin et al, 2007; n = 187; 4 weeks between assessments; mean time since injury was 7.8 years)

20 random participants were selected to assess their original responses within 2 weeks; n = 10 by same interviewer (intra interviewer), n = 10 with a second interviewer (inter interviewer)

| SF-36 Domain                                                         | Intra interviewer<br>(ICC) | Inter interviewer<br>(ICC) |
|----------------------------------------------------------------------|----------------------------|----------------------------|
| Physical Functioning                                                 | 0.71                       | 0.67                       |
| Role Physical                                                        | 0.89                       | 0.90                       |
| Bodily Pain                                                          | 0.87                       | 0.70                       |
| General Health                                                       | 0.85                       | 0.41                       |
| Vitality                                                             | 0.93                       | 0.86                       |
| Social Functioning                                                   | 0.93                       | 0.52                       |
| Role Emotional                                                       | 0.99                       | 0.98                       |
| Mental Health                                                        | 0.77                       | 0.57                       |
| Excellent Intra ICC > 0.9 in BOLD; Excellent Inter ICC > 0.7 in BOLD |                            |                            |

Interrater/Intrater  
Reliability

--

Internal  
Consistency

Parkinsonism (included Parkinson Disease and Parkinson-plus syndromes):

(Steffen & Seney, 2008; n = 37; mean age = 71; mean disease duration = 14 (6) years); Hoehn and Yahr Stages range from 1-to-4. ; Stage 1: n = 3, Stage 2: n = 7, Stage 3: n = 9, Stage 4: n = 8; Test-retest by same rater at 1-week interval; mean number of falls in the past 6 months = 7)

Internal Consistency for SF-36 v1 (Cronbach's alpha): [No source for this linked to SF-36v2]

| SF-36 Domain         | Internal Consistency<br>Cronbach's alpha Strength |
|----------------------|---------------------------------------------------|
| Physical Functioning | 0.87 Excellent                                    |
| Role Physical        | 0.74 Adequate                                     |
| Bodily Pain          | 0.91 Excellent                                    |
| General Health       | 0.80 Adequate                                     |
| Vitality             | 0.91 Excellent                                    |
| Social Functioning   | 0.84 Excellent                                    |
| Role Emotional       | 0.89 Excellent                                    |
| Mental Health        | 0.93 Excellent                                    |

(Brown et al, n = 96 total (n = 58 with follow-up data and 38 without); mean age = 72 (88% white, 84% male); years of school = 15.7 (2.4); via standardized telephone interview at baseline and ~18 months (mean = 17.9 (4.2) months In PD subjects, Hoehn & Yahr stages not reported.)

| Subscale (item #)              | Cronbach's alpha (strength) |
|--------------------------------|-----------------------------|
| Physical Functioning (10)      | 0.94 (Excellent)            |
| Role Limitations–Physical (4)  | 0.81 (Excellent)            |
| Role Limitations–Emotional (3) | 0.98 (Excellent)            |
| Pain (2)                       | 0.85 (Excellent)            |

|                          |                  |
|--------------------------|------------------|
| Emotional Well-Being (5) | 0.86 (Excellent) |
| Energy (4)               | 0.92 (Excellent) |
| General Health (5)       | 0.76 (Adequate)  |
| Social Function (2)      | 0.98 (Excellent) |
| Physical Health (PCS)    | 0.93 (Excellent) |
| Mental Health (MCS)      | 0.97 (Excellent) |

#### Acute Stroke:

(Hagen et al, 2003; n = 136; mean age = 70 (11) years; assessed 1, 3 and 6 months post-stroke)

Adequate to Excellent internal consistency across domains ( $\alpha > 0.70$ ) over multiple administrations (1, 3 and 6 months) except Vitality at 1 month post stroke ( $\alpha = 0.6824$ ) and General Health at 3 months post-stroke ( $\alpha = 0.6650$ )

#### Chronic Stroke:

(Anderson et al, 1996)

Excellent internal consistency (Cronbach's  $\alpha > 0.7$ , except Vitality section):

| SF-36 Domain          | Strength  | alpha |
|-----------------------|-----------|-------|
| Physical Functioning  | Excellent | 0.9   |
| Role Limits–physical  | Adequate  | 0.8   |
| Bodily Pain           | Excellent | 0.9   |
| General Health        | Adequate  | 0.7   |
| Vitality              | Adequate  | 0.6   |
| Social Functioning    | Adequate  | 0.7   |
| Role Limits–emotional | Excellent | 0.9   |
| Mental Health         | Adequate  | 0.7   |

### Spinal Cord Injury:

(Forchheimer, et al 2004)

Adequate to Excellent internal consistency across all domains (Chronbach's  $\alpha$  = 0.76 to 0.90, mean = 0.82)

| SF-36 Domain                                                                           | Internal Consistency<br>(Cronbach's alpha) |
|----------------------------------------------------------------------------------------|--------------------------------------------|
| Physical Functioning                                                                   | 0.98                                       |
| Role Physical                                                                          | 0.94                                       |
| Bodily Pain                                                                            | 0.79                                       |
| General Health                                                                         | 0.82                                       |
| Vitality                                                                               | 0.76                                       |
| Social Functioning                                                                     | 0.72                                       |
| Role Emotional                                                                         | 0.89                                       |
| Mental Health                                                                          | 0.78                                       |
| Excellent internal consistency > 0.80 in BOLD; Adequate internal consistency 0.70-0.80 |                                            |

### Chronic SCI:

(van Leeuwen et al 2012, n = 145, AIS A-D, 5 years post injury)

Adequate internal consistency of the Mental Health subscale of SF-36 (MHI-5), Cronbach's  $\alpha$  = 0.79

Traumatic Brain Injury: (Mackenzie, et al 2002, n =1230 (1197 without proxy, 33 by 18-54 years, gender=male 66%))

The  $\alpha$  coefficient for the SF-36 health survey with the cognitive function scale

| SF-36 Domain         | $\alpha$ coefficient | Strength  |
|----------------------|----------------------|-----------|
| Physical Functioning | 0.93                 | Excellent |
| Role Limits-physical | 0.88                 | Excellent |
| Bodily Pain          | 0.89                 | Excellent |

|                       |      |           |
|-----------------------|------|-----------|
| General Health        | 0.77 | Adequate  |
| Vitality              | 0.84 | Excellent |
| Social Functioning    | 0.82 | Excellent |
| Role Limits–emotional | 0.87 | Excellent |
| Mental Health         | 0.88 | Excellent |

Traumatic Brain Injury: (Findler et al; n=597 (without disability, n=271; mild TBI, n=98; moderate-severe TBI, n=228); Mean age at interview=no disability, 38.5(12.7); mild TBI, 41.7(10.8), moderate-severe TBI, 35.7(9.8)

Cronbach's alpha ranged from 0.68-0.87 (adequate to excellent) for the comparison group, from 0.79-0.91 (excellent) for the mild TBI group, and from 0.79-0.92 (adequate to excellent) for the moderate-severe TBI group

Traumatic Brain Injury: (Guilfoyle et al, 2011; n=514; mean age=36.6 (16.1) years; gender=male 76.3%)

| SF-36 domain      | Alpha coefficient | Strength  |
|-------------------|-------------------|-----------|
| Physical Function | 0.95              | Excellent |
| Role Physical     | 0.89              | Excellent |
| Bodily Pain       | 0.90              | Excellent |
| General Health    | 0.83              | Excellent |
| Vitality          | 0.83              | Excellent |
| Social function   | 0.82              | Excellent |
| Role Emotional    | 0.90              | Excellent |
| Mental Health     | 0.86              | Excellent |

Patients undergoing surgery for oral or oropharyngeal SCCA:

(Rogers S., Humphris G., Lowe D., Brown J., Vaughan E., 1998; n = 48, mean age (SD), 61 (12))

| Subscale             | Cronbach's alpha |
|----------------------|------------------|
| Physical functioning | 0.95             |

|                           |      |
|---------------------------|------|
| Role limitation, physical | 0.92 |
| Role limitation, mental   | 0.86 |
| Social functioning        | 0.77 |
| Mental health             | 0.78 |
| Energy/Vitality           | 0.72 |
| Pain                      | 0.81 |
| General health perception | 0.79 |

Laryngeal cancer (Italian version):

(Mosconi P., Cifani S., Crispino S., Fossati R., Apolone G., 2000; n = 165, 64 (9.2), patients 0-262 months post-treatment)

| Subscale                  | Cronbach's alpha |
|---------------------------|------------------|
| Physical functioning      | 0.88             |
| Role limitation, physical | 0.83             |
| Role limitation, mental   | 0.84             |
| Social functioning        | 0.91             |
| Mental health             | 0.81             |
| Energy/Vitality           | 0.81             |
| Pain                      | 0.85             |
| General health perception | 0.69             |

Criterion Validity  
(Predictive/Concurrent)

Parkinson Disease:

(Leonardi et al, 2012; n = 86 all scales)

Pearson correlations all significant at  $p < 0.0001$

| N=86 all scales          | SF-36 PCS /<br>Correlation Strength | SF-36 MCS /<br>Correlation Strength | NMS Questionnaire /<br>Correlation Strength |
|--------------------------|-------------------------------------|-------------------------------------|---------------------------------------------|
| WHO-DAS II summary score | -0.70 / Excellent                   | -0.52 / Adequate                    | 0.65 / Excellent                            |
| NMS questionnaire        | -0.54 / Adequate                    | -0.40 / Adequate                    | --                                          |

NMS = non motor symptoms questionnaire

WHO-DAS II = World Health Organization Disability Assessment Schedule

(Nilsson et al, 2010; n = 79 with diagnosis of idiopathic PD, 37 outpatient and 42 via survey; mean age 64 years (7.2) correlation study; 8.8 (2.3) days between testing sessions; duration of diagnosis = 15.9 (7.3) years; Hoehn & Yahr ratings not specified. Focus of study on FES (Swedish-13) & SAFFE (modified Survey of Activities and Fear of Falling in the Elderly))

Adequate correlation SF-36v1 PF subscale and FES(s):  $r_s = 0.66$ ;  $p < 0.001$

Excellent SF-36v1 PF subscale and SAFFE:  $r_s = -0.76$ ;  $p < 0.001$

Chronic Stroke:

(Dorman et al, 1999; n = 688)

Adequate concurrent validity between the EuroQol health-related quality of life and the SF-36's general health domain  $r = 0.66$

Poor concurrent validity between SF-36 mental health domain and the EuroQol psychological functioning subtest

Excellent to Poor correlations between individual Barthel Index scores at five years and dimensions of the SF36. (Wilkinson et al, 1997; UK sample, n = 97, mean age at stroke = 61, mean follow-up 4.9 years)

| SF36                 | r =   |
|----------------------|-------|
| Physical functioning | 0.810 |
| Social functioning   | 0.481 |
| Role: physical       | 0.415 |
| Role: emotional      | 0.217 |
| Mental health        | 0.332 |

|                |       |
|----------------|-------|
| Vitality       | 0.500 |
| Bodily pain    | 0.356 |
| General health | 0.438 |

Chronic SCI:

(Van Leeuwen et al, 2012)

| Concurrent Validity                                                                                                                    | Spearman Correlation |
|----------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| LiSat 9                                                                                                                                | 0.531 <sup>a</sup>   |
| Neuroticism                                                                                                                            | -0.546 <sup>a</sup>  |
| SF- Vitality                                                                                                                           | 0.528 <sup>a</sup>   |
| SF- general health                                                                                                                     | 0.367 <sup>a</sup>   |
| Divergent Validity                                                                                                                     |                      |
| FIM                                                                                                                                    | 0.094                |
| SIP-mobility range                                                                                                                     | -0.283               |
| Type of injury                                                                                                                         | -0.009               |
| Completeness of injury                                                                                                                 | -0.008               |
| Cause of injury                                                                                                                        | 0.192                |
| Demographics                                                                                                                           |                      |
| Age                                                                                                                                    | -0.020               |
| Gender                                                                                                                                 | -0.067               |
| Education                                                                                                                              | 0.028                |
| <sup>a</sup> =Adequate validity 0.31-0.59; Poor validity ≤ 0.30; VanLeeuwen anticipated poor correlations with Demographics and injury |                      |

Patients within 2 years of diagnosis for head and neck cancer:

(Karvonen-Gutierrez C.A., Ronis D.L., Fowler K.E., Terrell J.E., Gruber S.B., Duffy S.A., 2008; n = 495)

Predictive Validity:

When controlling for demographic, health behavior and clinical variables, QOL as measured by the SF-36, the PCS score is significantly associated with survival (hazard ratio 0.86, 95% CI 0.80-0.93).

For every 5-point increase in the PCS score, the risk of death decreased 0.14 times.

**Construct Validity  
(Convergent/Discriminant)**

Parkinson Disease: (Leonardi et al, 2012)

Distinguish severity: SF-36v2 composite scores were significantly different between patients rated Hoehn & Yahr < 3 (n = 68) and those rated HY ≥ 3 (n = 28), with the more advanced group reporting lower composite scores on PCS (reduced by 16.8%) and MCS (reduced by 18.1%)

Chronic Spinal Cord Injury:

(Forchheimer, et al 2004)

Excellent discriminant validity established between Physical capacity score (PCS) and Mental capacity score (MCS) constructs (-0.075)

Excellent convergent validity between impairment severity and PCS (F = 5.62, df = 3, P = 0.001)

Excellent Divergent validity between impairment severity and MCS scores (F = 0.175, df = 3, P = NS)

Chronic Spinal Cord Injury:

(Lin et al, 2007)

|                      |              | WHOQOL-BREF |                   |       |        |         |
|----------------------|--------------|-------------|-------------------|-------|--------|---------|
| SF-36                | Rating Scale | Overall     | Physical Capacity | Psych | Social | Environ |
| Rating Scale         | ---          | 0.68        | 0.73              | 0.64  | 0.54   | 0.57    |
| Physical Functioning | 0.71         | 0.57        | 0.78              | 0.57  | 0.50   | 0.54    |
| Role physical        | 0.47         | 0.35        | 0.51              | 0.40  | 0.33   | 0.48    |
| Bodily pain          | 0.64         | 0.52        | 0.68              | 0.56  | 0.48   | 0.55    |
| General Health       | 0.72         | 0.65        | 0.69              | 0.62  | 0.45   | 0.59    |
| Vitality             | 0.59         | 0.59        | 0.67              | 0.65  | 0.48   | 0.62    |

|                                                                                                                                                         |      |      |      |      |      |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|
| Social Functioning                                                                                                                                      | 0.50 | 0.52 | 0.62 | 0.63 | 0.43 | 0.58 |
| Role Emotional                                                                                                                                          | 0.32 | 0.30 | 0.41 | 0.37 | 0.24 | 0.39 |
| Mental Health                                                                                                                                           | 0.36 | 0.51 | 0.52 | 0.59 | 0.40 | 0.56 |
| Excellent correlation > 0.60 in BOLD; Adequate correlation 0.31-0.59; Excellent to Adequate convergent validity between SF-36 and WHOQOL-BREF subscales |      |      |      |      |      |      |

#### Chronic Spinal Cord Injury:

(Anderson et al, 1999 n = 181 veterans with SCI who were hospitalized within 6 months of assessment)

Excellent to adequate correlations between SF-36 and Behavioral Risk Factor Surveillance System (BRFSS) subscales

Mental Capacity Summary to all BRFSS subscales (r = -0.427-0.761 )

Mental Health subscale to all BRFSS subscales (r= -0.446 - -0.795)

Vitality subscale to all BRFSS subscales (r = -0.450 - -0.789)

Social Functioning subscale to all BRFSS (r = -0.293 - -0.622)

Role Emotional subscale to all BRFSS (r = -0.290- -0.610)

Poor to adequate correlations between SF-36 subscales Physical Functioning, Role Physical, Bodily Pain, General Health and Physical Summary and all BRFSS subscales (r = 0.065- 0.597)

Poor to adequate correlations between SF-36 and Quality of Well Being (r = 0.044 to 0.417) (poor  $\leq$  0.03; adequate 0.31-0.59)

Adequate to Poor correlation between SF-36 and IADLs (r = -0.159- to -0.454)

Traumatic Brain Injury: (Findler et al; n=597 (without disability, n=271; mild TBI, n=228); Mean age at interview=no disability, 38.5(12.7); mild TBI, 41.7(10.8), n=35.7(9.8)

#### Mild TBI:

Adequate to excellent correlations (-0.50 to -0.63) were found between SF-36 scale to physical functioning (General Health, Physical Functioning, Physical Role, Bodily Pain) and the Physical symptoms scale of the Symptoms Checklist (SCL)

Excellent correlations between SF-36 scales and participants' Health Problems List (HPL) responses (0.60 to -0.75)

Emotional Role and Mental Health scores were more strongly related to psychological factors (Cognitive and Affective/Behavioral) than to physical factors on the Symptom Checklist (SCL)

Adequate to excellent correlations (-0.52 to -0.77) were found between Beck Depression Inventory second edition (BDI-II) scores and the SF-36 subscales

Moderate to Severe TBI:

Correlations were lower and more uniform, strongest correlations found between the SF-36 Emotional Role scale and the SCL Affective/Behavioral scale (-0.53).

Correlations between the Physical Functioning scale of the SF-36 and the Cognitive and Affective/Behavioural scales of the SCL were lower than other correlations between scales within the group (-0.11 and -0.19, respectively).

Multiple Neurologic Diagnosis (polio, acute stroke, and TBI): McNaughton et al., 2005; n=308, Polio n=38, Stroke n=181, TBI n=89; mean age=polio 62.5 (11.3), stroke=74.4 (12.0), TBI=34.0 (17.8); gender female=polio 27%, stroke 96%, TBI 32%)

examined validity of the mental component score (MCS) and physical component score (PCS)

Principal component analysis (PCA) on the 12-month measures for subjects with stroke and TBI: 2 dimensions might account for a large proportion of the variability in the data set

Varimax rotation shows that the 2-factor model has 85% of the variance of the underlying variables with 1 factor loading mainly onto the Barthel Index, Functional Independence Measure (FIM), PCS, Community Integration Questionnaire (CIQ), and London Handicap Scale (LHS) and the other factor mainly onto the MCS

Traumatic Brain Injury: (Guilfoyle et al; n=514; mean age=36.6 (16.1) years; gender=male 76.3%)

Principal component analysis (PCA) of the correlation matrix of the eight SF-36 domains extracted a single PC with an eigenvalue exceeding unity, which explained 59.2% of the variance in the data

The second PC extracted had an associated eigenvalue of 0.75, and accounted for only 9.4% of the variance

Known Groups

Traumatic Brain Injury: (Findler et al; n=597 (without disability, n=271; mild TBI, n=98; moderate-severe TBI, n=228); Mean age at interview=no disability, 38.5(12.7); mild TBI, 41.7(10.8), moderate-severe TBI, 35.7(9.8)

mild TBI and moderate to severe TBI groups reported significantly lower health status across all scales compared to the comparison group

mild TBI group reported significantly lower scores (poorer health) on all scales compared to the moderate± severe TBI group, with the exception of Physical Function, where there were no differences between the two groups

Traumatic Brain Injury: (Jacobsson et al., 2010 n=67, mild TBI n=32, moderate to severe TBI n=35; mean age at time of injury=mild TBI:13 (13) years, moderate to severe TBI: 30 (12) years); gender=mild TBI: male 75%, moderate to severe TBI: male 77%; Swedish version of the SF-36)

|                           | SF-36 PCS | MCS    | SWLS    | Sex   | Age at Injury | Injury Severity | Time since injury | Marital status | Vocational situation |
|---------------------------|-----------|--------|---------|-------|---------------|-----------------|-------------------|----------------|----------------------|
| SF-36: MCS                | -0.00     |        |         |       |               |                 |                   |                |                      |
| SWLS                      | 0.41**    | 0.48** |         |       |               |                 |                   |                |                      |
| Sex                       | -0.19     | 0.01   | -0.02   |       |               |                 |                   |                |                      |
| Age at injury             | -0.14     | 0.29*  | 0.05    | 0.23  |               |                 |                   |                |                      |
| Injury severity           | 0.20      | -0.10  | -0.06   | -0.03 | 0.32**        |                 |                   |                |                      |
| Time since injury         | 0.13      | 0.06   | 0.30*   | -0.05 | -0.15         | 0.10            |                   |                |                      |
| Marital status            | 0.11      | 0.06   | 0.36**  | -0.01 | -0.18         | -0.11           | 0.08              |                |                      |
| Vocational situation      | 0.48**    | -0.02  | 0.32**  | -0.11 | -0.37**       | 0.13            | 0.11              | 0.21           |                      |
| Self appraisal of the TBI | -0.54**   | -0.12  | -0.46** | 0.09  | -0.05         | -0.31**         | -0.04             | -0.27*         | -0.35**              |

Correlation (Spearman's rho) is significant (two-tailed) on \*0.05, and \*\*0.01 levels

SWLS-Satisfaction With Life Scale

Patients with cancer of the upper aero digestive tract:

(Chen A.Y., Frankowski R., Bishop-Leone J., et al., 2001)

Construct validity of the MD Anderson Dysphagia Index (MDADI) was determined through correlation of the subscales of the SF-36 and MDADI. (Spearman correlation coefficient, greater than 0.60 - strong correlation, 0.40-0.60 - moderate to substantial, less than 0.40 - weak)

|                      | MDADI Subscales |           |            |          |
|----------------------|-----------------|-----------|------------|----------|
| SF-36 Subscales      | Global          | Emotional | Functional | Physical |
| Physical functioning | 0.29            | 0.36      | 0.31       | 0.40     |
| Role - physical      | 0.31            | 0.33      | 0.37       | 0.38     |
| Bodily Pain          | 0.21            | 0.23      | 0.24       | 0.26     |
| General Health       | 0.21            | 0.33      | 0.28       | 0.32     |
| Vitality/Energy      | 0.34            | 0.50      | 0.45       | 0.52     |
| Social Functioning   | 0.44            | 0.50      | 0.45       | 0.51     |
| Role - Emotional     | 0.34            | 0.40      | 0.42       | 0.43     |
| Mental Health        | 0.27            | 0.30      | 0.29       | 0.34     |
|                      |                 |           |            |          |
| PCS                  | 0.25            | 0.30      | 0.29       | 0.34     |
| MCS                  | 0.44            | 0.54      | 0.51       | 0.54     |

Patients with head and neck cancer who underwent selective or modified radical neck dissection:

(Taylor R.J., Chepeha J.C., Teknos T.N., Bradford C.R., Sharma P.K., Terrell J.E., Hogikyan N.D., Wolf G.T., Chepeha D.B., 2002; n = 54, patients had a minimum postoperative convalescence of 11 months)

Convergent validity of the Neck Dissection Impairment Index (NDII):

(Spearman or Pearson not specified)

| Subscale | Correlation to NDII | P-value |
|----------|---------------------|---------|
|----------|---------------------|---------|

|                           |      |        |
|---------------------------|------|--------|
| Physical functioning      | 0.50 | <0.001 |
| Role limitation, physical | 0.60 | 0.001  |
| Role limitation, mental   | 0.59 | 0.001  |
| Social functioning        | 0.62 | 0.001  |
| Mental health             | 0.56 | 0.001  |
| Energy/Vitality           | 0.44 | 0.001  |
| Pain                      | 0.32 | 0.001  |
| General health perception | 0.55 | 0.001  |

Patients undergoing surgery for oral or oropharyngeal SCCA:

(Rogers S., Humphris G., Lowe D., Brown J., Vaughan E., 1998)

Correlation between SF-36 and University of Washington Hand and Neck Questionnaire:

| Subscale                  | Pearson's Correlation |
|---------------------------|-----------------------|
| Physical functioning      | 0.61, P<0.001         |
| Role limitation, physical | 0.66, P<0.001         |
| Role limitation, mental   | 0.47, P<0.01          |
| Social functioning        | 0.54, P<0.001         |
| Mental health             | -0.08                 |
| Energy/Vitality           | 0.43, P<0.01          |
| Pain                      | 0.61, P<0.001         |
| General health perception | 0.42, P<0.01          |

(Rogers S.N., Lowe D., Brown J.S., Vaughan E.D., 1998)

Spearman correlation coefficients:

SF-36 with European Organization for Research and Treatment of Cancer (EORTC):  $r = 0.83$

SF-36 with University of Washington Head and Neck Disease-Specific Measure (UW-QOL):  $r = 0.80$

Laryngeal cancer (Italian version):

(Mosconi P., Cifani S., Crispino S., Fossati R., Apolone G., 2000)

Convergent Validity - within subscale coefficients all higher than 0.40

Discriminant Validity - higher item-scale correlations found within the subscale than between the subscales

**Acute Stroke: convergent validity(Ojo Owolabi, 2010; n=100;**

**> 1-month post-stroke)**

All SF-36 subscales were significantly correlated with Stroke Levity Scale and modified Rankin Scale ( $0.31 < p \text{ magnitude} < 0.67$ ,  $0.0000001 < p < 0.004$ ).

SF-36 and Health-related Quality of Life in Stroke Patients (HRQOLISP)

- Physical domain: highly correlated ( $p=0.79$ )
- Psychological domain: highly correlated ( $p=0.69$ )
- Social domain: moderately correlated ( $p=0.47$ )
- Physical domain of HRQOLISP: moderate to high correlation with all SF-36 domains ( $0.30 < p < 0.78$ ).
- Spiritual domains of HRQOLISP: not correlated with SF 36 domains

**Acute stroke (57 days of inpatient rehabilitation (SD=28 days); Katona 2015; Authors did not designate version or language used.)**

Convergent validity

- EQ-5D Index and SF-36 physical domain: moderate correlation
  - o Admission:  $r \text{ (Pearson)} = 0.60$ ;  $p < 0.001$
  - o Discharge:  $r \text{ (Pearson)} = 0.68$ ;  $p < 0.001$
- EQ-5D Index and SF-36 mental health domain: weak correlation
  - o Admission:  $r \text{ (Pearson)} = 0.35$ ;  $p < 0.05$
  - o Discharge:  $r \text{ (Pearson)} = 0.43$ ;  $p < 0.05$

**Sub-acute Stroke: Known Groups (Ojo Owolabi, 2010; n=100;**

**> 1-month post-stroke)**

All SF-36 domains sub-domains differed significantly among mRS strata ( $0.000001 < p \leq 0.023$ ).

**Content Validity**

Items that compose the SF-36 were drawn from a number of prior measures including:

The General Psychological Well-Being Inventory (GPWBI) (Dupuy, 1984)

Physical and role functioning measures (Patrick, Bush, & Chen, 1973; Hulka & Cassel, 1973; Reynolds, Rushing, & Miles, 1974; Stewart, Ware, & Brook, 1981)

The Health Perceptions Questionnaire (HPQ) (Ware, 1976)

The Functioning and Well-Being Profile (FWBP) (Stewart & Ware, 1992)

**Face Validity**

Not statistically assessed

**Floor/Ceiling Effects**

Parkinson Disease:

(Brown et al, 2009) regarding SF-36v1 {not located for SF-36v2}

Floor effects:SF-36v1 subscales: Role limitations – physical (51% scored min possible); Role limits – emotional (21.9% scored min possible).

Ceiling effects: SF-36v1 subscale: Role limitations – Emotional (75% scored max possible); Pain (15.6% scored max possible); Social function (29.2% scored max possible).

| Subscale                   | % score min (0) | max (100) |
|----------------------------|-----------------|-----------|
| Physical Functioning       | 4.2             | 3.1       |
| Role Limitations—Physical  | 51.0            | 10.4      |
| Role Limitations—Emotional | 21.9            | 75.0      |
| Pain                       | 0.0             | 15.6      |
| Emotional Well-Being       | 1.0             | 0.0       |
| Energy                     | 3.1             | 0.0       |
| General Health             | 2.1             | 1.0       |
| Social Function            | 6.3             | 29.2      |

#### Acute Stroke:

(Hagen et al, 2003; n = 153; 1 month post stroke)

| SF-36 Domain          | % Floor | % Ceiling |
|-----------------------|---------|-----------|
| Physical Functioning  | 23      | 1         |
| Role Physical         | 70      | 4         |
| (Lack of) Bodily Pain | 6       | 35        |
| General Health        | 0       | 3         |
| Vitality              | 4       | 0         |
| Social Functioning    | 27      | 16        |
| Role Emotional        | 37      | 26        |
| Mental Health         | 0       | 2         |

#### Acute Stroke

(Ojo Owolabi, 2010; n=100; > 1-month post-stroke))

| SF-36 Domain         | % Floor | % Ceiling |
|----------------------|---------|-----------|
| Physical Functioning | 18      | 19        |
| Role Physical        | 74      | 7         |
| Role-emotional       | 58      | 30        |
| Vitality             | 0       | 7         |
| Mental Health        | 0       | 34        |
| Social Functioning   | 6       | 19        |
| Bodily Pain          | 2       | 35        |

|                   |    |    |
|-------------------|----|----|
| General health    | 0  | 3  |
| Health Transition | 11 | 32 |

Chronic Stroke:

(Anderson et al, 1996)

The SF-36 avoids the "ceiling effect" of most disability scales:

| SF-36 Domain          | % floor | % ceiling |
|-----------------------|---------|-----------|
| Physical Functioning  | 4       | 6         |
| Role Physical         | 7       | 53        |
| (Lack of) Bodily Pain | 2       | 43        |
| General Health        | 2       | 2         |
| Vitality              | 1       | 1         |
| Social Functioning    | 3       | 67        |
| Role Emotional        | 7       | 72        |
| Mental Health         | 1       | 4         |

Traumatic Brain Injury:

(Guilfoyle et al, 2011; n = 514; mean age = 36.6 (16.1) years; gender = male 76.3%)

Floor effects were observed in two domains—Role Physical and Role Emotional—and ceiling effects were observed in four domains—Physical Function, Role Physical, Bodily Pain, and Role Emotional

| SF-36 domain      | Floor % | Ceiling % |
|-------------------|---------|-----------|
| Physical Function | 4.7%    | 16.7      |

|                 |      |      |
|-----------------|------|------|
| Role Physical   | 56.8 | 19.1 |
| Bodily Pain     | 2.0  | 21.4 |
| General Health  | 0.2  | 5.1  |
| Vitality        | 2.2  | 2.8  |
| Social function | 7.3  | 0.0  |
| Role Emotional  | 43.9 | 37.5 |
| Mental Health   | 0.6  | 4.0  |

Patients undergoing surgery for oral or oropharyngeal SCCA:

(Rogers S., Humphris G., Lowe D., Brown J., Vaughan E., 1998)

No floor or ceiling effects

#### Responsiveness

Chronic spinal cord injury:

(Lin et al, 2007)

Highly sensitive (ES = 0.60 & 0.92) with respect to employment status with Physical Functioning and Role Physical domains.

Moderately sensitive (ES = 0.21-0.44) with respect to employment status with Social Functioning, Role Emotional and Mental Health domains

Small responsiveness (ES = 0.00-0.16) with respect to employment status in Bodily Pain, General Health, and Vitality domains.

Mild Traumatic Brain Injury (mTBI): (Paniak et al.,1999; n=120 with mild TBI, 120 control=mTBI 32.7 (11.9), control 30.4 (11.6))

| SF 36 variable       | Effect Size |                 |
|----------------------|-------------|-----------------|
| Physical Functioning | 3.5         | Moderate change |
| Social               | 1.98        | Small change    |

|                            |      |                 |
|----------------------------|------|-----------------|
| Role Functioning Physical  | 2.72 | Moderate change |
| Bodily Pain                | 2.04 | Moderate change |
| Mental Health              | 0.90 | Small change    |
| Role Functioning Emotional | 0.96 | Small change    |
| Vitality                   | 1.78 | Small change    |
| General Health             | 0.18 | Small change    |
| Mental                     | 0.93 | Small change    |
| Physical                   | 2.48 | Moderate change |

Traumatic Brain Injury: (Hawthorne et al, 2009; n=66; mean age at time of injury=36 (15); mean time since injury=32 months; utilized SF-36 version 2)

| SF 36 variable             | Effect Size |
|----------------------------|-------------|
| Physical Functioning       | -0.56       |
| Role Functioning Physical  | -0.77       |
| Bodily Pain                | -0.38       |
| General Health             | -0.44       |
| Vitality                   | -0.43       |
| Social Function            | -0.81       |
| Role Functioning Emotional | -0.86       |
| Mental Health              | -0.70       |
| Physical                   | -0.47       |
| Mental                     | -0.76       |

The largest effect sizes were for sub-scales assessing social, emotional, and mental health, but there were moderate to large effects across all of the eight sub-scales, suggesting that TBI may have very broad effects across many different life parts.

Laryngeal cancer (Italian version):

(Mosconi P., Cifani S., Crispino S., Fossati R., Apolone G., 2000)

| Subscale                  | Effect Size |
|---------------------------|-------------|
| Physical functioning      | 0.45        |
| Role limitation, physical | 0.78        |
| Role limitation, mental   | 0.40        |
| Social functioning        | 0.66        |
| Mental health             | 0.29        |
| Energy/Vitality           | 0.04        |
| Pain                      | 0.88        |
| General health perception | 0.74        |
| Component Summary Scores  |             |
| Physical                  | 1.1         |
| Mental                    | 0.09        |

(reference: first level of treatment extent, 0.60 indicates an important magnitude of change)

#### Professional Association Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD Edge), Spinal Cord Injury Taskforce (PD Edge), Stroke Taskforce (StrokeEdge, StrokeEdge II), Traumatic Brain Injury Taskforce (TBI Edge), and Vestibular Taskforce (VEEdge) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

Abbreviations:

|         |                                                                            |
|---------|----------------------------------------------------------------------------|
| HR      | Highly Recommend                                                           |
| R       | Recommend                                                                  |
| LS / UR | Reasonable to use, but limited study in target group / Unable to Recommend |
| NR      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|              | Acute<br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post) | Subacute<br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | Chronic<br>(> 6 months) |
|--------------|---------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------|
| SCI EDGE     | NR                                                                                    | LS                                                     | R                       |
| StrokEDGE II | NR                                                                                    | R                                                      | R                       |

Recommendations Based on Parkinson Disease Hoehn and Yahr stage:

|         | I     | II    | III   | IV    | V     |
|---------|-------|-------|-------|-------|-------|
| PD EDGE | LS/UR | LS/UR | LS/UR | LS/UR | LS/UR |

Recommendations based on level of care in which the assessment is taken:

|              | Acute Care | Inpatient Rehabilitation | Skilled Nursing Facility | Outpatient Rehabilitation | Home Health |
|--------------|------------|--------------------------|--------------------------|---------------------------|-------------|
| MS EDGE      | NR         | NR                       | NR                       | R                         | R           |
| StrokEDGE II | NR         | R                        | R                        | R                         | R           |

|          |    |    |    |    |    |
|----------|----|----|----|----|----|
| TBI EDGE | NR | NR | NR | LS | LS |
|----------|----|----|----|----|----|

Recommendations based on SCI AIS Classification:

|          |         |         |
|----------|---------|---------|
|          | AIS A/B | AIS C/D |
| SCI EDGE | R       | R       |

Recommendations for use based on ambulatory status after brain injury:

|          |                        |                  |                      |
|----------|------------------------|------------------|----------------------|
|          | Completely Independent | Mildly dependant | Moderately Dependant |
| TBI EDGE | N/A                    | N/A              | N/A                  |

Recommendations based on EDSS Classification:

|         |                |                |                |
|---------|----------------|----------------|----------------|
|         | EDSS 0.0 – 3.5 | EDSS 4.0 – 5.5 | EDSS 6.0 – 7.5 |
| MS EDGE | R              | R              | R              |

Recommendations for entry-level physical therapy education and use in research:

|          |                                                      |                                           |                                                             |                                                      |
|----------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
|          | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
| MS EDGE  | No                                                   | Yes                                       | Yes                                                         | No                                                   |
| PD EDGE  | No                                                   | No                                        | Yes                                                         | Not reported                                         |
| SCI EDGE | No                                                   | Yes                                       | Yes                                                         | Not reported                                         |

|              |    |     |     |              |
|--------------|----|-----|-----|--------------|
| StrokEDGE II | No | Yes | Yes | Not reported |
| TBI EDGE     | No | Yes | Yes | Not reported |

#### Considerations

Physical function domain: significant floor effects for patients with SCI and other disabilities due to inability to perform some of the physical tasks described. Recommend the SF-36 state “walkwheel” to improve responsiveness for patients with spinal cord injury. (Lee et al., 2009)

Not recommended for:

Patients who cannot understand written or spoken language

Severely affected stroke survivors who require a proxy to complete the assessment

To document patient change (Dorman et al., 1999)

Some disadvantaged populations, slight declines in reliability may result (Turner-Bowker et al., 2002)

Postal administration of the SF-36 is not recommended (O'Mahony et al, 1998)

The Mental Health Subscale of SF-36 (MHI-5) VanLeeuwen, 2012 may be used in the future to determine mental health and severe mental health problems in persons with SCI. Cut off score  $\leq 72$  and  $\leq 60$  respectively.

The Brazilian version was evaluated by Cabral et al., 2012 (n=120; chronic stroke > 6 months after stroke)

Internal consistency: Reasonable internal consistency across domains (Cronbach's  $\alpha=0.79$ )

Convergent validity of SF-36-Brazilian Version & Nottingham Health Profile

| Convergent Validity | Spearman $\rho$ |
|---------------------|-----------------|
| Vitality            | 0.47            |
| Pain                | 0.63            |
| Mental health       | 0.70            |
| Social functioning  | 0.43            |
| Functional capacity | 0.82            |
| Total               | 0.80            |

Intra- & inter-rater reliability (n=74)

| Reliability | ICC (95% CI) | p-value |
|-------------|--------------|---------|
|-------------|--------------|---------|

|                           |                  |       |
|---------------------------|------------------|-------|
| Test-retest<br>(1 rater)  | 0.89 (0.83-0.93) | <0.01 |
| Inter-rater<br>(2-raters) | 0.89 (0.83-0.93) | <0.01 |

#### Floor & ceiling effects Chronic Stroke

| SF-36 Domain        | % floor | % ceiling |
|---------------------|---------|-----------|
| Vitality            | 6.7     | 5.8       |
| Pain                | 9.2     | 13.3      |
| Mental health       | 4.2     | 7.5       |
| Social functioning  | 4.2     | 44.2      |
| Functional capacity | 8.3     | 3.3       |

The SF-12 is a shorter version of the SF-36 containing 12 items; covers the summary physical health and mental health scales, but no information about each of the eight dimensions of the SF-36

The SF-12 is beginning to be more commonly used in the TBI population however its psychometric properties in this population have not been specifically assessed (Nichol et al, 2011)

Do you see an error or have a suggestion for this instrument summary? Please e-mail us!

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|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| Year published           | 1992                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Instrument in PDF Format | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

Approval Status

Approved



## REHAB 29. MEASURES DATABASE: STROKE IMPACT SCALE

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of Assessment</b>    | <b>Stroke Impact Scale</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Link to instrument</b>     | <a href="#">Available for free at the Landon Center on Aging SIS Homepage (external link)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Purpose</b>                | <b>Assesses health status following stroke</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Acronym</b>                | <b>SIS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Jason Raad, MS and Jennifer Moore, PT, DHS, NCS and the Rehabilitation Measures Team; Updated by Jane Sullivan, PT, DHS and the Stroke EDGE taskforce of the Academy of Neurologic Physical Therapy - a component of APTA; Updated by Jill Smiley, MPH and the Rehabilitation Measures Team in June 2013. Updated by Maggie Bland and Nancy Byl and the Stroke EDGE II taskforce Academy of Neurologic Physical Therapy - a component of APTA in 2016.                                                                                                                                                                                     |
| <b>Summary Date</b>           | <b>07 06 2013</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b>            | <ul style="list-style-type: none"> <li>• A 59 item measure</li> <li>• 8 domains assessed: <ul style="list-style-type: none"> <li>o Strength (4 items)</li> <li>o Hand function (5 items)</li> <li>o ADL/IADL (10 items)</li> <li>o Mobility (9 items)</li> <li>o Communication (7 items)</li> <li>o Emotion (9 items)</li> <li>o Memory and thinking (7 items)</li> <li>o Participation/Role function (8 items)</li> </ul> </li> <li>• Each item is rated in a 5-point Likert scale in terms of the difficulty the patient has experienced in completing each item</li> <li>• Summative scores are generated for each domain, scores range from 0-100</li> </ul> |

- An extra question on stroke recovery asks that the client rate on a scale from 0-100 how much the client feels that he/she has recovered from his/her stroke
- Formula for scoring domains:  
Transformed Scale = [(Actual raw score - lowest possible raw score) / Possible raw score] \* 100 (free scoring software available)
- 3 items change polarity in the "emotion" domain: 3f, 3h, and 3i; when manually scoring items must be reverse-scored
- A proxy version is available if patients are unable to answer (Duncan et al, 2002)
- Designed for repeated administration to track changes over time (refer to manual)
- Can be used in both in clinical and research applications (Refer to manual)
- Factor analysis of the SIS 2.0 revealed that the 4 domains (strength, hand function, mobility, and ADL/IADL) could be summed together to create a physical dimension score (the SIS-16)
- The SIS-16 consists of 16 items capturing daily activities
- For each item, the individual is asked to rate the level of difficulty of the item in the past 2 weeks using the following scale:
  - o 1 = could not do it at all
  - o 2 = very difficult
  - o 3 = somewhat difficult
  - o 4 = a little difficult
  - o 5 = not difficult at all

|                           |                         |
|---------------------------|-------------------------|
| <b>ICF Domain</b>         | Activity, Participation |
| <b>Time to Administer</b> | 15-20 minutes           |
| <b>Number of Items</b>    | 59                      |

|                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Equipment Required</b>                  | Score sheet; Computer scoring requires Microsoft Access, find it free at the <a href="#">instruments website</a>                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Training Required</b>                   | <ul style="list-style-type: none"> <li>• Yes, refer to the <a href="#">measures website</a> for more information:</li> <li>• The <a href="#">SIS Manual</a> is also available</li> </ul>                                                                                                                                                                                                                                                                                         |
| <b>Actual Cost</b>                         | Free to non-profit users via link above.                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                            | <p>Contact information and permission to use:</p> <p>MAPI Research Trust, Lyon, France:<br/> Email: <a href="mailto:PROinformation@mapi-trust.org">PROinformation@mapi-trust.org</a><br/> Internet: <a href="http://www.mapi-trust.org">www.mapi-trust.org</a></p> <p>Scale: <a href="http://www.mapi-trust.org/services/questionnairelicensing/catalog-questionnaires/298-sis">http://www.mapi-trust.org/services/questionnairelicensing/catalog-questionnaires/298-sis</a></p> |
| <b>Populations Tested</b>                  | <b>Stroke</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Standard Error of Measurement (SEM)</b> | <p><b><u>Stroke:</u></b></p> <p>(Lin et al, 2010; <math>n = 74</math>; mean age = 54.1 (11.4); mean time post-stroke = 17.5 (17.7) months, Chronic Stroke)</p> <ul style="list-style-type: none"> <li>• Strength = 8.7</li> <li>• ADL/IADL = 6.3</li> <li>• Mobility = 5.5</li> <li>• Hand function = 9.4</li> </ul>                                                                                                                                                             |
| <b>Minimal Detectable Change (MDC)</b>     | <p><b><u>Stroke:</u></b></p> <p>Minimal Detectable Change (Lin et al, 2010, Chronic Stroke)</p> <ul style="list-style-type: none"> <li>• Strength = 24.0</li> <li>• ADL/IADL = 17.3</li> <li>• Mobility = 15.1</li> <li>• Hand function = 25.9</li> </ul>                                                                                                                                                                                                                        |

**Minimally Clinically  
Important Difference  
(MCID)**

**Stroke:**

Clinically Important Differences (Lin et al, 2010, Chronic Stroke)

- Strength = 9.2
- ADL/IADL = 5.9
- Mobility = 4.5
- Hand function = 17.8

**Cut-Off Scores**

Not Applicable

**Normative Data**

**Stroke:**

(Duncan et al, 2002;  $n = 287$ ; mean age = 72.6 (10.0) years; < 28 days post-stroke; SIS Version 3.0, Acute Stroke)

| SIS Domain           | Mean (SD)   |
|----------------------|-------------|
| Strength             | 61.9 (22.0) |
| Memory               | 77.8 (19.1) |
| Emotion              | 74.3 (18.1) |
| Communication        | 81.0 (19.1) |
| ADL/IADL             | 66.5 (23.2) |
| Mobility             | 60.2 (23.1) |
| Hand function        | 55.9 (34.5) |
| Social participation | 58.9 (25.7) |
| SIS-16 physical      | 67.5 (21.2) |

(Huang et al, 2010;  $n = 58$ ; mean age = 56.42 (11.67) years; 17.85 months post stroke, range 7-88, Chronic Stroke)

| SIS Domain           | Mean (SD)     |
|----------------------|---------------|
| Strength             | 40.73 (20.05) |
| Memory               | 81.54 (19.17) |
| Emotion              | 59.63 (17.25) |
| Communication        | 89.71 (16.87) |
| ADL/IADL             | 67.41 (20.10) |
| Mobility             | 79.25 (18.08) |
| Hand function        | 29.63 (25.39) |
| Social participation | 47.92 (25.13) |
| SIS-16 physical      | 61.98 (12.27) |

#### Test-retest Reliability

#### Stroke:

(Duncan et al, 1999;  $n = 33$  minor severity;  $n = 58$  moderate severity; mean age minor severity = 69.3 (10.1); mean age moderate severity 71.9 (10.1); enrolled < 14 days post-stroke, Acute Stroke)

SIS version 2.0 (current version = 3.0) at 1, 3 and 6 months post-stroke:

- Adequate to Excellent test-retest reliability ICC = 0.70 to 0.92 (except for the emotion domain, ICC = 0.57)

(Edwards and O'connell, 2003;  $n = 74$  individuals who suffered from a stroke; mean age = 58.35(14.80) years; mean time since stroke = 56.8 months; Anglo-Saxon Australian sample, Chronic Stroke)

- Adequate to Excellent test-retest reliability in all domains except for the emotion domain
- Poor test-retest reliability in the emotion domain

## Interrater/Intrarater

### Reliability

#### Stroke:

(Carod-Artal et al, 2009);  $N = 180$  proxy-stroke patient pairs; mean age = 57.9 (13.5) years; Gender = 100 males and 80 females; mean time since stroke = 20.3 (23.6) months post stroke (chronic),

- Excellent interrater reliability for hand function (ICC = 0.82) and mobility (ICC = 0.80) domains
- Adequate interrater reliability for strength (ICC = 0.61), ADL/IADL (ICC = 0.74), and memory and thinking (ICC = 0.43) domains
- Poor interrater reliability for communication (ICC = 0.39), **emotion (ICC = 0.17), and social participation (ICC = 0.29)** domains

(Chou et al, 2015) In Taiwan, patients post stroke ( $N=121$ ) were tested and retested while in acute hospital, acute rehabilitation or outpatient clinic in Taiwan with baseline test and retested 2 weeks later.

| SIS 3.0                   | Cronbach's Alpha | ICC  | SEM | SRD  |
|---------------------------|------------------|------|-----|------|
| <i>Total Score</i>        | 0.96             | 0.94 | 4.3 | 12.0 |
| <i>Composite Physical</i> | 0.97             | 0.92 | 4.3 | 12.0 |
| SIS-16                    | 0.94             | 0.95 | 4.8 | 13.2 |

## Internal Consistency

#### Stroke:

(Duncan et al, 1999; SIS version 2.0, Acute Stroke)

- Excellent: Cronbach's alpha ranged from 0.83 to 0.90 across the 8 domains

(Carod-Artal et al, 2009, Chronic Stroke)

- Excellent internal consistency for 7 of the domains:
  - o Strength (ICC = 0.82)
  - o Hand function (ICC = 0.95)
  - o Mobility (ICC = 0.94)
  - o ADL/IADL (ICC = 0.87)

- o Memory (ICC = 0.92)
- o Communication (ICC = 0.84)
- o Social participation (ICC = 0.85)
- Adequate interrater reliability for emotion domain (ICC = 0.49)

## Criterion Validity

### Stroke:

#### (Predictive/Concurrent)

(Duncan et al, 2002, Acute Stroke)

| Measures Assessed                | Patient <i>r</i> | Proxy <i>r</i> |
|----------------------------------|------------------|----------------|
| Folstein MMSE and SIS memory     | 0.42             | 0.37           |
| Barthel Index and SIS ADL/IADL   | 0.72*            | 0.78*          |
| Barthel Index and SIS mobility   | 0.69             | 0.7*           |
| Lawton IADL and SIS ADL/IADL     | 0.77*            | 0.78*          |
| Motricity and SIS strength       | 0.67             | 0.69           |
| *indicates excellent correlation |                  |                |

#### Predictive Validity

(Kwon et al, 2006, Acute Stroke)

- Excellent correlation between FIM-motor correlation and SIS-ADL ( $r = 0.86^*$ )
- Excellent correlation between SF-36V (Physical Component) and SIS-PHYSICAL ( $r = 0.77^*$ )

\*SIS at 12 weeks; FIM and SF-36v at 16 weeks

(Duncan et al, 1999; SIS version 2.0, Acute Stroke)

| SIS Domain    | Comparative Measure       | Correlation | Rating    |
|---------------|---------------------------|-------------|-----------|
| Hand function | FMA-Upper Extremity Motor | $r = 0.81$  | Excellent |
| Mobility      | FIM Motor                 | $r = 0.83$  | Excellent |
|               | Barthel Index             | $r = 0.82$  | Excellent |
|               | Duke Mobility Scale       | $r = 0.83$  | Excellent |

|                      |                            |             |           |
|----------------------|----------------------------|-------------|-----------|
|                      | SF-36 Physical Functioning | $r = 0.84$  | Excellent |
| <b>Strength</b>      | NIHSS Motor                | $r = -0.59$ | Adequate  |
|                      | FMA Total                  | $r = 0.72$  | Excellent |
| <b>ADL/IADL</b>      | Barthel Index              | $r = 0.84$  | Excellent |
|                      | FIM Motor                  | $r = 0.84$  | Excellent |
|                      | Lawton IADL                | $r = 0.82$  | Excellent |
| <b>Memory</b>        | MMSE                       | $r = 0.58$  | Adequate  |
| <b>Communication</b> | FIM Social/Cognition       | $r = 0.53$  | Adequate  |
|                      | NIHSS Language             | $r = -0.44$ | Adequate  |
| <b>Emotion</b>       | Geriatric Depression Scale | $r = -0.77$ | Excellent |
|                      | SF-36 Mental Health        | $r = 0.74$  | Excellent |
| <b>Participation</b> | SF-36 Emotional Role       | $r = 0.28$  | Poor      |
|                      | SF-36 Physical Role        | $r = 0.45$  | Adequate  |
|                      | SF-36 Social Functioning   | $r = 0.70$  | Excellent |
| <b>Physical</b>      | Barthel Index              | $r = 0.76$  | Excellent |
|                      | FIM Motor                  | $r = 0.79$  | Excellent |
|                      | SF-36 Physical Functioning | $r = 0.75$  | Excellent |
|                      | Lawton IADL                | $r = 0.73$  | Excellent |

(Lin, Fu, et al, 2010, Chronic Stroke)

- Adequate to Excellent criterion validity for the hand function subscale ( $\rho = 0.51-0.68$ ;  $p < 0.01$ )

(Huang et al, 2010) Patients (N=58), mean age 56.42 ( $\pm 11.67$ ) years old, (an average of 17.85[range 7-88] months chronic post-stroke) were treated with CIT for 2 hours daily for 3 weeks)

- The initial FIM score predicted the overall and ADL/IADL subscale scores.

- Participants between 63.5 and 67.9 years had the greatest improvement in overall SIS.

(Lin, Chuang, et al, 2010) Fifty-nine participants, mean age 55.50 ( $\pm$  11.66) years old, seen an average of 16.14  $\pm$  13.95 months post-stroke.

- Adequate concurrent validity between the SIS Hand Function Domain (version 3.0) and the Berg Balance Test (0.52 - 0.59,  $p < 0.01$ ) and the Action Research Arm Test (0.36 – 0.45,  $p < 0.01$ ).
- Adequate to Excellent concurrent validity between the SIS Hand Function Domain (version 3.0) and the Nine Hole Peg Test (-0.58 - -0.66,  $p < 0.01$ ).

(Chen et al, 2012) Predictive validity examined for the ARAT and the SIS in 191 patients post stroke, mean age 55.17 ( $\pm$ 11.14) years old, an average of 17.19 ( $\pm$  15.29) months post-stroke.

- The correlation of the ARAT and the SIS hand function and SIS-Physical was 0.58 (95% CI = 0.49-0.67) and 0.45 (95% CI = 0.33 to 0.56) respectively, significant at  $P < 0.001$ .

## Construct Validity

### Stroke:

#### (Convergent/Discriminant) Convergent validity

- Excellent correlation between Burden of Stroke Scale (BOSS) and SIS total scores ( $r = -0.83$ )

(Duncan et al, 1999, Acute Stroke)

- Most domains of the SIS can differentiate between patients with varying degrees of stroke severity

(Carod-Artal et al, 2009, Chronic Stroke)

- Correlation between proxy ratings and stroke functional measures tended to be slightly lower than for patient-based self assessment
- Correlations were observed between functional status and the following SIS proxy-version domains:
  - o Mobility ( $r = -0.73$ ) Excellent
  - o ADL/IADL ( $r = -0.69$ ) Excellent
  - o Strength ( $r = -0.44$ ) Adequate
  - o Hand function ( $r = -0.44$ ) Adequate

- Correlations were observed between the Barthel Index and the following SIS proxy-domains:
  - Mobility ( $r = 0.80$ ) Excellent
  - ADL/IADL ( $r = 0.74$ ) Excellent
  - Strength ( $r = 0.52$ ) Adequate
  - Hand function ( $r = 0.52$ ) Adequate
- Poor correlation between the HADS-Depression subscale and the SIS emotion domain were observed ( $r = -0.20$ )

(O'Dell, 2013) Thirty-two community dwelling participants an average of  $4.1 \pm 4.5$  years post-stroke participated in upper extremity robotics training.

- Adequate correlation between the SIS Hand Function Domain and the Arm Motor Ability Test-9 ( $0.40, p = 0.025$ ).
- Poor correlation between the SIS Communication Domain and the Arm Motor Ability Test-9 ( $-0.16, p = 0.39$ ).

**Content Validity** Development of the SIS was based on a study at the Landon Center on Aging, University of Kansas Medical Center (Duncan, Wallace, Studenski, Lai, & Johnson, 2001) using feedback from individual interviews with patients and focus group interviews with patients, caregivers, and health care professionals

**Face Validity** Not Established

**Floor/Ceiling Effects** Acute Stroke:  
(Duncan et al, 1999; SIS version 2.0)

| % of sample who encountered Floor or Ceiling effects |                       |          |                           |          |
|------------------------------------------------------|-----------------------|----------|---------------------------|----------|
|                                                      | Minor Stroke (n = 96) |          | Moderate Stroke (n = 144) |          |
| SIS                                                  | %Floor                | %Ceiling | %Floor                    | %Ceiling |
| Strength                                             | 0                     | 13.5     | 1.4                       | 2.1      |
| Hand Function                                        | 2                     | 14.6     | 40.2                      | 4.9      |
| Mobility                                             | 0                     | 6        | 0.6                       | 2.1      |

|                      |   |      |     |      |
|----------------------|---|------|-----|------|
| <b>ADL/IADL</b>      | 0 | 2.1  | 2.8 | 1.4  |
| <b>Memory</b>        | 0 | 12.5 | 0.6 | 10.4 |
| <b>Communication</b> | 0 | 35.4 | 1.4 | 25.7 |
| <b>Emotion</b>       | 0 | 4.1  | 0   | 4.2  |
| <b>Participation</b> | 0 | 15.6 | 3.5 | 1.49 |
| <b>Physical</b>      | 0 | 1    | 0.6 | 0    |
| <b>Barthel</b>       | 0 | 64.6 | 0   | 24.8 |

**Chou et al, 2015 (N=121 patients acute and subacute post stroke)**

| Percent of sample who encountered Floor or Ceiling effects |                 |                 |                       |
|------------------------------------------------------------|-----------------|-----------------|-----------------------|
|                                                            | Stroke (n =121) |                 | Item Domain)          |
|                                                            |                 |                 | Correlation corrected |
| <b>SIS</b>                                                 | <b>%Floor</b>   | <b>%Ceiling</b> | <b>Range</b>          |
| <b>Strength</b>                                            | 10              | 11              | 0.79-0.83             |
| <b>Hand Function</b>                                       | 26              | 24              | 0.90-0.96             |
| <b>Mobility</b>                                            | 1               | 19              | 0.52-0.90             |
| <b>ADL/IADL</b>                                            | 1               | 22              | 0.34-0.87             |
| <b>Memory</b>                                              | 1               | 37              | 0.55-0.78             |
| <b>Communication</b>                                       | 1               | 60              | 0.63-0.77             |
| <b>Emotion</b>                                             | 1               | 6               | 0.29-0.62             |
| <b>Participation</b>                                       | 2               | 16              | 0.52-0.75             |
| <b>Physical</b>                                            | 1               | 8               | 0.28-0.85             |
| <b>Total</b>                                               |                 |                 | 0.17-0.79             |
| <b>SIS-16 Total</b>                                        | 1               | 14              | 0.33-0.86             |

**Responsiveness**

**Stroke:**

(Duncan et al, 1999; SIS version 2.0, Acute Stroke)

For patients with minor and moderate strokes, the SIS is sensitive to change from 1 to 3 and 1 to 6 months post-stroke. However the SIS is not sensitive between 3 to 6 months for minor stroke, but does demonstrate sensitivity for this period with moderate stroke patients.

(Lin, Fu, et al, 2010, Chronic Stroke)

- The hand function subscale showed medium responsiveness (SRM = 0.52; Wilcoxon Z = 4.24;  $p < 0.05$ )
- Responsiveness of the SIS total score was significantly larger than that of the Stroke Specific Quality of Life Scale total (SRM difference = 0.36; 95% CI, 0.02-0.71)

## Professional Association Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

### Abbreviations:

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

### Recommendations for use based on acuity level of the patient:

|  | Acute | Subacute | Chronic |
|--|-------|----------|---------|
|--|-------|----------|---------|

|                  | (CVA < 2 months post)<br><br>(SCI < 1 month post)<br><br>(Vestibular < 6 weeks post) | (CVA 2 to 6 months)<br><br>(SCI 3 to 6 months) | (> 6 months) |
|------------------|--------------------------------------------------------------------------------------|------------------------------------------------|--------------|
| <b>StrokEDGE</b> | <i>NR</i>                                                                            | <i>HR</i>                                      | <i>HR</i>    |

Recommendations based on level of care in which the assessment is taken:

|                  | Acute Care | Inpatient Rehabilitation | Skilled Nursing Facility | Outpatient Rehabilitation | Home Health |
|------------------|------------|--------------------------|--------------------------|---------------------------|-------------|
| <b>StrokEDGE</b> | <i>NR</i>  | <i>UR</i>                | <i>HR</i>                | <i>HR</i>                 | <i>HR</i>   |

Recommendations for entry-level physical therapy education and use in research:

|                  | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|------------------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| <b>StrokEDGE</b> | <i>Yes</i>                                           | <i>Yes</i>                                | <i>Yes</i>                                                  | <i>Not reported</i>                                  |

#### Considerations

- The respondent must be able to follow a 3-step command
- The author recommends that patients score at least 16 on the Mini-Mental Exam
- The SIS can be mail administered, completed by proxy, completed by proxy by mailed administration, or be administered by telephone
- Proxies (if used) are more likely to rate a patient as impaired (Duncan et al, 2002)

- The SIS should be used with caution in individuals with mild impairment as the items in the communication, memory, and emotion domains are considered easy and only capture limitations in most impaired individuals
- Would be appropriate in these settings provided the client has spent time living in the community since stroke diagnosis as many items relate to living at home
- Alternately, the tool could be used and a percentage score calculated omitting "home-based" items

**Do you see an error or have a suggestion for this instrument summary?**  
Please [e-mail us!](#)

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**Link to instrument**

[Available for free at the Landon Center on Aging SIS Homepage \(external link\)](#)

### 30. REHAB MEASURES DATABASE: STROKE REHABILITATION ASSESSMENT OF MOVEMENT MEASURE

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Link to instrument     | <a href="#">STREAM</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Title of Assessment    | Stroke Rehabilitation Assessment of Movement Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Acronym                | STREAM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Instrument Reviewer(s) | Reviewed by Heather Anderson and Rie Yoshida of the StrokEdge II task force, Neurology Section, APTA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Summary Date           | 3/24/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Purpose                | <ul style="list-style-type: none"> <li>The STREAM was designed for use by physical therapists to provide a quantitative evaluation of motor functioning for stroke patients. The STREAM was specifically designed to be easy to administer in a clinical setting.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Description            | <p>The STREAM is composed of 30 items distributed across 3 domains:</p> <ul style="list-style-type: none"> <li><b>Upper-limb (UL)</b> movements (scored on a 3-point ordinal scale)</li> <li><b>Lower-limb (LL)</b> movements (scored on a 3-point ordinal scale)</li> <li><b>Basic mobility (MO)</b> items (scored on a 4-point ordinal scale)</li> </ul> <p>Scoring the STREAM:</p> <ul style="list-style-type: none"> <li>Total of 20 points for each of the limb sub-scales (40 points total)</li> <li>Total of 30 points for the mobility subscale</li> <li>Scores can be transformed, allowing for items that can't be scored</li> <li>Subscales are converted to a percentage, even though the scores are not interval based. This is done to allow for occasional items that cannot be scored. Total scores are calculated using the average of the 3 subscale scores</li> <li>Instructions for score transformation can be found in the instruments manual</li> </ul> <p>Three versions of STREAM exists: the original 30 item STREAM-30, revised STREAM-27, and simplified STREAM-15</p> <ul style="list-style-type: none"> <li>STREAM-27 omitted 2 UL subscale items: scapular elevation and opposition; 1 LL subscale item: hip abduction from STREAM-30</li> <li>STREAM-15 comprises of 5 items in each of the subscales from original STREAM-30</li> </ul> |

|                                  |                                                    |
|----------------------------------|----------------------------------------------------|
| <b>Area of Assessment</b>        | Coordination; Functional Mobility; Range of Motion |
| <b>Body Part</b>                 | Upper Extremity; Lower Extremity                   |
| <b>ICF Domain</b>                | Body Function; Activity                            |
| <b>Domain</b>                    | Motor                                              |
| <b>Assessment Type</b>           | Performance Measure                                |
| <b>Length of Test</b>            | 06 to 30 Minutes                                   |
| <b>Time to Administer</b>        | 15 minutes                                         |
| <b>Number of Items</b>           | 30                                                 |
| <b>Equipment Required</b>        | None                                               |
| <b>Training Required</b>         | None                                               |
| <b>Type of training required</b> | No Training                                        |
| <b>Cost</b>                      | Free                                               |
| <b>Actual Cost</b>               | Free                                               |
| <b>Age Range</b>                 | Adult: 18-64 years; Elderly adult: 65+             |
| <b>Administration Mode</b>       | Paper/Pencil                                       |
| <b>Diagnosis</b>                 | Stroke                                             |

| Populations Tested                  | <ul style="list-style-type: none"><li>Stroke</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                  |             |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------|--|--|---------|-----|--------|------------|--------|--|--|--|-----------|-----|-----------|------------|-----------|-----|-----------|------------|--------------|-----|-----------|-----------|----------|--|--|--|-------------|-----|-----------|-------------|-------------|-----|-----------|-----------|----------------|-----|-----------|------------|----|--|--|--|-------|-----|-----------|------------|-------|-----|-----------|------------|----------|-----|-----------|-----------|------|--|--|--|
| Standard Error of Measurement (SEM) | <p><b>Chronic Stroke:</b> (Chen et al, 2007; <i>n</i> = 50; mean age = 60.9 (12.8) years; median time between stroke and assessment = 24 months, mean Barthel Index (BI) scores = 15.9 (5.3) points)</p> <ul style="list-style-type: none"><li>Standard Error of Measurement (SEM) = 1.5 points</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  |             |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| Minimal Detectable Change (MDC)     | <p><b>Chronic Stroke:</b> (Chen et al, 2007)</p> <ul style="list-style-type: none"><li>Smallest Real Difference (SRD) = 4.2 points</li></ul> <p><b>Acute Stroke:</b> (Hsueh et al, 2008; <i>n</i> = 50 mean age = 61.9 (11.7) years; onset to admission 18.6 (11.7) days; stay in rehab = 22.3 (5.7) days)</p> <ul style="list-style-type: none"><li></li></ul> <table><tr><th colspan="4">STREAM Smallest Real Difference:</th></tr><tr><th>Measure</th><th>ICC</th><th>95% CI</th><th>SRD (SRD%)</th></tr><tr><td>STREAM</td><td></td><td></td><td></td></tr><tr><td>UE-STREAM</td><td>.97</td><td>0.96-0.98</td><td>2.8 (14.0)</td></tr><tr><td>LE-STREAM</td><td>.98</td><td>0.96-0.99</td><td>2.5 (12.6)</td></tr><tr><td>Motor-STREAM</td><td>.98</td><td>0.97-0.99</td><td>3.9 (9.9)</td></tr><tr><td>S-STREAM</td><td></td><td></td><td></td></tr><tr><td>UE-S-STREAM</td><td>.95</td><td>0.92-0.97</td><td>11.6 (11.6)</td></tr><tr><td>LE-S-STREAM</td><td>.97</td><td>0.95-0.98</td><td>9.1 (9.1)</td></tr><tr><td>Motor-S-STREAM</td><td>.97</td><td>0.95-0.98</td><td>17.4 (8.7)</td></tr><tr><td>FM</td><td></td><td></td><td></td></tr><tr><td>UE-FM</td><td>.98</td><td>0.96-0.99</td><td>7.2 (10.9)</td></tr><tr><td>LE-FM</td><td>.95</td><td>0.91-0.97</td><td>3.8 (11.3)</td></tr><tr><td>Motor-FM</td><td>.98</td><td>0.97-0.99</td><td>8.4 (8.4)</td></tr><tr><td>S-FM</td><td></td><td></td><td></td></tr></table> | STREAM Smallest Real Difference: |             |  |  | Measure | ICC | 95% CI | SRD (SRD%) | STREAM |  |  |  | UE-STREAM | .97 | 0.96-0.98 | 2.8 (14.0) | LE-STREAM | .98 | 0.96-0.99 | 2.5 (12.6) | Motor-STREAM | .98 | 0.97-0.99 | 3.9 (9.9) | S-STREAM |  |  |  | UE-S-STREAM | .95 | 0.92-0.97 | 11.6 (11.6) | LE-S-STREAM | .97 | 0.95-0.98 | 9.1 (9.1) | Motor-S-STREAM | .97 | 0.95-0.98 | 17.4 (8.7) | FM |  |  |  | UE-FM | .98 | 0.96-0.99 | 7.2 (10.9) | LE-FM | .95 | 0.91-0.97 | 3.8 (11.3) | Motor-FM | .98 | 0.97-0.99 | 8.4 (8.4) | S-FM |  |  |  |
| STREAM Smallest Real Difference:    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| Measure                             | ICC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 95% CI                           | SRD (SRD%)  |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| STREAM                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| UE-STREAM                           | .97                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.96-0.98                        | 2.8 (14.0)  |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| LE-STREAM                           | .98                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.96-0.99                        | 2.5 (12.6)  |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| Motor-STREAM                        | .98                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.97-0.99                        | 3.9 (9.9)   |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| S-STREAM                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| UE-S-STREAM                         | .95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.92-0.97                        | 11.6 (11.6) |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| LE-S-STREAM                         | .97                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.95-0.98                        | 9.1 (9.1)   |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| Motor-S-STREAM                      | .97                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.95-0.98                        | 17.4 (8.7)  |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| FM                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| UE-FM                               | .98                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.96-0.99                        | 7.2 (10.9)  |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| LE-FM                               | .95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.91-0.97                        | 3.8 (11.3)  |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| Motor-FM                            | .98                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.97-0.99                        | 8.4 (8.4)   |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |
| S-FM                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             |  |  |         |     |        |            |        |  |  |  |           |     |           |            |           |     |           |            |              |     |           |           |          |  |  |  |             |     |           |             |             |     |           |           |                |     |           |            |    |  |  |  |       |     |           |            |       |     |           |            |          |     |           |           |      |  |  |  |

|                                                         | <table><tr><td><b>UE-S-FM</b></td><td>.93</td><td>0.89-0.96</td><td>12.2 (12.2)</td></tr><tr><td><b>LE-S-FM</b></td><td>.96</td><td>0.93-0.97</td><td>8.6 (8.6)</td></tr><tr><td><b>Motor-S-FM</b></td><td>.96</td><td>0.94-0.98</td><td>16.0 (8.0)</td></tr></table> <p>STREAM = Motor Scale of Stroke Rehabilitation Assessment of Movement<br/>S-STREAM = Simplified Motor Scale of STREAM<br/>SRD = smallest real difference<br/>FM = Fugl-Meyer Motor Scale<br/>S-FM = Simplified Fugl-Meyer Motor Scale<br/>UE = Upper Extremity<br/>LE = Lower Extremity</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>UE-S-FM</b>                           | .93         | 0.89-0.96 | 12.2 (12.2) | <b>LE-S-FM</b> | .96    | 0.93-0.97 | 8.6 (8.6) | <b>Motor-S-FM</b> | .96 | 0.94-0.98 | 16.0 (8.0) |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-------------|-----------|-------------|----------------|--------|-----------|-----------|-------------------|-----|-----------|------------|--------|--|----------|--|------|--------|-----------|--------|-----------|--------|-----------|--------|---------------|--------------------|-----------|----|-----------|----|-----------|----|--|--------------------|-----------|----|-----------|-----|-----------|-----|--|--------------------|-----------|----|-----------|----|-----------|-----|--|--------------------------|-----------|----|-----------|----|-----------|----|
| <b>UE-S-FM</b>                                          | .93                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.89-0.96                                | 12.2 (12.2) |           |             |                |        |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
| <b>LE-S-FM</b>                                          | .96                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.93-0.97                                | 8.6 (8.6)   |           |             |                |        |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
| <b>Motor-S-FM</b>                                       | .96                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.94-0.98                                | 16.0 (8.0)  |           |             |                |        |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
| <b>Minimally Clinically Important Difference (MCID)</b> | <p><b>Stroke:</b> (Hsieh et al, 2008; <i>n</i> = 81 stroke patients who were recruited from Departments of Physical Medicine and Rehabilitation of three hospital in Taiwan; mean age = 55.9 (13.3) years; mean MMSE score = 25.8 (2.8) years; mean STREAM baseline score = 10.27 (7.6) for upper extremity, 9.6 (6.7) for lower extremity, and 16.1 (7.6) for mobility)</p> <ul style="list-style-type: none"><li>MCID for upper-extremity subscale (<i>n</i> = 42) = 2.2</li><li>MCID for lower-extremity subscale (<i>n</i> = 38) = 1.9</li><li>MCID for mobility subscale (<i>n</i> = 43) = 4.8</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                          |             |           |             |                |        |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
| <b>Cut-Off Scores</b>                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                          |             |           |             |                |        |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
| <b>Normative Data</b>                                   | <p><b>Acute Stroke:</b> (Ahmed et al, 2003; <i>n</i> = 63; mean age = 67 (14) years; assessed within a week of stroke, then again at 4 weeks and 3 months)</p> <table><tr><th colspan="8">STREAM Norms Over Time with Comparisons:</th></tr><tr><th colspan="2">Instrument</th><th colspan="2">Initial</th><th colspan="2">5 week</th><th colspan="2">3 months</th></tr><tr><th>Name</th><th>Domain</th><th>Mean (SD)</th><th>Median</th><th>Mean (SD)</th><th>Median</th><th>Mean (SD)</th><th>Median</th></tr><tr><td><b>STREAM</b></td><td><b>Total Score</b></td><td>75 (26.7)</td><td>86</td><td>86 (19.1)</td><td>94</td><td>89 (18.0)</td><td>97</td></tr><tr><td></td><td><b>UE subscale</b></td><td>73 (33.3)</td><td>90</td><td>85 (26.2)</td><td>100</td><td>88 (24.0)</td><td>100</td></tr><tr><td></td><td><b>LE subscale</b></td><td>75 (28.9)</td><td>85</td><td>86 (22.3)</td><td>95</td><td>90 (19.0)</td><td>100</td></tr><tr><td></td><td><b>Mobility subscale</b></td><td>74 (25.9)</td><td>83</td><td>88 (16.4)</td><td>97</td><td>91 (15.0)</td><td>97</td></tr></table> | STREAM Norms Over Time with Comparisons: |             |           |             |                |        |           |           | Instrument        |     | Initial   |            | 5 week |  | 3 months |  | Name | Domain | Mean (SD) | Median | Mean (SD) | Median | Mean (SD) | Median | <b>STREAM</b> | <b>Total Score</b> | 75 (26.7) | 86 | 86 (19.1) | 94 | 89 (18.0) | 97 |  | <b>UE subscale</b> | 73 (33.3) | 90 | 85 (26.2) | 100 | 88 (24.0) | 100 |  | <b>LE subscale</b> | 75 (28.9) | 85 | 86 (22.3) | 95 | 90 (19.0) | 100 |  | <b>Mobility subscale</b> | 74 (25.9) | 83 | 88 (16.4) | 97 | 91 (15.0) | 97 |
| STREAM Norms Over Time with Comparisons:                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                          |             |           |             |                |        |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
| Instrument                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Initial                                  |             | 5 week    |             | 3 months       |        |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
| Name                                                    | Domain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Mean (SD)                                | Median      | Mean (SD) | Median      | Mean (SD)      | Median |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
| <b>STREAM</b>                                           | <b>Total Score</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75 (26.7)                                | 86          | 86 (19.1) | 94          | 89 (18.0)      | 97     |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
|                                                         | <b>UE subscale</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 73 (33.3)                                | 90          | 85 (26.2) | 100         | 88 (24.0)      | 100    |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
|                                                         | <b>LE subscale</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75 (28.9)                                | 85          | 86 (22.3) | 95          | 90 (19.0)      | 100    |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |
|                                                         | <b>Mobility subscale</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 74 (25.9)                                | 83          | 88 (16.4) | 97          | 91 (15.0)      | 97     |           |           |                   |     |           |            |        |  |          |  |      |        |           |        |           |        |           |        |               |                    |           |    |           |    |           |    |  |                    |           |    |           |     |           |     |  |                    |           |    |           |    |           |     |  |                          |           |    |           |    |           |    |

|                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|--------------|-------------------------|------------|--------------------------|------------|--------------------|-----------|-------------------------|----------------------|-------------|------|-------------|------|-------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|
|                                                                                                                                                                                                      | <table><tr><td><b>Barthel Index</b></td><td><b>Total</b></td><td>72 (27.9)</td><td>85</td><td>86 (20.4)</td><td>100</td><td>92 (14.0)</td><td>100</td></tr><tr><td><b>Gait speed (m/s)</b></td><td><b>Total</b></td><td>0.55 (0.38)</td><td>0.58</td><td>0.82 (0.43)</td><td>0.90</td><td>0.85 (0.36)</td><td>0.93</td></tr><tr><td colspan="8">STREAM = Stroke Rehabilitation Assessment of Movement<br/>UE = Upper Extremity<br/>LE = Lower Extremity</td></tr></table>                                                                                                                                                                                                                                                                                                                    | <b>Barthel Index</b>                                      | <b>Total</b> | 72 (27.9)               | 85         | 86 (20.4)                | 100        | 92 (14.0)          | 100       | <b>Gait speed (m/s)</b> | <b>Total</b>         | 0.55 (0.38) | 0.58 | 0.82 (0.43) | 0.90 | 0.85 (0.36) | 0.93 | STREAM = Stroke Rehabilitation Assessment of Movement<br>UE = Upper Extremity<br>LE = Lower Extremity                                                                                                |  |  |  |  |  |  |  |
| <b>Barthel Index</b>                                                                                                                                                                                 | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 72 (27.9)                                                 | 85           | 86 (20.4)               | 100        | 92 (14.0)                | 100        |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| <b>Gait speed (m/s)</b>                                                                                                                                                                              | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.55 (0.38)                                               | 0.58         | 0.82 (0.43)             | 0.90       | 0.85 (0.36)              | 0.93       |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| STREAM = Stroke Rehabilitation Assessment of Movement<br>UE = Upper Extremity<br>LE = Lower Extremity                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| <b>Test-retest Reliability</b>                                                                                                                                                                       | <p><b>Chronic Stroke:</b> (Chen et al, 2007, <i>n</i> = 50, 7 days between assessments)</p> <table><tr><td colspan="2">Test re-test data for the Mobility subscale of the STREAM</td></tr><tr><td>First Session Mean (SD)</td><td>17.9 (7.2)</td></tr><tr><td>Second Session Mean (SD)</td><td>17.8 (7.6)</td></tr><tr><td>Mean <i>d</i> (SD)</td><td>0.1 (2.1)</td></tr><tr><td>ICC (95% CI)</td><td>0.96 (0.93 to 0.98)*</td></tr><tr><td>SEM</td><td>1.5</td></tr><tr><td>SRD</td><td>4.2</td></tr><tr><td colspan="2">*Excellent</td></tr><tr><td colspan="2">d = difference of score between the 2 test sessions<br/>ICC = intraclass correlation coefficient<br/>CI = confidence interval<br/>SEM = standard error of measurement<br/>SRD = smallest real difference</td></tr></table> | Test re-test data for the Mobility subscale of the STREAM |              | First Session Mean (SD) | 17.9 (7.2) | Second Session Mean (SD) | 17.8 (7.6) | Mean <i>d</i> (SD) | 0.1 (2.1) | ICC (95% CI)            | 0.96 (0.93 to 0.98)* | SEM         | 1.5  | SRD         | 4.2  | *Excellent  |      | d = difference of score between the 2 test sessions<br>ICC = intraclass correlation coefficient<br>CI = confidence interval<br>SEM = standard error of measurement<br>SRD = smallest real difference |  |  |  |  |  |  |  |
| Test re-test data for the Mobility subscale of the STREAM                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| First Session Mean (SD)                                                                                                                                                                              | 17.9 (7.2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| Second Session Mean (SD)                                                                                                                                                                             | 17.8 (7.6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| Mean <i>d</i> (SD)                                                                                                                                                                                   | 0.1 (2.1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| ICC (95% CI)                                                                                                                                                                                         | 0.96 (0.93 to 0.98)*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| SEM                                                                                                                                                                                                  | 1.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| SRD                                                                                                                                                                                                  | 4.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| *Excellent                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| d = difference of score between the 2 test sessions<br>ICC = intraclass correlation coefficient<br>CI = confidence interval<br>SEM = standard error of measurement<br>SRD = smallest real difference |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| <b>Interrater/ Intrarater Reliability</b>                                                                                                                                                            | <p><b>Chronic Stroke:</b> (Daley et al, 1999; <i>n</i> = 20; mean age = 66.7 (10.7) years; mean time between stroke onset and assessment = 104.5 (42.7) days)</p> <table><tr><td><b>Interrater and Intrarater Reliability:</b></td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Interrater and Intrarater Reliability:</b>             |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| <b>Interrater and Intrarater Reliability:</b>                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                           |              |                         |            |                          |            |                    |           |                         |                      |             |      |             |      |             |      |                                                                                                                                                                                                      |  |  |  |  |  |  |  |

| Sub scale                                                                                                   | Direct Observation (Interrater Agreement) | Videotaped Assessments (Intrarater Agreement) |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------|
| Upper-extremity subscale                                                                                    | .994                                      | .963                                          |
| Lower-extremity subscale                                                                                    | .993                                      | .999                                          |
| Basic mobility subscale                                                                                     | .982                                      | .999                                          |
| Total scores on STREAM                                                                                      | .995                                      | .999                                          |
| GCC = generalizability correlation coefficient<br>Reliability coefficients of .95 or better are recommended |                                           |                                               |

#### Internal Consistency

##### Chronic Stroke: (Daley et al, 1999)

- Internal Consistency (Cronbach's alpha):
  - o **Excellent:** Mobility subscale = .965
  - o **Excellent:** Limb subscales = .979
  - o **Excellent:** overall STREAM scores = .984

#### Criterion Validity (Predictive/ Concurrent)

##### Acute Stroke: (Ahmed et al, 2003)

| STREAM Predictive and Concurrent Validity Correlations: |          |                                |                                  |         |         |     |      |
|---------------------------------------------------------|----------|--------------------------------|----------------------------------|---------|---------|-----|------|
| Stream                                                  | Time     | Box and Block<br>(Affected UE) | Box and Block<br>(Unaffected UE) | Barthel | Balance | TUG | Gait |
| Total                                                   | Initial  | .73                            | .36                              | .78     | .75     | .80 | .74  |
|                                                         | 5 weeks  | .77                            | .37                              | .71     | .68     | .64 | .62  |
|                                                         | 3 months | .78                            | .44                              | .75     | .65     | .57 | .73  |
| UE                                                      | Initial  | .78                            | .31                              | .67     | .57     | .69 | .56  |
|                                                         | 5 weeks  | .79                            | .36                              | .66     | .61     | .49 | .53  |

|                 |                 |     |     |     |     |     |     |
|-----------------|-----------------|-----|-----|-----|-----|-----|-----|
|                 | <b>3 months</b> | .76 | .31 | .67 | .53 | .60 | .64 |
| <b>LE</b>       | <b>Initial</b>  | .53 | .40 | .71 | .73 | .75 | .74 |
|                 | <b>5 weeks</b>  | .64 | .29 | .59 | .55 | .59 | .55 |
|                 | <b>3 months</b> | .70 | .30 | .63 | .55 | .51 | .65 |
| <b>Mobility</b> | <b>Initial</b>  | .66 | .55 | .84 | .88 | .85 | .83 |
|                 | <b>5 weeks</b>  | .69 | .40 | .75 | .71 | .57 | .65 |
|                 | <b>3 months</b> | .66 | .40 | .82 | .78 | .62 | .76 |

**Acute Stroke:** Ward et al, 2011; n = 30; mean age 66.5 (SD 13.7) years; mean time assessed following stroke 7.8 days (SD 3.5; range 3-15); assessed at admission and discharge; mean time in rehabilitation = 23.3 (range 7-53) days)

| Spearman correlations and corresponding p-values                                                                                                                           |                 |           |        |           |        |        |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------|--------|-----------|--------|--------|--------|
| STREAM                                                                                                                                                                     |                 | Admission |        | Discharge |        | Change |        |
|                                                                                                                                                                            |                 | FIM       | SIS-16 | FIM       | SIS-16 | FIM    | SIS-16 |
| <b>Total STREAM</b>                                                                                                                                                        | <b>rho:</b>     | 0.7766    | 0.7073 | 0.7802    | 0.7153 | 0.2535 | 0.4456 |
|                                                                                                                                                                            | <b>p-value:</b> | <.0001    | <.0001 | <.001     | <.0001 | .1765  | .0136  |
| <b>Mobility STREAM</b>                                                                                                                                                     | <b>rho:</b>     | 0.6501    | 0.6451 | 0.8292    | 0.7985 | 0.3055 | 0.2655 |
|                                                                                                                                                                            | <b>p-value:</b> | .0001     | .0001  | <.0001    | <.0001 | .1007  | .1561  |
| <b>UE STREAM</b>                                                                                                                                                           | <b>rho:</b>     | 0.7489    | 0.6088 | 0.7012    | 0.5499 | 0.1277 | 0.2461 |
|                                                                                                                                                                            | <b>p-value:</b> | <.0001    | .0004  | <.0001    | .0016  | .5011  | .1898  |
| <b>LE STREAM</b>                                                                                                                                                           | <b>rho:</b>     | 0.7905    | 0.5992 | 0.6954    | 0.6371 | 0.2811 | 0.1955 |
|                                                                                                                                                                            | <b>p-value:</b> | <.001     | .0005  | <.0001    | .0002  | .1324  | .3006  |
| STREAM = Stroke Rehabilitation Assessment of Movement<br>FIM = Functional Independence Measure<br>SIS-16 = 16 item Stroke Impact Scale<br>SRM = Standardized response mean |                 |           |        |           |        |        |        |

**Acute Stroke:** Ward et al, 2011

**Spearman correlations (values are Spearman rho coefficients) between admission FIM, SIS-16 and STREAM scores and predicted vs actual length of stay**

| Measure                | Predicted length of stay | Actual length of stay |
|------------------------|--------------------------|-----------------------|
| <b>Motor FIM</b>       | -0.9438                  | -0.6846               |
| <b>SIS-16</b>          | -0.6743                  | -0.7953               |
| <b>Total STREAM</b>    | -0.8011                  | -0.7972               |
| <b>Mobility STREAM</b> | -0.6361                  | -0.7423               |
| <b>UE STREAM</b>       | -0.7717                  | -0.7469               |
| <b>LE STREAM</b>       | -0.8446                  | -0.7364               |

P-values are <.0001 for all correlations except for STREAM mobility and predicted length of stay where P = .0002

**STREAM** = Stroke Rehabilitation Assessment of Movement

**FIM** = Functional Independence Measure

**SIS-16** = 16 item Stroke Impact Scale

**Construct Validity (Convergent/Discriminant)**

**Acute Stroke:** (Hsueh et al, 2003, n = 59; mean age 64.2 (11.5) years; assessed within 14 days of stroke onset, Taiwanese sample)

**Convergent Validity and Predictive Validity of the STREAM at 4 Time Points**

| Days | n  | Convergent Validity* (p) | Predictive Validity† (p) |
|------|----|--------------------------|--------------------------|
| 14   | 57 | 0.80                     | 0.54                     |
| 30   | 54 | 0.87                     | 0.67                     |
| 90   | 44 | 0.82                     | 0.81                     |
| 180  | 43 | 0.76                     | --                       |

\*Relationships between the STREAM and the BI at 4 time points.  
†Relationships between the STREAM and the BI at 3 time points (14, 30, and 90 days) after stroke.

**Content Validity** Items from the initial STREAM were reviewed by two panels of experts made up to 20 physical therapists. Feedback from these experts were used to refine the measure.

**Face Validity** Not statistically assessed

**Floor/Ceiling Effects** **Acute Stroke:** (Hsueh et al, 2008)

**STREAM Floor and Ceiling Effects at Admission and Discharge**

|                     | At Admission, n (%) |           | t Discharge, n (%) |           |
|---------------------|---------------------|-----------|--------------------|-----------|
|                     | Floor               | Ceiling   | Floor              | Ceiling   |
| <b>UE-STREAM</b>    | 13 (26.0)           | 10 (20.0) | 4 (8.0)            | 20 (40.0) |
| <b>LE-STREAM</b>    | 10 (20.0)           | 2 (4.0)   | 1 (2.0)            | 12 (24.0) |
| <b>Motor-STREAM</b> | 9 (18.0)            | 1 (2.0)   | 1 (2.0)            | 10 (20.0) |
| <b>S-STREAM</b>     | 2 (4.0)             | 0 (0.0)   | 0 (0.0)            | 6 (12.0)  |

UE = Upper Extremity

LE = Lower Extremity

STREAM = Motor Scale of Stroke Rehabilitation Assessment of Movement

S-STREAM = Simplified Motor Scale of STREAM

**Acute Stroke:** (Hsueh et al, 2003)

**STREAM Floor and Ceiling Effects at 4 Time Points**

| Days after Stroke | Floor | Ceiling |
|-------------------|-------|---------|
|                   |       |         |

|              | n (%) | n (%)    |
|--------------|-------|----------|
| 14 (n = 57)  | 0 (0) | 0 (0)    |
| 30 (n = 54)  | 0 (0) | 2 (3.7)  |
| 90 (n = 44)  | 0 (0) | 6 (13.6) |
| 180 (n = 43) | 0 (0) | 7 (16.3) |

**Subacute Stroke:** (Huang et al, 2015,  $n = 195$ ; mean age = 63.4 (13.7) years, Taiwanese sample, compared original 30-item STREAM with STREAM-27 and simplified STREAM-15)

- Significant floor and ceiling effects in STREAM-30
  - UL subscale: both significant floor effects (21.0%-31.3%) and ceiling effects (19.0%-26.2%) found for both admission and discharge
  - LL subscale: significant floor effect (20.5%) at admission and significant ceiling effect (19.5%) at discharge
  - MO subscale: no significant floor or ceiling effects

Neither floor nor ceiling effects found in 3 subscales of STREAM-27 and STREAM-15

## Responsiveness

**Acute Stroke:** (Higgins et al, 2005;  $n = 55$ ; mean age = 66 (15), assessed at 5 weeks after onset)

| Standard Response Means (SRM) for STREAM: |      |                         |
|-------------------------------------------|------|-------------------------|
| Sub-scale                                 | SRM  | 95% Confidence Interval |
| STREAM Total                              | 0.98 | 0.74 – 1.17             |
| STREAM (upper limb)                       | 0.75 | 0.56 – 0.93             |
| STREAM (lower limb)                       | 0.63 | 0.36 – 0.86             |

**Acute Stroke:** (Hsueh et al, 2008; assessed at admission and within 48 hours of discharge; mean time in rehabilitation = 22.3 (5.7) days)

- S-STREAM found to be the most responsive

**STREAM Responsiveness:**

| Scale                 | Change score (SD) | Strength | Effect Size <i>d</i> | SRM  |
|-----------------------|-------------------|----------|----------------------|------|
| <b>STREAM</b>         |                   |          |                      |      |
| <b>UE-STREAM</b>      | 3.3 (4.2)         | small    | 0.38                 | 0.78 |
| <b>LE-STREAM</b>      | 3.3 (3.9)         | small    | 0.44                 | 0.84 |
| <b>Motor-STREAM</b>   | 6.5 (6.9)         | small    | 0.45                 | 0.95 |
| <b>S-STREAM</b>       |                   |          |                      |      |
| <b>UE-S-STREAM</b>    | 14.5 (12.2)       | small    | 0.49                 | 1.19 |
| <b>LE-S-STREAM</b>    | 14.7 (12.9)       | medium   | 0.54                 | 1.14 |
| <b>Motor-S-STREAM</b> | 29.1 (23.2)       | medium   | 0.53                 | 1.26 |
| <b>FM</b>             |                   |          |                      |      |
| <b>UE-FM</b>          | 8.4 (8.5)         | small    | 0.34                 | 1.00 |
| <b>LE-FM</b>          | 4.3 (5.2)         | small    | 0.41                 | 0.83 |
| <b>Motor-FM</b>       | 12.7 (11.0)       | small    | 0.38                 | 1.16 |
| <b>S-FM</b>           |                   |          |                      |      |
| <b>UE-S-FM</b>        | 14.6 (14.4)       | small    | 0.47                 | 1.00 |
| <b>LE-S-FM</b>        | 14.9 (17.9)       | medium   | 0.51                 | 0.83 |
| <b>Motor-S-FM</b>     | 29.4 (29.7)       | medium   | 0.51                 | 0.99 |

STREAM = Motor Scale of Stroke Rehabilitation Assessment of Movement

S-STREAM = Simplified Motor Scale of STREAM

FM = Fugl-Meyer Motor Scale

UE = Upper Extremity

LE = Lower Extremity

S-FM = Simplified Fugl-Meyer Motor Scale

SRM = Standardized Response Mean

**Acute Stroke:** Ward et al, 2011

| Scale                                                                                                                                                                                                                                                                                                                                                                                     | Change score (SD) | Strength | SRM  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------|------|
| <b>Total STREAM</b>                                                                                                                                                                                                                                                                                                                                                                       | 12.3 (8.8)        | Large    | 1.40 |
| <b>UE-STREAM</b>                                                                                                                                                                                                                                                                                                                                                                          | 12.4 (12.9)       | Large    | 0.97 |
| <b>LE-STREAM</b>                                                                                                                                                                                                                                                                                                                                                                          | 10.2 (9.9)        | Large    | 1.03 |
| <b>Mobility-STREAM</b>                                                                                                                                                                                                                                                                                                                                                                    | 11.9 (14.4)       | Large    | 0.83 |
| <b>FIM (motor)</b>                                                                                                                                                                                                                                                                                                                                                                        | 23.7 (10.1)       | Large    | 2.34 |
| <b>SIS-16</b>                                                                                                                                                                                                                                                                                                                                                                             | 23.1 (14.0)       | Large    | 1.65 |
| <p>STREAM = Stroke Rehabilitation Assessment of Movement<br/> FIM = Functional Independence Measure<br/> SIS-16 = 16 item Stroke Impact Scale<br/> SRM = Standardized response mean<br/> Change score = difference in score between admission and discharge<br/> Strength = Small (0.20 - <math>\leq</math>0.50); Medium (0.50 - <math>\leq</math>0.80); Large <math>\geq</math> 0.80</p> |                   |          |      |

**Acute Stroke:** (Hsueh et al, 2003)

| <b>Responsiveness of the STREAM at Different Stages of Recovery</b> |          |      |            |
|---------------------------------------------------------------------|----------|------|------------|
| Days                                                                | <i>n</i> | SRM  | Wilcoxon z |
| 14–30                                                               | 51       | 1.17 | 6.02*      |
| 30–90                                                               | 43       | 0.95 | 4.95*      |
| 90–180                                                              | 43       | 0.40 | 2.23†      |
| 14–90                                                               | 43       | 1.61 | 5.72*      |
| 14–180                                                              | 43       | 1.65 | 5.57*      |
| *P < 0.001; †P < 0.05                                               |          |      |            |

**Acute Stroke:** (Yu et al, 2013; n = 66; mean age 63.1 (SD 12.1) years; mean time assessed following stroke 18 days (range 6-64)

- **A moderate to good association** (0.80;  $p < 0.001$ ) between changes in scores on the Mobility STREAM and the Hierarchical Balance Short Form (HBSF); Difference 0.00; 95% CI: (-0.10 – 0.10)

**Acute Stroke:** (Yu et al, 2012;  $n = 85$ ; mean age 65.5 (SD 11.6) years; mean time assessed following stroke 19 days (range 5-79)

- **Moderate** external responsiveness ( $p < 0.001$ ) for changes in Mobility STREAM compared to Balance Computerized Adaptive Test (CAT): ( $\beta = 0.67$ ;  $r^2 = 0.44$ ); compared to Postural Assessment Scale for Stroke patients (PASS): ( $\beta = 0.77$ ;  $r^2 = 0.59$ )
- **Sufficient** explanatory power of predictive validity ( $p < 0.001$ ) for changes in Mobility STREAM at discharge compared to Balance CAT: ( $\beta = 0.76$ ;  $r^2 = 0.57$ ); compared to PASS: ( $\beta = 0.80$ ;  $r = 0.63$ )

**Subacute Stroke:** (Huang et al, 2015)

- Group level responsiveness:
  - Internal responsiveness: similar among 3 STREAM versions (STREAM-30, STREAM-27, STREAM-15)
  - External responsiveness: similar among the 3 STREAM measures. The UL and LL subscales demonstrated moderate external responsiveness and the MO subscale showed high external responsiveness
  - The results demonstrate that **all versions of stream are equally able to identify changes in movement status and mobility when used in a group**
- Individual level responsiveness:
  - Internal responsiveness: mean SCs for STREAM-27 significantly higher than those of STREAM-15 in all subscales (UL, LL, and MO)
  - External responsiveness: significantly more participants found to have important improvement by STREAM-27 or BI than by STREAM-15 and BI in MO subscale

The results demonstrate that **STREAM-27 can detect more participants with significant movement and mobility improvement than STREAM-15**

## Professional Association Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StroKEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

#### Abbreviations:

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post) | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months) |
|---------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|
| <b>StrokEDGE II</b> | <i>HR</i>                                                                                    | <i>HR</i>                                                     | <i>HR</i>                      |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>StrokEDGE II</b> | <i>HR</i>         | <i>HR</i>                       | <i>HR</i>                       | <i>HR</i>                        | <i>HR</i>          |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|---------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>StrokEDGE II</b> | <i>No</i>                                                   | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>N</i>                                                    |

#### Considerations

Do you see an error or have a suggestion for this instrument summary? Please [e-mail us](#)!

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## Year published

1986

## Instrument in PDF Format

Yes

## Approval Status

Approved

### 31. REHAB MEASURES DATABASE: STROKE SPECIFIC QUALITY OF LIFE SCALE

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     | <a href="http://www.strokengine.ca/wp-content/uploads/2015/01/Stroke-Specific-Quality-of-Life-Scale.pdf">http://www.strokengine.ca/wp-content/uploads/2015/01/Stroke-Specific-Quality-of-Life-Scale.pdf</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Title of Assessment</b>    | Stroke Specific Quality of Life Scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Acronym</b>                | SS-QOL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Michele Sulwer, PT, DPT, NCS and Genevieve Pinto-Zipp, PT, EdD, of the StrokEDGE II, Neurology Section, APTA, in 3/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Summary Date</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Purpose</b>                | Assessment of health-related quality of life specific to stroke survivors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b>            | <ul style="list-style-type: none"> <li>• 49 items</li> <li>• Items are assessed on 5-point Likert Scale <ul style="list-style-type: none"> <li>o Each item is answered using 1 of 3 different response sets (1) amount of help required to do specific tasks, ranging from no help to total help (2) amount of trouble experienced when attempting tasks, ranging from unable to do it to no trouble at all (3) degree of agreement with statements regarding their functioning, ranging from strongly agree to strongly disagree</li> </ul> </li> <li>• Provides both summary and domain specific scores <ul style="list-style-type: none"> <li>o Domain scores are composed of unweighted averages</li> <li>o Summary scores are composed of an unweighted average of the 12 domain average scores</li> </ul> </li> <li>• Scores range from 49-245</li> <li>• Higher scores indicate better functioning</li> </ul> |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           | <ul style="list-style-type: none"> <li>The twelve domains include <ul style="list-style-type: none"> <li>Mobility</li> <li>Energy</li> <li>Upper Extremity Function</li> <li>Work and Productivity</li> <li>Mood</li> <li>Self-care</li> <li>Social Roles</li> <li>Family Roles</li> <li>Vision</li> <li>Language</li> <li>Thinking</li> <li>Personality</li> </ul> </li> <li>May be used with proxies, however research suggests agreement between patient and proxy was best for observable physical domains (Duncan et al, 2002)</li> </ul> |
| <b>Area of Assessment</b> | Behavior; Cognition; Functional Mobility; Language; Negative Affect; Personality; Quality of Life; Social Relationships; Upper Extremity Function                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Body Part</b>          | Not Applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>ICF Domain</b>         | Participation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Domain</b>             | Cognition; Emotion; General Health; Motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Assessment Type</b>    | Patient Reported Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Length of Test</b>     | 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Time to Administer</b> | 10-15 minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Number of Items</b>    | 49                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                                                  |                                                                                                                                                                 |                   |                                           |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------|
| Equipment Required                               | None                                                                                                                                                            |                   |                                           |
| Training Required                                | None                                                                                                                                                            |                   |                                           |
| Type of training required                        | No Training                                                                                                                                                     |                   |                                           |
| Cost                                             | Free                                                                                                                                                            |                   |                                           |
| Actual Cost                                      | Scale can be found in:<br><br>Williams, L. S., M. Weinberger, et al. (1999). "Development of a stroke-specific quality of life scale." Stroke 30(7): 1362-1369. |                   |                                           |
| Age Range                                        | Adult: 18-64 years; Elderly adult: 65+                                                                                                                          |                   |                                           |
| Administration Mode                              | Paper/Pencil                                                                                                                                                    |                   |                                           |
| Diagnosis                                        | Stroke                                                                                                                                                          |                   |                                           |
| Populations Tested                               | Stroke                                                                                                                                                          |                   |                                           |
| Standard Error of Measurement (SEM)              | Not Established                                                                                                                                                 |                   |                                           |
| Minimal Detectable Change (MDC)                  | <b><u>Chronic Stroke:</u></b> (Lin et al 2011);n=25 patients >6 months post stroke.                                                                             |                   |                                           |
|                                                  |                                                                                                                                                                 | MDC <sub>95</sub> | % of patients exceeding MDC <sub>95</sub> |
|                                                  | Mobility Subscale                                                                                                                                               | 5.9 points        | 9.5% - 28.4%                              |
|                                                  | Self-Care Subscale                                                                                                                                              | 4.0 points        | 6.8% - 28.4%                              |
|                                                  | UE Function Subscale                                                                                                                                            | 5.3 points        | 12.2% - 33.8%                             |
| Minimally Clinically Important Difference (MCID) | <b><u>Chronic Stroke:</u></b> (Lin et al 2011); n=74; patients >6 months post stroke                                                                            |                   |                                           |
|                                                  |                                                                                                                                                                 | MDC <sub>95</sub> | % of patients exceeding MDC <sub>95</sub> |
|                                                  | Mobility Subscale                                                                                                                                               | 1.5 – 2.4 points  | 9.5% - 28.4%                              |

|                                              | Self-Care Subscale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1.2 – 1.9 points | 6.8% - 28.4%  |                                              |                |      |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|----------------------------------------------|----------------|------|--|--|--|--|--|-----------|--|--|------------|--|--|---------|-------------|----------------|------|-------------|----------------|------|--------|------|------|------|------|------|------|------|----|----|----|----|----|----|----|----|----|----|----|----|----|-------|-----|-----|-----|-----|-----|-----|
|                                              | UE Function Subscale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1.2 – 1.8 points | 12.2% - 33.8% |                                              |                |      |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
| Cut-Off Scores                               | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                              |                |      |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
| Normative Data                               | <p><b>Acute Stroke:</b> (Williams et al, 1999; <i>n</i> = 34; mean age = 61 years; patients assessed 1 &amp; 3 months post stroke (+/- 1 week); mean Canadian Neurologic Scale at admission = 9.2)</p> <table><tr><th colspan="7">Scores 1 and 3 Months After Stroke by HRQOL*</th></tr><tr><th></th><th colspan="3">1 Month**</th><th colspan="3">3 Months**</th></tr><tr><th>Measure</th><th>A Lot Worse</th><th>A Little Worse</th><th>Same</th><th>A Lot Worse</th><th>A Little Worse</th><th>Same</th></tr><tr><td>SS-QOL</td><td>3.23</td><td>3.61</td><td>4.19</td><td>3.10</td><td>3.89</td><td>4.35</td></tr><tr><td>SF-3</td><td>41</td><td>52</td><td>63</td><td>33</td><td>49</td><td>68</td></tr><tr><td>BI</td><td>93</td><td>91</td><td>97</td><td>92</td><td>98</td><td>99</td></tr><tr><td>NIHSS</td><td>3.4</td><td>3.2</td><td>1.5</td><td>2.4</td><td>1.1</td><td>1.1</td></tr></table> <p>*Overall HRQOL was rated by patients at both time points</p> <p>** mean scores</p> |                  |               | Scores 1 and 3 Months After Stroke by HRQOL* |                |      |  |  |  |  |  | 1 Month** |  |  | 3 Months** |  |  | Measure | A Lot Worse | A Little Worse | Same | A Lot Worse | A Little Worse | Same | SS-QOL | 3.23 | 3.61 | 4.19 | 3.10 | 3.89 | 4.35 | SF-3 | 41 | 52 | 63 | 33 | 49 | 68 | BI | 93 | 91 | 97 | 92 | 98 | 99 | NIHSS | 3.4 | 3.2 | 1.5 | 2.4 | 1.1 | 1.1 |
| Scores 1 and 3 Months After Stroke by HRQOL* |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                              |                |      |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
|                                              | 1 Month**                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               | 3 Months**                                   |                |      |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
| Measure                                      | A Lot Worse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | A Little Worse   | Same          | A Lot Worse                                  | A Little Worse | Same |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
| SS-QOL                                       | 3.23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3.61             | 4.19          | 3.10                                         | 3.89           | 4.35 |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
| SF-3                                         | 41                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 52               | 63            | 33                                           | 49             | 68   |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
| BI                                           | 93                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 91               | 97            | 92                                           | 98             | 99   |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
| NIHSS                                        | 3.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3.2              | 1.5           | 2.4                                          | 1.1            | 1.1  |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
| Test-retest Reliability                      | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                              |                |      |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |
| Interrater/Intrarater Reliability            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                              |                |      |  |  |  |  |  |           |  |  |            |  |  |         |             |                |      |             |                |      |        |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |    |    |    |       |     |     |     |     |     |     |

## Internal Consistency

### Acute Stroke: (Williams et al, 1999):

- **Excellent** Internal Consistency

| Domain                                                                   | Items | Mean (SD)   | Alpha |
|--------------------------------------------------------------------------|-------|-------------|-------|
| Energy                                                                   | 3     | 2.9 (1.44)  | 0.88  |
| Family Roles                                                             | 3     | 3.74 (1.28) | 0.79  |
| Language                                                                 | 5     | 4.41 (0.68) | 0.85  |
| Mobility                                                                 | 6     | 4.11 (0.84) | 0.86  |
| Mood                                                                     | 5     | 3.91 (1.03) | 0.80  |
| Personality                                                              | 3     | 3.57 (1.21) | 0.77  |
| Self-care                                                                | 5     | 4.51 (0.85) | 0.89  |
| Social Roles                                                             | 5     | 3.07 (1.33) | 0.85  |
| Thinking                                                                 | 3     | 3.39 (1.21) | 0.73  |
| Upper Extremity Function                                                 | 5     | 4.21 (0.94) | 0.83  |
| Vision                                                                   | 3     | 4.61 (0.72) | 0.81  |
| Work/Productivity                                                        | 3     | 3.67 (1.11) | 0.75  |
| Excellent; Cronbach's alpha ( $\geq 0.73$ across each of the 12 domains) |       |             |       |

Subarachnoid Haemorrhage: Boosman et al, 2009; n=141;  
36.1 $\pm$ 7.9 (23-52) months post-SAE

- **Good** internal consistency for all 12 domains  
Cronbach's alpha 0.80.
- **Excellent** reliability of the Physical and Psychosocial Subscores and total score.

**Criterion Validity  
(Predictive/Concurrent)**

**Chronic Stroke:** (Lin et al 2010;  $n = 74$ ; mean age = 54.11 (11.44) years; pre and post 3-week intervention; mean time since stroke 17.46 (17.67) months)

- **Excellent** correlation only between the SS-QOL Self-Care and FIM
- **Adequate to poor** correlations between the domains of the SS-QOL and the Fugl-Meyer Assessment, FIM, and Frenchay Activities Index

| SS-QOL Domain     | FMA    | FIM    | FAI    |
|-------------------|--------|--------|--------|
| UE Function       | 0.30*  | 0.39** | 0.21   |
| Self-care         | 0.27   | 0.65** | 0.52** |
| Work/Productivity | 0.27*  | 0.40** | 0.44** |
| Family Roles      | 0.28*  | 0.38** | 0.32** |
| Social Roles      | 0.34** | 0.21   | 0.12   |
| Mobility          | 0.03   | 0.38** | 0.2    |
| Energy            | 0.16   | 0.13   | 0.12   |
| Language          | 0.08   | 0.15   | 0.22   |
| Mood              | 0.01   | 0.23   | 0.16   |
| Personality       | 0.1    | 0.19   | 0.06   |
| Thinking          | 0.02   | 0.21   | -0.04  |
| Vision            | 0.02   | 0.21   | -0.04  |

\*  $P < .05$ , \*\*  $P < .01$

FMA: Fugl-Meyer Assessment  
FIM: Functional Independence Measure  
FAI: Frenchay Activities Index

**Subarachnoid Haemorrhage:** (Bosman et al, 2009; n=141, mean age=51.4 (12.3) years; mean time since SAH s/p aneurysm occlusion via clipping or coiling 36.1 (7.9) months

- **Moderate to Strong** correlation between all SS-QOL domains and Physical Subtotal scores with CFQ, LiSat-9, and HADS
- **Weak to Moderate** correlations between Physical SS-QOL subtotal and GOS

| SS-QOL Domain          | GOS  | CFQ   | LiSat-9 | HADS  |
|------------------------|------|-------|---------|-------|
| Self-Care              | 0.42 | -0.30 | 0.56    | -0.42 |
| Mobility               | 0.26 | -0.39 | 0.55    | -0.50 |
| UE Function            | 0.33 | -0.44 | 0.56    | -0.48 |
| Language               | 0.10 | -0.53 | 0.42    | -0.44 |
| Vision                 | 0.08 | -0.38 | 0.41    | -0.48 |
| Work                   | 0.14 | -0.49 | 0.60    | -0.61 |
| Thinking               | 0.03 | -0.65 | 0.40    | -0.45 |
| Family Roles           | 0.08 | -0.40 | 0.57    | -0.61 |
| Social Roles           | 0.10 | -0.40 | 0.62    | -0.63 |
| Personality            | 0.05 | -0.43 | 0.51    | -0.65 |
| Mood                   | 0.09 | -0.43 | 0.57    | -0.71 |
| Energy                 | 0.03 | -0.42 | 0.44    | -0.64 |
| Physical Subscore      | 0.25 | -0.52 | 0.64    | -0.59 |
| Psychological Subscore | 0.07 | -0.53 | 0.61    | -0.73 |

Correlations above 0.24 were significant  $p < 0.0033$ ; two tailed, using Bonferroni correction

GOS – Glasgow Outcome Scale

CFQ – Cognitive Failure Questionnaire

LiSat-9 – Life Satisfaction Checklist

HADS – Hospital Anxiety and Depression Scale

**Construct Validity  
(Convergent/Discriminant)**

**Acute Stroke:** (Williams et al, 1999)

**Construct Validity of SS-QOL Domains**

| SS-QOL Domain*       | Established Measure                           | Strength  | r <sup>2</sup> | p       |
|----------------------|-----------------------------------------------|-----------|----------------|---------|
| Energy               | SF-36 vitality                                | Adequate  | 0.51           | < 0.001 |
| Family Roles         | SF-36 emotional and physical role limitations | Poor      | 0.29           | < 0.001 |
| Mobility             | SF-36 physical function                       | Adequate  | 0.41           | < 0.001 |
| Mood                 | BDI                                           | Adequate  | 0.43           | < 0.001 |
| Personality          | BDI                                           | Adequate  | 0.33           | < 0.001 |
| Self-care            | BI                                            | Adequate  | 0.45           | < 0.001 |
| Work/Productivity    | SF-36 physical role limitations               | Adequate  | 0.31           | < 0.001 |
| Overall SS-QOL score | Overall SF-36 score                           | Excellent | 0.65           | < 0.001 |

- Items in the language and thinking domains were not associated with items on the NIHSS.
  - These results may have occurred because patients with cognitive and language deficits were excluded from the study.

**Content Validity**

**Acute Stroke:** (Williams et al, 1999)

- Items and domains were developed through interviews conducted with stroke patients ( $n = 32$  poststroke patients)

|                          | <ul style="list-style-type: none"><li>• SS-QOL and International Classification of Functioning, Disability, and Health (ICF) categories were independently assessed by two healthcare professionals.<ul style="list-style-type: none"><li>o Agreement across all but three concepts was acceptable; kappa ranged from 0.75 to 1.00 (Teixeira-Salmela et al, 2009)</li></ul></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |         |           |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------|---------|-----------|--------|---|----|----|--------------|---|---|----|----------|---|---|----|----------|---|---|----|------|---|---|----|-------------|---|---|----|-----------|---|---|----|-------------|---|---|----|----------|---|---|----|--------------------------|---|---|----|--------|---|---|----|-------------------|---|---|----|
| Face Validity            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |           |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Floor/Ceiling Effects    | <p><b><u>Acute Stroke:</u></b> (Williams et al, 1999)</p> <table><tr><th>Domain</th><th>Items</th><th>% Floor</th><th>% Ceiling</th></tr><tr><td>Energy</td><td>3</td><td>17</td><td>18</td></tr><tr><td>Family Roles</td><td>3</td><td>4</td><td>35</td></tr><tr><td>Language</td><td>5</td><td>1</td><td>37</td></tr><tr><td>Mobility</td><td>6</td><td>1</td><td>23</td></tr><tr><td>Mood</td><td>5</td><td>1</td><td>30</td></tr><tr><td>Personality</td><td>3</td><td>4</td><td>23</td></tr><tr><td>Self-care</td><td>5</td><td>3</td><td>51</td></tr><tr><td>Social Role</td><td>5</td><td>9</td><td>14</td></tr><tr><td>Thinking</td><td>3</td><td>4</td><td>13</td></tr><tr><td>Upper Extremity Function</td><td>5</td><td>1</td><td>31</td></tr><tr><td>Vision</td><td>3</td><td>1</td><td>63</td></tr><tr><td>Work/Productivity</td><td>3</td><td>3</td><td>21</td></tr></table> <p><b><u>Subarachnoid Haemorrhage:</u></b> Boosman et al, 2009</p> | Domain  | Items     | % Floor | % Ceiling | Energy | 3 | 17 | 18 | Family Roles | 3 | 4 | 35 | Language | 5 | 1 | 37 | Mobility | 6 | 1 | 23 | Mood | 5 | 1 | 30 | Personality | 3 | 4 | 23 | Self-care | 5 | 3 | 51 | Social Role | 5 | 9 | 14 | Thinking | 3 | 4 | 13 | Upper Extremity Function | 5 | 1 | 31 | Vision | 3 | 1 | 63 | Work/Productivity | 3 | 3 | 21 |
| Domain                   | Items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | % Floor | % Ceiling |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Energy                   | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 17      | 18        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Family Roles             | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4       | 35        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Language                 | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1       | 37        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Mobility                 | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1       | 23        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Mood                     | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1       | 30        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Personality              | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4       | 23        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Self-care                | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3       | 51        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Social Role              | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9       | 14        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Thinking                 | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4       | 13        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Upper Extremity Function | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1       | 31        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Vision                   | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1       | 63        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |
| Work/Productivity        | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3       | 21        |         |           |        |   |    |    |              |   |   |    |          |   |   |    |          |   |   |    |      |   |   |    |             |   |   |    |           |   |   |    |             |   |   |    |          |   |   |    |                          |   |   |    |        |   |   |    |                   |   |   |    |

- Ceiling effect present for 10/12 domains and for physical component. Most strongly self-care & vision domains.

## Responsiveness

**Acute Stroke:** (Williams et al, 1999)

| Domain                   | Responsiveness        | SES* |
|--------------------------|-----------------------|------|
| Energy                   | mildly responsive     | 0.36 |
| Family Roles             | mildly responsive     | 0.41 |
| Language                 | moderately responsive | 0.63 |
| Mobility                 | moderately responsive | 0.53 |
| Mood                     | mildly responsive     | 0.41 |
| Personality              | mildly responsive     | 0.20 |
| Self-care                | moderately responsive | 0.55 |
| Social Role              | markedly responsive   | 0.83 |
| Thinking                 | mildly responsive     | 0.36 |
| Upper Extremity Function | mildly responsive     | 0.44 |
| Vision                   | moderately responsive | 0.59 |
| Work/Productivity        | moderately responsive | 0.54 |

\*Standardized Effect Sizes

**Acute Stroke:** (Lin et al 2010)

Responsiveness of the Stroke Impact Scale 3.0 (SIS) was found to be significantly larger than the SS-QOL total (Standard Response Mean difference = .36; 95% CI = .02 to .71)

## Professional Association Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce

(MSEDGE), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

#### Abbreviations:

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br>(CVA < 2 months post)<br>(SCI < 1 month post)<br>(Vestibular < 6 weeks post) | <b>Subacute</b><br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | <b>Chronic</b><br>(> 6 months) |
|---------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|
| <b>StrokEDGE II</b> | <i>UR</i>                                                                                    | <i>UR</i>                                                     | <i>UR</i>                      |

Recommendations based on level of care in which the assessment is taken:

|                     | Acute Care | Inpatient Rehabilitation | Skilled Nursing Facility | Outpatient Rehabilitation | Home Health |
|---------------------|------------|--------------------------|--------------------------|---------------------------|-------------|
| <b>StrokEDGE II</b> | NR         | NR                       | NR                       | UR                        | UR          |

Recommendations for entry-level physical therapy education and use in research:

|                     | Students should learn to administer this tool? (Y/N) | Students should be exposed to this tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool? (Y/N) |
|---------------------|------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------|
| <b>StrokEDGE II</b> | No                                                   | No                                             | Yes                                                         | Yes                                                   |

## Considerations

- Due to linguistic complexity, the SS-QOL may not be appropriate for patients with communication disabilities (Hilari and Byng, 2001).
- SS-QOL-12 has good criterion validity, predicting 88-95% of the variance of the original SS-QOL. Mean differences between the SS-QOL-12 and SS-QOL and their 95% CI were generally within 0.1 points on a 1-5 scale. (Post et al, 2011)

Do you see an error or have a suggestion for this instrument summary? Please [e-mail us!](#)

## Bibliography

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aneurysmal subarachnoid haemorrhage." J Neurol Neurosurg Psychiatry 81:485-489. [Find it on PubMed](#)

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[Post, M.W.M., Boosman, H., et al. \(2011\). "Development and validation of a short version of the Stroke Specific Quality of Life Scale." J Neurol Neurosurg Psychiatry 82:283-286. Find it on PubMed](#)

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Williams, L. S., Weinberger, M., et al. (1999). "Measuring quality of life in a way that is meaningful to stroke patients." Neurology 53: 1839-1843. [Find it on PubMed](#)

|                                 |                                                                                                                                                                      |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | Williams, L. S., Weinberger, M., et al. (1999). "Development of a stroke-specific quality of life scale." Stroke 30(7): 1362-1369. <a href="#">Find it on PubMed</a> |
| <b>Year published</b>           | 1999                                                                                                                                                                 |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                  |
| <b>Approval Status</b>          | Approved                                                                                                                                                             |

### 32. REHAB MEASURES DATABASE—TARDIEU SPASTICITY SCALE

| <b>Link to instrument</b>     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |             |   |                                                             |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------|---|-------------------------------------------------------------|
| <b>Title of Assessment</b>    | Tardieu Scale/Modified Tardieu Scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |             |   |                                                             |
| <b>Acronym</b>                | MTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |             |   |                                                             |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Christopher Newman, PT, MPT, NCS, Jennifer H. Kahn, PT, DPT, NCS, and the SCI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 8/2012. Updated by Michele Sulwer, PT, DPT, NCS and Genevieve Pinto-Zipp, PT, EdD, of the StrokEDGE II, Neurology Section, APTA, 3/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       |             |   |                                                             |
| <b>Summary Date</b>           | 12/23/2013; March 2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |             |   |                                                             |
| <b>Purpose</b>                | To assess the muscle's response to stretch at various given velocities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |             |   |                                                             |
| <b>Description</b>            | <p>Tardieu is a scale for measuring spasticity that takes into account resistance to passive movement at both slow and fast speed. The scale originally began development in the 1950s and has gone through multiple revisions (reviewed in Haugh 2006). The most recent versions of the Modified Tardieu Scale use the following criteria:</p> <ul style="list-style-type: none"> <li>• Individuals are positioned in sitting to test the UEs and supine to test the LEs</li> <li>• 2 Measurements: <ul style="list-style-type: none"> <li>◦ Quality of muscle reaction</li> <li>◦ Angle of muscle reaction</li> </ul> </li> <li>• 3 Speed definitions: <ul style="list-style-type: none"> <li>◦ V1 is slow as possible</li> <li>◦ V2 speed of limb falling under gravity</li> <li>◦ V3 moving as fast as possible</li> </ul> </li> <li>• Quality of Muscle Reaction (scored 0-5); 0 is no resistance to passive ROM to 5 indicating joint is immobile. (Some versions scored 0-4)</li> </ul> <table border="1"> <thead> <tr> <th>Grade</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>No resistance throughout the course of the passive movement</td></tr> </tbody> </table> | Grade | Description | 0 | No resistance throughout the course of the passive movement |
| Grade                         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |             |   |                                                             |
| 0                             | No resistance throughout the course of the passive movement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |             |   |                                                             |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------|---|--------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------|
|                                  | <table border="1"> <tr> <td>1</td><td>Slight resistance throughout the course of the passive movement, with no clear catch at precise angle</td></tr> <tr> <td>2</td><td>Clear catch at precise angle, interrupting the passive movement, followed by release</td></tr> <tr> <td>3</td><td>Fatigable clonus (&lt;10 seconds when maintaining pressure) occurring at precise angle</td></tr> <tr> <td>4</td><td>Infatigable clonus (&gt;10 seconds when maintaining pressure) occurring at precise angle</td></tr> </table> <ul style="list-style-type: none"> <li>Joint Angle: Modified Tardieu describes R1 and R2; R1 is the angle of muscle reaction, R2 is the full PROM</li> <li>The angle of full ROM (R2) is taken at a very slow speed (V1). The angle of muscle reaction (R1) is defined as the angle in which a catch or clonus is found during a quick stretch (V3). R1 is then subtracted from R2 and this represents the dynamic tone component of the muscle. (Boyd 1999)</li> </ul> | 1 | Slight resistance throughout the course of the passive movement, with no clear catch at precise angle | 2 | Clear catch at precise angle, interrupting the passive movement, followed by release | 3 | Fatigable clonus (<10 seconds when maintaining pressure) occurring at precise angle | 4 | Infatigable clonus (>10 seconds when maintaining pressure) occurring at precise angle |
| 1                                | Slight resistance throughout the course of the passive movement, with no clear catch at precise angle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| 2                                | Clear catch at precise angle, interrupting the passive movement, followed by release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| 3                                | Fatigable clonus (<10 seconds when maintaining pressure) occurring at precise angle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| 4                                | Infatigable clonus (>10 seconds when maintaining pressure) occurring at precise angle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Area of Assessment</b>        | Functional Mobility                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Body Part</b>                 | Not Applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>ICF Domain</b>                | Body Structure; Body Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Domain</b>                    | Motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Assessment Type</b>           | Performance Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Length of Test</b>            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Time to Administer</b>        | Dependent on number of joints being tested.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Number of Items</b>           | Dependent on number of joints being tested.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Equipment Required</b>        | Goniometer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Training Required</b>         | No formal training required. Recommend training from an experienced tester for better understanding of how to correctly administer test.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Type of training required</b> | No Training                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Cost</b>                      | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Actual Cost</b>               | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Age Range</b>                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Administration Mode</b>       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Diagnosis</b>                 | Cerebral Palsy; Geriatrics; Stroke; Traumatic Brain Injury                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |
| <b>Populations Tested</b>        | <ul style="list-style-type: none"> <li>Cerebral Palsy</li> <li>Adults with severe brain injury</li> <li>Stroke</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |                                                                                                       |   |                                                                                      |   |                                                                                     |   |                                                                                       |

- Adults with profound intellectual and multiple disabilities (PIMD)

**Standard Error of Measurement (SEM)**

**Stroke:**

(Paulis et al, 2011;  $n = 13$  subjects living in a nursing home; mean age = 70.2(12.30) years; compared test-retest and interrater reliability of Tardieu of elbow flexors measured with goniometry vs. inertial sensors (IS))

- Tardieu (R2-R1) SEM Goni = 6.19, IS = 8.81
- Passive ROM (R2) SEM Goni= 5.04, IS= 6.80
- Angle of Catch (R1) SEM Goni = 4.47, IS= 5.72

**Severe Brain Injury:**

(Mehrholtz et al, 2005;  $n = 30$ , patients with impaired consciousness due to severe cerebral damage of various etiologies; mean age = 63.9(12.9) years)

| SEM for Intra-rater Reliability             |      |
|---------------------------------------------|------|
| Domain                                      | SEM  |
| Shoulder flexion                            | 0.05 |
| Shoulder external rotation                  | 0.05 |
| Elbow flexion                               | 0.04 |
| Elbow extension                             | 0.04 |
| Wrist flexion                               | 0.02 |
| Wrist extension                             | 0.04 |
| Hip flexion                                 | 0.02 |
| Hip extension                               | 0.04 |
| Knee flexion                                | 0.05 |
| Knee extension                              | 0.03 |
| Ankle extension (knee joint flexed)         | 0.02 |
| Ankle extension (knee joint fully extended) | 0.04 |

| SEM for Inter-rater Reliability             |      |
|---------------------------------------------|------|
| Domain                                      | SEM  |
| Shoulder flexion                            | 0.05 |
| Shoulder external rotation                  | 0.05 |
| Elbow flexion                               | 0.03 |
| Elbow extension                             | 0.03 |
| Wrist flexion                               | 0.07 |
| Wrist extension                             | 0.03 |
| Hip flexion                                 | 0.04 |
| Hip extension                               | 0.03 |
| Knee flexion                                | 0.04 |
| Knee extension                              | 0.03 |
| Ankle extension (knee joint flexed)         | 0.03 |
| Ankle extension (knee joint fully extended) | 0.04 |

**Minimal Detectable Change (MDC)**

**Stroke:**

(Paulis et al, 2011)

Smallest Detectable Difference (SDD) calculated from above referenced SEM data and test retest data:

|                                                   | <ul style="list-style-type: none"> <li>• Tardieu (R2-R1) SEM Goni = 17.16, IS = 24.41</li> <li>• Passive ROM (R2) SEM Goni= 13.98, IS= 18.85</li> <li>• Angle of Catch(R1) SEM Goni = 12.39, IS= 15.85</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------|--------------------------|--------------|-------------------|------|-----------|--|-----------------|---|--------------------------|----|------------------------|---|------------------|---|-----------------------------------------|----------|---------------------|--|-------------------------|---|-----------------------------------|---|--------------------------------------------|---|---------------------------------------|------------|-----------------------------------------|------------|---------------------------------------------------|-------------|
| Minimally Clinically Important Difference (MCID)  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Cut-Off Scores                                    | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Normative Data                                    | <p><b>Severe brain injury:</b><br/>(Mehrholtz et al, 2005)</p> <p><i>Patient Characteristics</i></p> <table border="1"> <thead> <tr> <th>Characteristic</th><th>Patients, <i>n</i> = 30</th></tr> </thead> <tbody> <tr> <td>Age (years)<sup>a</sup></td><td>63.9 (±12.9)</td></tr> <tr> <td>Sex (female/male)</td><td>9/21</td></tr> <tr> <td>Diagnosis</td><td></td></tr> <tr> <td>Ischemic Stroke</td><td>7</td></tr> <tr> <td>Intracerebral Hemorrhage</td><td>11</td></tr> <tr> <td>Traumatic brain injury</td><td>5</td></tr> <tr> <td>Cerebral hypoxia</td><td>7</td></tr> <tr> <td>Duration of illness (days)<sup>a</sup></td><td>78 (±93)</td></tr> <tr> <td>Antispastic therapy</td><td></td></tr> <tr> <td>Local (botulinum toxin)</td><td>0</td></tr> <tr> <td>Systemic (baclofen or tizanidine)</td><td>2</td></tr> <tr> <td>Implanted intrathecal baclofen pump system</td><td>0</td></tr> <tr> <td>Glasgow Coma Scale score<sup>a</sup></td><td>6.9 (±2.3)</td></tr> <tr> <td>Coma Remission Scale score<sup>a</sup></td><td>8.0 (±4.5)</td></tr> <tr> <td>Body mass index (kg/m<sup>2</sup>)<sup>a</sup></td><td>24.1 (±3.8)</td></tr> </tbody> </table> <p><sup>a</sup> Mean ± standard deviation.</p> | Characteristic | Patients, <i>n</i> = 30 | Age (years) <sup>a</sup> | 63.9 (±12.9) | Sex (female/male) | 9/21 | Diagnosis |  | Ischemic Stroke | 7 | Intracerebral Hemorrhage | 11 | Traumatic brain injury | 5 | Cerebral hypoxia | 7 | Duration of illness (days) <sup>a</sup> | 78 (±93) | Antispastic therapy |  | Local (botulinum toxin) | 0 | Systemic (baclofen or tizanidine) | 2 | Implanted intrathecal baclofen pump system | 0 | Glasgow Coma Scale score <sup>a</sup> | 6.9 (±2.3) | Coma Remission Scale score <sup>a</sup> | 8.0 (±4.5) | Body mass index (kg/m <sup>2</sup> ) <sup>a</sup> | 24.1 (±3.8) |
| Characteristic                                    | Patients, <i>n</i> = 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Age (years) <sup>a</sup>                          | 63.9 (±12.9)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Sex (female/male)                                 | 9/21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Diagnosis                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Ischemic Stroke                                   | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Intracerebral Hemorrhage                          | 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Traumatic brain injury                            | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Cerebral hypoxia                                  | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Duration of illness (days) <sup>a</sup>           | 78 (±93)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Antispastic therapy                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Local (botulinum toxin)                           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Systemic (baclofen or tizanidine)                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Implanted intrathecal baclofen pump system        | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Glasgow Coma Scale score <sup>a</sup>             | 6.9 (±2.3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Coma Remission Scale score <sup>a</sup>           | 8.0 (±4.5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Body mass index (kg/m <sup>2</sup> ) <sup>a</sup> | 24.1 (±3.8)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |
| Test-retest Reliability                           | <p><b>Severe Brain Injury:</b><br/>(Mehrholtz et al, 2005)</p> <ul style="list-style-type: none"> <li>• <b>Adequate</b> Intrarater reliability <i>k</i> = 0.65-0.87 for muscle groups tested; except shoulder ER <i>k</i> = 0.53</li> <li>• Angle of muscle reaction: joint (ICC = elbow flexors, 0.73 (<b>Adequate</b>); knee flexors, 0.72 (<b>Adequate</b>); ankle PF with knee flexed, 0.70 (<b>Adequate</b>); ankle PF with knee extended, 0.65 (<b>Adequate</b>))</li> </ul> <p><b>Children with CP:</b><br/>(Fosang et al, 2003; <i>n</i> = 18, ages 2-10 yrs old, determine reliability and magnitude of error for MAS, PROM, and Tardieu Scale)</p> <ul style="list-style-type: none"> <li>• <b>Adequate to Excellent</b> Correlation for MTS at Hamstrings (ICC = 0.68-0.90)</li> <li>• <b>Poor to Excellent</b> Coorelation of MTS at Gastroc (ICC = 0.38-0.90)</li> <li>• <b>Adequate</b> to High Correlation MTS at Hip Add (ICC = 0.61-0.93)</li> </ul>                                                                                                                                                                                                                                                  |                |                         |                          |              |                   |      |           |  |                 |   |                          |    |                        |   |                  |   |                                         |          |                     |  |                         |   |                                   |   |                                            |   |                                       |            |                                         |            |                                                   |             |

### **Stroke:**

(Paulis et al, 2011)

Test-retest reliability of Tardieu performed with goniometer and with inertial sensors (IS) of elbow flexors

| <u>R2-R1</u>    | <u>ICC</u>            |
|-----------------|-----------------------|
| Goniometric     | <b>Excellent 0.86</b> |
| IS              | <b>Excellent 0.76</b> |
| <u>PROM, R2</u> | <u>ICC</u>            |
| Goniometric     | <b>Excellent 0.87</b> |
| IS              | <b>Excellent 0.86</b> |

| <u>AoC (R1)*</u> | <u>ICC</u>            |
|------------------|-----------------------|
| Goniometric      | <b>Excellent 0.91</b> |
| IS               | <b>Excellent 0.82</b> |

\*AoC: Area of Catch

Interrater / Intrarater Reliability

### **Severe Brain Injury:**

(Mehrholtz et al, 2005)

#### *Intrarater reliability*

| Domain                                      | Cohen's kappa | Standards for use |
|---------------------------------------------|---------------|-------------------|
| Shoulder flexion                            | 0.65          | Poor              |
| Shoulder external rotation                  | 0.53          | Poor              |
| Elbow flexion                               | 0.78          | Adequate          |
| Elbow extension                             | 0.75          | Adequate          |
| Wrist flexion                               | 0.87          | Excellent         |
| Wrist extension                             | 0.71          | Adequate          |
| Hip flexion                                 | 0.76          | Adequate          |
| Hip extension                               | 0.72          | Adequate          |
| Knee flexion                                | 0.67          | Poor              |
| Knee extension                              | 0.81          | Excellent         |
| Ankle extension (knee joint flexed)         | 0.82          | Excellent         |
| Ankle extension (knee joint fully extended) | 0.72          | Adequate          |

#### *Interrater reliability*

| Domain                              | Cohen's kappa | Standards for use |
|-------------------------------------|---------------|-------------------|
| Shoulder flexion                    | 0.44          | Poor              |
| Shoulder external rotation          | 0.39          | Poor              |
| Elbow flexion                       | 0.48          | Poor              |
| Elbow extension                     | 0.51          | Poor              |
| Wrist flexion                       | 0.33          | Poor              |
| Wrist extension                     | 0.38          | Poor              |
| Hip flexion                         | 0.42          | Poor              |
| Hip extension                       | 0.37          | Poor              |
| Knee flexion                        | 0.53          | Poor              |
| Knee extension                      | 0.44          | Poor              |
| Ankle extension (knee joint flexed) | 0.47          | Poor              |

|                                                    |      |             |
|----------------------------------------------------|------|-------------|
| <b>Ankle extension (knee joint fully extended)</b> | 0.29 | <b>Poor</b> |
|----------------------------------------------------|------|-------------|

**Stroke:**

(Ansari et al, 2008;  $n = 30$  individuals with hemiplegia > 1 month post stroke)

Interrater reliability for MTS used to assess elbow flexor spasticity:

- **Adequate** interrater reliability for R2-R1 (ICC = 0.72)
- **Adequate** interater reliability for MTS quality (ICC = 0.74) and R1 (ICC = 0.74) and R2 (ICC = 0.56)

**Stroke:**

(Paulis et al, 2011)

| R2-R1       | ICC                   |
|-------------|-----------------------|
| Goniometric | <b>Adequate</b> 0.66  |
| IS          | <b>Excellent</b> 0.84 |
| PROM, R2    | ICC                   |
| Goniometric | <b>Excellent</b> 0.89 |
| IS          | <b>Excellent</b> 0.89 |

| AoC* (R1)   | ICC                   |
|-------------|-----------------------|
| Goniometric | <b>Adequate</b> 0.60  |
| IS          | <b>Excellent</b> 0.87 |

\*AoC: Angle of Catch

**Stroke:**

(Singh et al, 2011;  $n = 91$  people with acute stroke; mean age = 64 ( $SD = 11.1$ ) years)

| ICCs                              | elbow flexors          | ankle plantar flexors  |
|-----------------------------------|------------------------|------------------------|
| R1                                | <b>Excellent</b> 0.998 | <b>Excellent</b> 0.990 |
| R2                                | <b>Excellent</b> 0.978 | <b>Excellent</b> 0.995 |
| R2-R1                             | <b>Excellent</b> 0.991 | <b>Excellent</b> 0.907 |
| MTS scores                        | <b>Excellent</b> 0.847 | <b>Excellent</b> 0.863 |
| $p < 0.0001$ for all of the above |                        |                        |

**Children with CP:**

(Yam and Leung, 2006;  $n = 17$  children with CP; mean age = 7yr 9mo)

Interrater reliability between MAS and MTS, 4 joints in LE tested:

- **Poor to Adequate:** Modified Tardieu (ICC = 0.22-0.71)
- **Poor to Adequate:** R1 (ICC = 0.37-0.71); R2 (ICC = 0.17-0.74; R2-R1 (ICC = 0.4-0.69)

**Children with CP:**

(Fosang et al, 2003)

- **Adequate** interrater reliability (ICC = 0.58-0.72)

Internal  
Consistency

Not Established

| Criterion Validity (Predictive / Concurrent)   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------|-----------|------------------|----------|-----------|----------------|----------------------------------------------------------------------------|-----------|-----------------|--|--------------------------------------------------------|--------------------------------------------------------|-------------------------|--|--|--|--|
| Construct Validity (Convergent / Discriminant) | <p><b>Stroke:</b><br/>(Patrick and Ada, 2006; <math>n = 16</math>, chronic stroke living in the community, comparing MAS, MTS, and clinical measure of spasticity in laboratory - EMG)</p> <ul style="list-style-type: none"><li>• PEA (Percentage of exact agreement) of Tardieu and laboratory measure of spasticity, 100% for elbow flexors and plantar flexors</li><li>• <b>Excellent</b> Convergent Validity (<math>r = 0.86</math> elbow flexors; 0.62 ankle)</li><li>• PFPEA of Tardieu and laboratory measures of contracture was 94% for elbow flexors and plantar flexors</li><li>• <b>Excellent</b> Convergent Validity (<math>r = 0.89</math> for elbow flexors; 0.84 for plantar flexors)</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
| Content Validity                               | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
| Face Validity                                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
| Floor / Ceiling Effects                        | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
| Responsiveness                                 | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
| Professional Association Recommendations       | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEDGE), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> <table><tr><th colspan="2">Abbreviations:</th></tr><tr><td><b>HR</b></td><td>Highly Recommend</td></tr><tr><td><b>R</b></td><td>Recommend</td></tr><tr><td><b>LS / UR</b></td><td>Reasonable to use, but limited study in target group / Unable to Recommend</td></tr><tr><td><b>NR</b></td><td>Not Recommended</td></tr></table> <p>Recommendations for use based on acuity level of the patient:</p> <table><tr><th></th><th>Acute<br/>(CVA &lt; 2 months post)<br/>(SCI &lt; 1 month post)</th><th>Subacute<br/>(CVA 2 to 6 months)<br/>(SCI 3 to 6 months)</th><th>Chronic<br/>(&gt; 6 months)</th></tr><tr><td></td><td></td><td></td><td></td></tr></table> | Abbreviations:                                         |                         | <b>HR</b> | Highly Recommend | <b>R</b> | Recommend | <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend | <b>NR</b> | Not Recommended |  | Acute<br>(CVA < 2 months post)<br>(SCI < 1 month post) | Subacute<br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | Chronic<br>(> 6 months) |  |  |  |  |
| Abbreviations:                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
| <b>HR</b>                                      | Highly Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
| <b>R</b>                                       | Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
| <b>LS / UR</b>                                 | Reasonable to use, but limited study in target group / Unable to Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
| <b>NR</b>                                      | Not Recommended                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
|                                                | Acute<br>(CVA < 2 months post)<br>(SCI < 1 month post)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Subacute<br>(CVA 2 to 6 months)<br>(SCI 3 to 6 months) | Chronic<br>(> 6 months) |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |
|                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                        |                         |           |                  |          |           |                |                                                                            |           |                 |  |                                                        |                                                        |                         |  |  |  |  |

|                     | (Vestibular < 6 weeks post) |           |           |
|---------------------|-----------------------------|-----------|-----------|
| <b>SCI EDGE</b>     | <i>LS</i>                   | <i>LS</i> | <i>LS</i> |
| <b>StrokEDGE II</b> | <i>UR</i>                   | <i>UR</i> | <i>UR</i> |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>MS EDGE</b>      | <i>UR</i>         | <i>UR</i>                       | <i>UR</i>                       | <i>UR</i>                        | <i>UR</i>          |
| <b>StrokEDGE II</b> | <i>UR</i>         | <i>UR</i>                       | <i>UR</i>                       | <i>UR</i>                        | <i>UR</i>          |

Recommendations based on SCI AIS Classification:

|                 | <b>AIS A/B</b> | <b>AIS C/D</b> |
|-----------------|----------------|----------------|
| <b>SCI EDGE</b> | <i>LS</i>      | <i>LS</i>      |

Recommendations based on EDSS Classification:

|                | <b>EDSS 0.0 – 3.5</b> | <b>EDSS 4.0 – 5.5</b> | <b>EDSS 6.0 – 7.5</b> |
|----------------|-----------------------|-----------------------|-----------------------|
| <b>MS EDGE</b> | <i>UR</i>             | <i>UR</i>             | <i>UR</i>             |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|---------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>MS EDGE</b>      | <i>No</i>                                                   | <i>No</i>                                        | <i>No</i>                                                          | <i>Yes</i>                                                  |
| <b>SCI EDGE</b>     | <i>No</i>                                                   | <i>No</i>                                        | <i>No</i>                                                          | <i>Not reported</i>                                         |
| <b>StrokEDGE II</b> | <i>No</i>                                                   | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Yes</i>                                                  |

#### Considerations

Do you see an error or have a suggestion for this instrument summary? Please [e-mail us!](#)

#### Bibliography

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|                                 |          |
|---------------------------------|----------|
| <b>Year published</b>           |          |
| <b>Instrument in PDF Format</b> | Yes      |
| <b>Approval Status</b>          | Approved |

### 33. REHAB MEASURES DATABASE: TRUNK CONTROL TEST

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     | <a href="#">Available on the Government of Western Australia's Website</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Title of Assessment</b>    | Trunk Control Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Acronym</b>                | TCT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Irene Ward, PT, DPT, NCS and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 6/2012; Update by Rie Yoshida and Heather Anderson of the StrokEdge II Task Force, Neurology Section, APTA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Summary Date</b>           | 11/16/2012; updated March 2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Purpose</b>                | To measures four simple aspects of trunk movement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b>            | <ul style="list-style-type: none"> <li>• 4 items (rolling to weak side, rolling to strong side, balance in sitting position, sit up from lying down).</li> <li>• Total score range: 0 (minimum) to 100 (maximum, indicating better performance).</li> <li>• Score of each item: (0, 12 or 25) 0= unable to perform movement without assistance; 12= able to perform movement, but in an abnormal style, for example, pulls on bed clothes, rope or monkey pole, or uses arms to steady self when sitting; 25=able to complete movement normally. For the sitting balance item, a patient scores 12 if they need to touch anything with their hands to stay upright, and 0 if they are unable to stay up (by any means) for 30 seconds.</li> <li>• Total score of TCT= Sum points (rolling to weak side + rolling to strong side + balance in sitting + sit up from lying down). Collin C., Wade D. (1990) Assessing motor impairment after stroke: a pilot reliability study. <i>Journal of Neurology, Neurosurgery, and Psychiatry</i>. 53:576-579.</li> </ul> |
| <b>Area of Assessment</b>     | Bed Mobility and Sitting Balance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Body Part</b>              | Trunk                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|                                            |                                                                                                                                                                                                                                       |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ICF Domain</b>                          | Body Structure; Body Function                                                                                                                                                                                                         |
| <b>Domain</b>                              | Motor                                                                                                                                                                                                                                 |
| <b>Assessment Type</b>                     | Performance                                                                                                                                                                                                                           |
| <b>Length of Test</b>                      | 05 Minutes or Less                                                                                                                                                                                                                    |
| <b>Time to Administer</b>                  | Less than 5 minutes                                                                                                                                                                                                                   |
| <b>Number of Items</b>                     | 4 items                                                                                                                                                                                                                               |
| <b>Equipment Required</b>                  | Bed or treatment table                                                                                                                                                                                                                |
| <b>Training Required</b>                   | Description of measure can be found in the following reference: Collin C., Wade D. (1990) Assessing motor impairment after stroke: a pilot reliability study. <i>Journal of Neurology, Neurosurgery, and Psychiatry</i> . 53:576-579. |
| <b>Type of training required</b>           | None specified                                                                                                                                                                                                                        |
| <b>Cost</b>                                | None                                                                                                                                                                                                                                  |
| <b>Actual Cost</b>                         | Not specified                                                                                                                                                                                                                         |
| <b>Age Range</b>                           | Adult                                                                                                                                                                                                                                 |
| <b>Administration Mode</b>                 | Paper/pencil                                                                                                                                                                                                                          |
| <b>Diagnosis</b>                           | Geriatrics; Stroke                                                                                                                                                                                                                    |
| <b>Populations Tested</b>                  | <ul style="list-style-type: none"> <li>• Stroke</li> <li>• Elderly (recovering from acute illness)</li> </ul>                                                                                                                         |
| <b>Standard Error of Measurement (SEM)</b> | Not Established                                                                                                                                                                                                                       |
| <b>Minimal Detectable Change (MDC)</b>     | Not Established                                                                                                                                                                                                                       |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Minimally Clinically Important Difference (MCID)</b> | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Cut-Off Scores</b>                                   | <p><b><u>Stroke:</u></b> (Collin and Wade, 1990; 12 female and 24 male patients, age range of male patients = 15-77 years, age range of women = 45-69 years; tested 6, 12 and 18 weeks post stroke)</p> <ul style="list-style-type: none"> <li>At 18 weeks, scores of 50 or more were associated with recovery of walking</li> <li>Patients scoring under 40 were non-ambulatory</li> </ul>                                                                                                                                                                                                                                               |
| <b>Normative Data</b>                                   | <p><b><u>Chronic stroke:</u></b> (Verheyden et al, 2006, <math>n = 51</math>, 16 females, 35 males, mean age= 65 (11) years, range 39-84 years; median days post stroke= 129 days; 29 patients walked without assistance, 22 patients could not walk without assistance or were non-ambulatory)</p> <ul style="list-style-type: none"> <li>The median score on TCT was 61 points (61%)</li> <li>Subjects unable to walk without physical assistance had a median score on the TCT of 43 points (24-49)</li> <li>Subjects who were able to walk without physical assistance had a median score on the TCT of 61 points (61-100)</li> </ul> |
| <b>Test-retest Reliability</b>                          | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Interrater/Intrarater Reliability</b>                | <p><b><u>Stroke:</u></b> (Collin and Wade, 1990)</p> <ul style="list-style-type: none"> <li><b>Excellent</b> interrater reliability (<math>r = 0.76</math>, <math>p &lt; 0.001</math>)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Internal Consistency</b>                             | <p><b><u>Stroke:</u></b> (Franchignoni et al, 1997; <math>n = 49</math>, mean age=68 (13) years; average interval from onset of stroke to admission to rehab was 46 days (median, 40; range 31-78 days))</p> <ul style="list-style-type: none"> <li>Cronbach's index suggests that the items of the TCT describe a homogeneous variable: the values for the TCT at admission and at discharge were <math>\alpha = 0.86</math> and <math>\alpha = 0.83</math>, respectively.</li> </ul>                                                                                                                                                    |
| <b>Criterion Validity (Predictive/Concurrent)</b>       | <p>Predictive Validity:</p> <p><b><u>Stroke:</u></b> (Duarte et al, 2002, <math>n = 28</math>, mean time after stroke onset= 15.3 (6) days; mean initial disability measured with the FIM and motFIM was 84 (22.4) and 52.7 (19.2); mean TCT= 76.4 (24))</p>                                                                                                                                                                                                                                                                                                                                                                              |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <ul style="list-style-type: none"> <li>The better the initial trunk control patients have, the longer walking distance and the faster speed they achieve at hospital discharge. <ul style="list-style-type: none"> <li>TCT showed a statistically significant difference (<math>p=0.003</math>) between patients whose walking distance at discharge was longer than 50 m (mean TCT 88.9 (SD 14.3)) and patients whose walking distance was shorter than 50 m (mean TCT 61.9(25.2)).</li> <li><b>Excellent</b> correlations were also statistically significant between the TCT and the time required to walk a 10 m straight walkway at a comfortable (<math>r = -0.644</math>) and at maximal (<math>r = -0.654</math>) safe pace: the better initial TCT was, the higher gait velocities at discharge were.</li> </ul> </li> <li><b>Excellent</b> inverse correlation between TCT and length of stay: hemiparetic patients with worse trunk control at admission stay longer in a rehabilitation ward. (<math>r=-0.722</math>).</li> <li><b>Excellent</b> correlation between admission TCT scores and FIM at discharge. Total FIM <math>r = 0.738</math>, motFIM <math>=0.723</math>.</li> </ul> <p><b>Elderly:</b> (Farriols et al, 2009, <math>n = 21</math> patients, mean age 78.5(6.7) years, who had developed walking disability after prolonged bed rest for an acute condition)</p> <ul style="list-style-type: none"> <li>Contrary to earlier studies involving younger individuals with stroke, this study failed to show a good correlation between TCT and ability to walk in elderly patients after prolonged bed rest for an acute illness.</li> </ul> <p><b>Acquired Brain Injury:</b> (Montecchi, 2013, <math>n = 59</math> patients, mean age 48.9(14.01) years, who had developed ABI following stroke, head trauma or anoxia)</p> <ul style="list-style-type: none"> <li><b>Excellent</b> correlation between TCT and TRS (Trunk Recovery Scale). Spearman's rank correlation coefficient <math>r_s = 0.943</math>; 95% CI: 0.904 – 0.967)</li> </ul> |
| <b>Construct Validity<br/>(Convergent/Discriminant)</b> | <p><b>Stroke:</b> (Collin and Wade, 1990)</p> <ul style="list-style-type: none"> <li><b>Excellent</b> construct validity between the TCT and the gross motor function subscale of the Rivermead Motor Assessment at 6, 12 and 18 weeks post stroke. (<math>r = 0.70</math> to <math>0.79</math>)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                  |                 |           |                       |                                                                            |                  |                 |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|-----------------|-----------|-----------------------|----------------------------------------------------------------------------|------------------|-----------------|
| <b>Content Validity</b>                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                  |                 |           |                       |                                                                            |                  |                 |
| <b>Face Validity</b>                            | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                  |                 |           |                       |                                                                            |                  |                 |
| <b>Floor/Ceiling Effects</b>                    | <p><b><u>Chronic stroke:</u></b> (Verheyden et al, 2006)</p> <ul style="list-style-type: none"> <li>Twelve participants (24%) reached the maximum score of 100 points on the TCT.</li> <li>This indicates a ceiling effect on the TCT in non-acute and chronic stroke patients.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |                  |                 |           |                       |                                                                            |                  |                 |
| <b>Responsiveness</b>                           | <p><b><u>Stroke:</u></b> (Franchignoni et al, 1997)</p> <ul style="list-style-type: none"> <li>36 patients (72%) changed the overall TCT score at discharge</li> <li>The TCT test showed a good sensitivity to change</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                  |                 |           |                       |                                                                            |                  |                 |
| <b>Professional Association Recommendations</b> | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD Edge), Spinal Cord Injury Taskforce (PD Edge), Stroke Taskforce (StrokeEdge II), Traumatic Brain Injury Taskforce (TBI Edge), and Vestibular Taskforce (VEEdge) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p> <div style="border: 1px solid black; padding: 10px; margin-top: 20px;"> <p><b>Abbreviations:</b></p> <table> <tr> <td><b><i>HR</i></b></td><td>Highly Recommend</td></tr> <tr> <td><b><i>R</i></b></td><td>Recommend</td></tr> <tr> <td><b><i>LS / UR</i></b></td><td>Reasonable to use, but limited study in target group / Unable to Recommend</td></tr> <tr> <td><b><i>NR</i></b></td><td>Not Recommended</td></tr> </table> </div> | <b><i>HR</i></b> | Highly Recommend | <b><i>R</i></b> | Recommend | <b><i>LS / UR</i></b> | Reasonable to use, but limited study in target group / Unable to Recommend | <b><i>NR</i></b> | Not Recommended |
| <b><i>HR</i></b>                                | Highly Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                  |                 |           |                       |                                                                            |                  |                 |
| <b><i>R</i></b>                                 | Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |                  |                 |           |                       |                                                                            |                  |                 |
| <b><i>LS / UR</i></b>                           | Reasonable to use, but limited study in target group / Unable to Recommend                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |                  |                 |           |                       |                                                                            |                  |                 |
| <b><i>NR</i></b>                                | Not Recommended                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                  |                 |           |                       |                                                                            |                  |                 |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br><b>(CVA &lt; 2 months post)</b><br><b>(SCI &lt; 1 month post)</b><br><b>(Vestibular &lt; 6 weeks post)</b> | <b>Subacute</b><br><b>(CVA 2 to 6 months)</b><br><b>(SCI 3 to 6 months)</b> | <b>Chronic</b><br><b>(&gt; 6 months)</b> |
|---------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------|
| <b>StrokEDGE II</b> | <i>NR</i>                                                                                                                  | <i>NR</i>                                                                   | <i>NR</i>                                |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>MS EDGE</b>      | <i>UR</i>         | <i>UR</i>                       | <i>UR</i>                       | <i>NR</i>                        | <i>UR</i>          |
| <b>StrokEDGE II</b> | <i>LS</i>         | <i>LS</i>                       | <i>NR</i>                       | <i>NR</i>                        | <i>NR</i>          |
| <b>TBI EDGE</b>     | <i>LS</i>         | <i>LS</i>                       | <i>LS</i>                       | <i>LS</i>                        | <i>LS</i>          |

Recommendations for use based on ambulatory status after brain injury:

|                 | <b>Completely Independent</b> | <b>Mildly dependant</b> | <b>Moderate Dependence</b> |
|-----------------|-------------------------------|-------------------------|----------------------------|
| <b>TBI EDGE</b> | <i>N/A</i>                    | <i>N/A</i>              | <i>N/A</i>                 |

Recommendations based on EDSS Classification:

|                | <b>EDSS 0.0 – 3.5</b> | <b>EDSS 4.0 – 5.5</b> | <b>EDSS 6.0 – 7.0</b> |
|----------------|-----------------------|-----------------------|-----------------------|
| <b>MS EDGE</b> | <i>NR</i>             | <i>NR</i>             | <i>NR</i>             |

Recommendations for entry-level physical therapy education and use in research:

|                     | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|---------------------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| <b>MS EDGE</b>      | No                                                   | No                                        | No                                                          | Yes                                                  |
| <b>StrokEDGE II</b> | No                                                   | No                                        | No                                                          | Yes                                                  |
| <b>TBI EDGE</b>     | No                                                   | Yes                                       | No                                                          | Not reported                                         |

#### Considerations

- Farriols et al did not find this tool effective in predicting recovery of ambulation in the elderly population following acute illness.

Do you see an error or have a suggestion for this instrument summary? Please [e-mail us!](#)

#### Bibliography

Collin, C. and Wade, D. (1990). "Assessing motor impairment after stroke: a pilot reliability study." Journal of Neurology, Neurosurgery and Psychiatry 53(7): 576-579. [Find it on PubMed](#)

Duarte, E., Marco, E., et al. (2002). "Trunk control test as a functional predictor in stroke patients." J Rehabil Med 34(6): 267-272. [Find it on PubMed](#)

Farriols, C., Bajo, L., et al. (2009). "Functional decline after prolonged bed rest following acute illness in elderly patients: is trunk control test (TCT) a predictor of recovering ambulation?" Archives of Gerontology and Geriatrics 49(3): 409-412. [Find it on PubMed](#)

Franchignoni, F. P., Tesio, L., et al. (1997). "Trunk control test as an early predictor of stroke rehabilitation outcome." Stroke (00392499) 28(7): 1382-1385. [Find it on PubMed](#)

Montecchi MG, Muratori A, Lombardi K, Morrone E, Brianti R. Trunk Recovery Scale: A new tool to measure postural control in patients with severe acquired brain injury. A study of the psychometric

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>properties. <i>European Journal of Physical Medicine and Rehabilitation</i>. 2013; 49(3):341-351. <a href="#">Find it on PubMed</a></p> <p>Verheyden, G., Nieuwboer, A., et al. (2007). "Clinical tools to measure trunk performance after stroke: a systematic review of the literature." <i>Clinical Rehabilitation</i> 21(5): 387-394. <a href="#">Find it on PubMed</a></p> <p>Verheyden, G., Vereeck, L., et al. (2006). "Trunk performance after stroke and the relationship with balance, gait and functional ability." <i>Clinical Rehabilitation</i> 20(5): 451-458. <a href="#">Find it on PubMed</a></p> |
| <b>Year published</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Approval Status</b>          | Approved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

### 34. REHAB MEASURES DATABASE: TRUNK IMPAIRMENT SCALE

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     | <a href="#">Available on the Government of Western Australia's Website</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Title of Assessment</b>    | Trunk Impairment Scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Acronym</b>                | TIS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Irene Ward, PT, DPT, NCS and the TBI task force of the Academy of Neurologic Physical Therapy - a component of APTA in 6/2012; Updated by Onkar J. Rajadhyaksha, PT in 10/2012; Updated with references from the PD population by Rosemary Gallagher, PT, DPT, GCS and the PDEdge Taskforce of the Academy of Neurologic Physical Therapy - a component of APTA in 2/2013; Updated by Michele Sulwer, PT, DPT, NCS and Genevieve Pinto-Zipp, PT, of the StrokEdge II, Neurology Section, APTA in 3/2016                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Summary Date</b>           | 1/29/2014                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Purpose</b>                | To measure the motor impairment of the trunk after a stroke through the evaluation of static and dynamic sitting balance as well as co-ordination of trunk movement (Verheyden et al, 2004)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b>            | <ul style="list-style-type: none"> <li>• Scores range from a minimum of 0 to a maximum of 23. If patient scores 0 on the first item, the total score on the TIS is 0. Each item can be performed three times. The highest score counts. Otherwise, no practice session allowed.</li> <li>• The patient can be corrected between attempts.</li> <li>• The tests are verbally explained to the patient and can be demonstrated if needed.</li> <li>• Three subscales: static sitting, balance, dynamic sitting balance and coordination. Each subscale has between three and 10 items.</li> <li>• Starting position: patient is sitting at the edge of a bed or treatment table without back and arm support. Thighs are supported, knees at 90°, feet flat on the floor, arms resting on the legs, head and trunk in midline position. If hypertonia is present, the position of the arm is taken as the starting position.</li> </ul> |

|                                  |                                                                                                                                                                                                                                                                                                  |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>The TIS can be found in the Appendix of the following article: Verheyden G. and Nieuwboer A. (2004). The trunk impairment scale: a new tool to measure motor impairment of the trunk after stroke. <i>Clinical Rehabilitation</i>. 18:326-334.</li> </ul> |
| <b>Area of Assessment</b>        |                                                                                                                                                                                                                                                                                                  |
| <b>Body Part</b>                 |                                                                                                                                                                                                                                                                                                  |
| <b>ICF Domain</b>                | Body Structure; Body Function; Activity                                                                                                                                                                                                                                                          |
| <b>Domain</b>                    |                                                                                                                                                                                                                                                                                                  |
| <b>Assessment Type</b>           | Performance Measure                                                                                                                                                                                                                                                                              |
| <b>Length of Test</b>            | 06 to 30 Minutes                                                                                                                                                                                                                                                                                 |
| <b>Time to Administer</b>        | < 20 minutes                                                                                                                                                                                                                                                                                     |
| <b>Number of Items</b>           | 17 items                                                                                                                                                                                                                                                                                         |
| <b>Equipment Required</b>        | <ul style="list-style-type: none"> <li>Treatment table or bed without back and arm support</li> <li>Score sheet</li> <li>Stop watch</li> </ul>                                                                                                                                                   |
| <b>Training Required</b>         | None necessary                                                                                                                                                                                                                                                                                   |
| <b>Type of training required</b> | No Training                                                                                                                                                                                                                                                                                      |
| <b>Cost</b>                      | Not Free                                                                                                                                                                                                                                                                                         |
| <b>Actual Cost</b>               | Cost of equipment                                                                                                                                                                                                                                                                                |
| <b>Age Range</b>                 |                                                                                                                                                                                                                                                                                                  |
| <b>Administration Mode</b>       |                                                                                                                                                                                                                                                                                                  |
| <b>Diagnosis</b>                 | Cerebral Palsy; Multiple Sclerosis; Parkinson's Disease; Stroke; Traumatic Brain Injury                                                                                                                                                                                                          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Populations Tested</b>                               | <ul style="list-style-type: none"> <li>• Stroke</li> <li>• Cerebral Palsy</li> <li>• Multiple Sclerosis</li> <li>• Parkinson's Disease</li> <li>• Traumatic Brain Injury</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Standard Error of Measurement (SEM)</b>              | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Minimal Detectable Change (MDC)</b>                  | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Minimally Clinically Important Difference (MCID)</b> | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Cut-Off Scores</b>                                   | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Normative Data</b>                                   | <p><b><u>Sub-Acute Stroke:</u></b></p> <p>(Verheyden &amp; Nieuwboer, 2004; <math>n = 28</math>, median age = 63 years, median days since stroke 61 days, majority of patients had moderate ADL function and limited motor recovery)</p> <ul style="list-style-type: none"> <li>• Time needed to complete the TIS ranged between 2 to 18 minutes</li> <li>• Scores ranged between 0 and 21, median score was 14</li> </ul> <p><b><u>Chronic stroke</u></b></p> <p>(Verheyden et al. 2006, <math>n = 51</math> (16 females, 35 males), mean age = 65 (11) years (range 39-84), median days post stroke= 129, 29 patients walked without assistance, 22 patients could not walk without assistance or were non-ambulatory)</p> <ul style="list-style-type: none"> <li>• Median total score = 11 points (48%)</li> <li>• Median score for the static sitting balance subscale = 6 (86%)</li> <li>• Median score for the dynamic sitting balance subscale = 3 (30%)</li> <li>• Median score for the coordination subscale = 2 (23%)</li> </ul> |

- Non-ambulatory patients had a median TIS score of 8 (3-9)
- Ambulatory patients had a median TIS score of 14 (11-18)

#### **Healthy individuals:**

(Verheyden et al, 2005; n = 80, 40 patients with stroke and 40 age- and sex- matched healthy individuals; Mean age of patients with stroke = 64(14) years and that of healthy individuals = 65(14) years; Median number of days since stroke onset = 46 (range = 9- 2341))

| <b>TIS (Subscale)</b>                   | <b>Median</b> | <b>IQR</b> | <b>Range</b> |
|-----------------------------------------|---------------|------------|--------------|
| Static Sitting Balance<br>(range 0-7)   | 7             | 7          | 7            |
| Dynamic Sitting Balance<br>(range 0-10) | 10            | 9-10       | 6-10         |
| Coordination<br>(range 0-6)             | 6             | 5-6        | 4-6          |
| Total TIS<br>(range 0-23)               | 23            | 22-23      | 17-23        |

#### **Test-retest Reliability**

#### **Sub-Acute Stroke:**

(Verheyden & Nieuwboer, 2004; n = 28, median age = 63 years, median days since stroke = 61 days, majority of patients had moderate ADL function and limited motor recovery)

- **Excellent** reliability for clinical care and research in the static sitting balance subscale, 0.91 (0.83)
- **Excellent** reliability for clinical care and research in the dynamic sitting balance subscale, 0.94 (0.89)
- **Good** reliability for research in the coordination subscale, 0.87 (0.76)
- Overall, **excellent** reliability for clinical care and research in the TIS, 0.96 (0.93)

#### **Sub-acute to chronic Stroke:**

|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                        | <p>(Verheyden et al, 2003; <math>n = 28</math>; Median age = 63 (Range = 32-87); days since stroke = 21-2341)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> test-retest reliability (ICC = 0.96)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Interrater/Intrater Reliability</b> | <p>Interrater Reliability:</p> <p><b><u>Sub-Acute Stroke:</u></b></p> <p>(Verheyden &amp; Nieuwboer, 2004; <math>n = 28</math>, median age = 63 years, median days since stroke 61 days, majority of patients had moderate ADL function and limited motor recovery)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> reliability in the static sitting balance subscale, 0.99 (0.99)</li> <li>• <b>Excellent</b> reliability in the dynamic sitting balance subscale, 0.98 (0.96)</li> <li>• <b>Excellent</b> reliability in the coordination subscale, 0.85 (0.74)</li> <li>• Overall, <b>excellent</b> reliability for in the TIS, 0.99 (0.97)</li> </ul> <p><b><u>Sub-acute to chronic Stroke:</u></b></p> <p>(Verheyden et al, 2003)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> inter-observer reliability when the patients were observed on the same day separated by 1 or 2 hours of recovery time (ICC = 0.99)</li> </ul> |
| <b>Internal Consistency</b>            | <p><b><u>Sub-Acute Stroke:</u></b></p> <p>(Verheyden &amp; Nieuwboer, 2004; <math>n = 28</math>, median age = 63 years, median days since stroke 61 days, majority of patients had moderate ADL function and limited motor recovery)</p> <ul style="list-style-type: none"> <li>• <b>Adequate</b> for static sitting balance subscale (Cronbach's alpha 0.79)</li> <li>• <b>Excellent</b> for dynamic sitting balance subscale (Cronbach's alpha 0.86)</li> <li>• <b>Not adequate</b> for the coordination subscale (Cronbach's alpha 0.65)</li> <li>• <b>Excellent</b> for the total TIS (Cronbach's alpha 0.89)</li> </ul>                                                                                                                                                                                                                                                                                                                                      |

**Criterion Validity  
(Predictive/Concurrent)**

Concurrent validity:

**Parkinson's Disease:**

(Verheyden et al, 2007;  $n = 52$ ; 26 PD(17M) mean age 65(9) years, mean disease duration 9(4)years, 26 Controls)

- Significant Spearman Rank correlation with a combination of part III score of the UPDRS (partial  $R^2 = 0.54$ ,  $P < 0.000$ ) and age (partial  $R^2 = 0.09$ ,  $P = 0.030$ )

**Sub-Acute Stroke:**

(Verheyden & Nieuwboer, 2004;  $n = 28$ , median age = 63 years, median days since stroke 61 days, majority of patients had moderate ADL function and limited motor recovery)

- **Excellent** concurrent validity between TIS and Trunk Control Test, 0.83

**Acute Stroke:**

(Di Monaco et al, 2010;  $n = 60$ , mean age = 68.0(12.2), interval between stroke and admission to rehab = 21.4(13.3) days)

- **Excellent** concurrent validity between TIS and Postural Assessment Scale, (0.849,  $P < 0.001$ )

**Sub-acute to chronic Stroke:**

(Verheyden et al, 2003)

- **Excellent** correlation between the TIS and Trunk Control Test ( $p = 0.83$ ) in patients with acute to sub-acute stroke

Predictive validity:

**Acute Stroke:**

(Verheyden et al, 2007,  $n = 102$ , mean age = 70(10) years, 47 female and 55 men, tested upon admission to acute rehab and again 6 months after stroke)

- Total TIS (partial  $R^2 = 0.52$ ,  $p < 0.0001$ ) and static sitting balance subscale score (partial  $R^2 = 0.50$ ,  $p < 0.0001$ ) were the most important factors when predicting Barthel Index score at 6 months after stroke.

**Acute Stroke:**

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <p>(Di Monaco et al, 2010; <math>n = 60</math>, mean age = 68.0(12.2), interval between stroke and admission to rehab = 21.4(13.3) days)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> validity between TIS at admission and FIM scores at discharge (0.695, <math>P &lt; 0.001</math>)</li> <li>• TIS scores assessed at admission to rehabilitation were significantly lower in the patients who were transferred to an institution than those discharged home at the end of inpatient rehabilitation (<math>P = 0.002</math>)</li> <li>• Odds ratio analysis of TIS and discharge destination (0.620, 95% CI 0.393 to 0.979, <math>P = 0.040</math>)</li> </ul> <p><b>Sub-acute to Chronic Stroke</b></p> <p>(Kim et al, 2015) <math>n = 135</math>, mean age = 62.14 (12.9), tested at 4 weeks post stroke and again at 6 months after stroke.</p> <ul style="list-style-type: none"> <li>• Initial total TIS scores (and subscales including Sitting, Dynamic TIS) in non-ambulatory patients were positively correlated with all sub-items in the Korean version of Modified Barthel Index (K-MBI) at 4 weeks after stroke (<math>p &lt; 0.05</math>). Particularly the TIS – Dynamic subscale was shown to be the only significant factor for K-MBI 6 months after stroke (<math>R^2 = 0.653</math>, <math>p &lt; 0.001</math>)</li> <li>• Initial total TIS scores (and subscales including Sitting, Dynamic TIS) in non-ambulatory patients were significantly correlated with Functional Ambulation Categories at 4 weeks and 6 months after stroke</li> </ul> |
| <b>Construct Validity<br/>(Convergent/Discriminant)</b> | <p>Convergent:</p> <p><b><u>Parkinson's Disease:</u></b></p> <p>(Verheyden et al 2007)</p> <ul style="list-style-type: none"> <li>• The authors state that results of the study demonstrate Construct validity of the TIS in people with PD because they had significantly lower scores than controls on the total TIS and static sitting balance and coordination subscale of the TIS. Scores on the dynamic sitting balance subscale were lower for people with PD but were not significant.</li> </ul> <p><b><u>Sub-Acute Stroke:</u></b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | <p>(Verheyden &amp; Nieuwboer, 2004; <math>n = 28</math>, median age = 63 years, median days since stroke 61 days, majority of patients had moderate ADL function and limited motor recovery)</p> <ul style="list-style-type: none"> <li>• <b>Adequate</b> construct validity between the TIS and Barthel Index, 0.86</li> </ul> <p><b><u>Sub-acute to chronic stroke:</u></b></p> <p>(Verheyden et al, 2003)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> spearman rank correlation between the TIS and the Barthel Index (<math>p = 0.86</math>)</li> </ul> <p><b><u>Acute to Sub-acute Stroke:</u></b></p> <p>(Verheyden &amp; Kersten, 2010; <math>n = 162</math>; Mean age = 67(11) years; all stages of stroke)</p> <ul style="list-style-type: none"> <li>• <b>Construct validity</b> of dynamic sitting balance and coordination subscale confirmed using Rasch analysis. (chi-square = 42.65; <math>p</math>-value = 0.0052 for dynamic sitting balance, chi-square = 7.87, <math>p</math>-value = 0.446 for coordination subscale)</li> </ul> <p>Discriminant:</p> <p><b><u>Stroke:</u></b></p> <p>(Verheyden et al 2005, 40 stroke patients and 40 age and sex-matched healthy individuals, mean age = 65)</p> <ul style="list-style-type: none"> <li>• Significant differences between stroke patients and healthy individuals (<math>P &lt; 0.0001</math>)</li> </ul> |
| <b>Content Validity</b>      | <p><b><u>Sub-Acute Stroke:</u></b></p> <p>(Verheyden &amp; Nieuwboer, 2004; <math>n = 28</math>, median age = 63 years, median days since stroke 61 days, majority of patients had moderate ADL function and limited motor recovery)</p> <ul style="list-style-type: none"> <li>• Content validity of the TIS was achieved through literature review, observation of stroke patients, clinical experience of the authors and discussing the content of the scale with stroke rehabilitation specialists.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Face Validity</b>         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Floor/Ceiling Effects</b> | <b><u>Chronic stroke:</u></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                 | <p>(Verheyden et al, 2006, <math>n = 51</math> (16 females, 35 males), mean age = 65 (11) years (range 39-84), median days post stroke = 129, 29 patients walked without assistance, 22 patients could not walk without assistance or were non-ambulatory)</p> <ul style="list-style-type: none"> <li>No patient was able to score the maximum of 23 points on the TIS as opposed to 12 (24%) participants reached the maximum score of 100 points on the Trunk Control Test.</li> </ul> <p><b><u>Acute to Sub-acute Stroke:</u></b></p> <p>(Verheyden &amp; Kersten, 2010; <math>n = 162</math> from acute unit, in-patient and out-patient rehabilitation setting ; Mean age = 67(11) years; days since stroke = 6-94 days)</p> <ul style="list-style-type: none"> <li><b>Poor</b> ceiling effects (90%)(ceiling effect for static sitting balance subscale was large and hence, it was excluded from the TIS version 2.0)</li> </ul> <p><b><u>Parkinson's Disease:</u></b></p> <p>(Verheyden et al 2007)</p> <ul style="list-style-type: none"> <li>Poor ceiling effects: 73% reached max score on static sitting balance subscale; 38% reached max score on dynamic sitting balance subscale; (8%) reached max score on coordination subscale; and (4%) reached max score of total TIS</li> </ul> |
| <b>Responsiveness</b>                           | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Professional Association Recommendations</b> | <p>Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.</p> <p>For detailed information about how recommendations were made, please visit: <a href="http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations">http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

#### Abbreviations:

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| <b>HR</b>      | Highly Recommend                                                           |
| <b>R</b>       | Recommend                                                                  |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group / Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                            |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br><b>(CVA &lt; 2 months post)</b><br><b>(SCI &lt; 1 month post)</b><br><b>(Vestibular &lt; 6 weeks post)</b> | <b>Subacute</b><br><b>(CVA 2 to 6 months)</b><br><b>(SCI 3 to 6 months)</b> | <b>Chronic</b><br><b>(&gt; 6 months)</b> |
|---------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------|
| <b>StrokEDGE II</b> | <i>R</i>                                                                                                                   | <i>R</i>                                                                    | <i>R</i>                                 |

Recommendations Based on Parkinson Disease Hoehn and Yahr stage:

|                | <b>I</b>     | <b>II</b>    | <b>III</b>   | <b>IV</b>    | <b>V</b>  |
|----------------|--------------|--------------|--------------|--------------|-----------|
| <b>PD EDGE</b> | <i>LS/UR</i> | <i>LS/UR</i> | <i>LS/UR</i> | <i>LS/UR</i> | <i>NR</i> |

Recommendations based on level of care in which the assessment is taken:

|  | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|--|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
|  |                   |                                 |                                 |                                  |                    |

|                     |           |           |           |           |           |
|---------------------|-----------|-----------|-----------|-----------|-----------|
| <b>MS EDGE</b>      | <i>R</i>  | <i>R</i>  | <i>R</i>  | <i>NR</i> | <i>R</i>  |
| <b>StrokEDGE II</b> | <i>R</i>  | <i>R</i>  | <i>R</i>  | <i>R</i>  | <i>R</i>  |
| <b>TBI EDGE</b>     | <i>LS</i> | <i>LS</i> | <i>LS</i> | <i>LS</i> | <i>LS</i> |

Recommendations for use based on ambulatory status after brain injury:

|                 | <b>Completely Independent</b> | <b>Mildly dependant</b> | <b>Moderate Dependancy</b> |
|-----------------|-------------------------------|-------------------------|----------------------------|
| <b>TBI EDGE</b> | <i>N/A</i>                    | <i>N/A</i>              | <i>N/A</i>                 |

Recommendations based on EDSS Classification:

|                | <b>EDSS 0.0 – 3.5</b> | <b>EDSS 4.0 – 5.5</b> | <b>EDSS 6.0 – 7.0</b> |
|----------------|-----------------------|-----------------------|-----------------------|
| <b>MS EDGE</b> | <i>NR</i>             | <i>R</i>              | <i>R</i>              |

Recommendations for entry-level physical therapy education and use in research:

|                     | <b>Students should learn to administer this tool? (Y/N)</b> | <b>Students should be exposed to tool? (Y/N)</b> | <b>Appropriate for use in intervention research studies? (Y/N)</b> | <b>Is additional research warranted for this tool (Y/N)</b> |
|---------------------|-------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| <b>MS EDGE</b>      | <i>Yes</i>                                                  | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Yes</i>                                                  |
| <b>PD EDGE</b>      | <i>No</i>                                                   | <i>No</i>                                        | <i>No</i>                                                          | <i>Not reported</i>                                         |
| <b>StrokEDGE II</b> | <i>Yes</i>                                                  | <i>Yes</i>                                       | <i>Yes</i>                                                         | <i>Yes</i>                                                  |
| <b>TBI EDGE</b>     | <i>No</i>                                                   | <i>Yes</i>                                       | <i>No</i>                                                          | <i>Not reported</i>                                         |

#### Considerations

- There are two different scales both named the Trunk Impairment Scale and both intended for the stroke population.

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | <p>One scale was originally published in 2004 by Verheyden et al and is the focus of this review. The other scale was published by Fujiwara in 2004 and is not the focus of this review.</p> <ul style="list-style-type: none"> <li>• The patient will need to be permitted to sit-up for the test and be able to follow basic commands.</li> <li>• The TIS has sufficient reliability, internal consistency and validity for use in clinical practice and stroke research (Verheyden et al, 2004).</li> <li>• Younger individuals, females and individuals who are more active in their daily life are found to score higher on TIS. Older individuals, males and less physically active individuals score lower on TIS. (Verheyden et al, 2005)</li> <li>• TIS 2.0 consists of dynamic balance subscale and coordination subscale. The sitting balance subscale was not included due to ceiling effects. (Verheyden and Kersten, 2010)</li> <li>• TIS-modNV is the Norwegian version with modifications of combining items from the dynamic sitting balance and coordination subscales. Six ordinal superitems (called testlets) were constructed. It demonstrated good construct validity, excellent internal consistency, and high intertester and test-retest reliability for the total score. ( Gjelsvik et al, 2012)</li> <li>• The TIS has been found to have large ceiling effects in two out of the three subscales of the test in this population. Further research is needed regarding: reliability, measurement error, predictive validity, and responsiveness before this measure can be recommended for clinical or use in research.</li> </ul> <p>Do you see an error or have a suggestion for this instrument summary? Please <a href="#">e-mail us!</a></p> |
| <b>Bibliography</b> | <p>Di Monaco, M., Trucco, M., et al. (2010). "The relationship between initial trunk control or postural balance and inpatient rehabilitation outcome after stroke: a prospective comparative study." Clinical Rehabilitation 24(6): 543-554. <a href="#">Find it on PubMed</a></p> <p>Fujiwara, T., Liu, M., et al. (2004). "Development of a new measure to assess trunk impairment after stroke (trunk impairment scale): its psychometric properties." American Journal of Physical Medicine and Rehabilitation 83(9): 681-688. <a href="#">Find it on PubMed</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p><a href="#">Gjelsvik, B., Breivik, K., et al. (2012). "The Trunk Impairment Scale – modified to ordinal scale in the Norwegian version." Disability &amp; Rehabilitation 34(16): 1385-1395. Find it on PubMed</a></p> <p><a href="#">Kim J., Seo K., et al. 2015. "The Relationship Between Initial Trunk Performances and Functional Prognosis in Patients With Stroke." Annals of Rehabilitation Medicine 39(1):66-73. Find it on PubMed</a></p> <p>Verheyden, G. and Kersten, P. (2008). "Evaluating the construct validity of the Trunk Impairment Scale: a Rasch analysis of its subscales... Proceedings of SRR: abstracts from the Society for Research in Rehabilitation summer meeting held at Weetwood Hall, Leeds, 3 and 4 July 2007." Clinical Rehabilitation 22(7): 664-664. <a href="#">Find it on PubMed</a></p> <p>Verheyden, G. and Kersten, P. (2010). "Investigating the internal validity of the Trunk Impairment Scale (TIS) using Rasch analysis: the TIS 2.0." Disability and Rehabilitation 32(25): 2127-2137. <a href="#">Find it on PubMed</a></p> <p>Verheyden, G., Nieuwboer, A., et al. (2007). "Trunk performance after stroke: an eye catching predictor of functional outcome." Journal of Neurology, Neurosurgery and Psychiatry 78(7): 694-698. <a href="#">Find it on PubMed</a></p> <p>Verheyden, G., Nieuwboer, A., et al. (2005). "Discriminant ability of the Trunk Impairment Scale: a comparison between stroke patients and healthy individuals." Disability and Rehabilitation 27(17): 1023-1028. <a href="#">Find it on PubMed</a></p> <p>Verheyden, G., Nieuwboer, A., et al. (2004). "The Trunk Impairment Scale: a new tool to measure motor impairment of the trunk after stroke." Clinical Rehabilitation 18(3): 326-334. <a href="#">Find it on PubMed</a></p> <p>Verheyden, G., Vereeck, L., et al. (2006). "Trunk performance after stroke and the relationship with balance, gait and functional ability." Clinical Rehabilitation 20(5): 451-458. <a href="#">Find it on PubMed</a></p> <p>Verheyden, G., Willems, A. M., et al. (2007). "Validity of the trunk impairment scale as a measure of trunk performance in people with Parkinson's disease." Archives of Physical Medicine and Rehabilitation 88(10): 1304-1308. <a href="#">Find it on PubMed</a></p> |
| <b>Year published</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Instrument in PDF Format</b> | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

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**Approval Status**

Approved

### 35. REHAB MEASURES DATABASE: WOLF MOTOR FUNCTION TEST

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Link to instrument</b>     | <a href="#">WMFT info can be found on Stroke (external link)</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Title of Assessment</b>    | <p>Wolf Motor Function Test</p> <p>Originally called the Emory Motor Test (Woodbury et al, 2010)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Acronym</b>                | WMFT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Instrument Reviewer(s)</b> | Initially reviewed by Jason Raad MS and the Rehabilitation Measures Team; Updated by Irene Ward, PT, DPT, NCS and the TBI EDGE task force of the Academy of Neurologic Physical Therapy - a component of APTA in 2012.; Updated by Heather Anderson and Rie Yoshida of the StrokEdge II task force in 2016.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Summary Date</b>           | 3/19/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Purpose</b>                | Quantitative measure of upper extremity motor ability through timed and functional tasks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b>            | <ul style="list-style-type: none"> <li>The original version consisted of 21 item; the widely used version of the WMFT consists of 17 items</li> <li>Composed of 3 parts: <ul style="list-style-type: none"> <li>Time</li> <li>Functional ability</li> <li>Strength</li> </ul> </li> <li>Includes 15 function-based tasks and 2 strength based tasks <ul style="list-style-type: none"> <li>Performance time is referred to as WMFT-TIME</li> <li>Functional ability is referred to as WMFT-FAS</li> </ul> </li> <li>Items 1-6 involve timed functional tasks, items 7-14 are measures of strength, and the remaining 9 items consist of analyzing movement quality when completing various tasks</li> <li>Examiner should test the less affected upper extremity followed by the most affected side.</li> <li>Uses a 6-point ordinal scale <ul style="list-style-type: none"> <li>"0" = "does not attempt with the involved arm" to</li> </ul> </li> </ul> |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           | <ul style="list-style-type: none"> <li>o "5" = "arm does participate; movement appears to be normal."</li> <li>• Maximum score is 75</li> <li>• Lower scores are indicative of lower functioning levels</li> <li>• WMFT-TIME allows 120 seconds per task</li> </ul>                                                                                                                                                                                                                                                                                                                                            |
| <b>Area of Assessment</b> | Dexterity; Strength; Upper Extremity Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Body Part</b>          | Upper Extremity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>ICF Domain</b>         | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Domain</b>             | Motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Assessment Type</b>    | Performance Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Length of Test</b>     | 06 to 30 Minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Time to Administer</b> | 35 minutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Number of Items</b>    | The original version consisted of 21 items (Wolf et al., 2005)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Equipment Required</b> | <ul style="list-style-type: none"> <li>• Standardized table (54 inches long, 30 inches wide, and 29 inches high) and chair</li> <li>• Standardized test item template</li> <li>• Height-adjustable bedside table</li> <li>• Box (one that does not require patient to flex or abduct shoulder more than 90 degrees)</li> <li>• Individual wrist weights, 1-20 pounds</li> <li>• 12-oz beverage can, unopened</li> <li>• 7" pencil with 6 flat sides</li> <li>• 2" paper clip</li> <li>• 3 checkers</li> <li>• Three 3" x5" note cards</li> <li>• Standardized lock and key board at 45 degree angle</li> </ul> |

|                                     | <ul style="list-style-type: none"><li>• Standardized face towel</li><li>• Standardized basket</li><li>• Dynamometer</li><li>• Talcum powder to reduce friction as needed</li><li>• Stopwatch</li><li>• Video camera (optional)</li></ul>                                                                                                                                                                                                                                                                                                                                                               |                               |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--|--|----------|------------------|-----|-------------------------|--|-----|---|------------------|-----|---|----------------|-----|---|--------------|-----|
| Training Required                   | None necessary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| Type of training required           | No Training                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| Cost                                | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                               |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| Actual Cost                         | Free                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                               |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| Age Range                           | Adult: 18-64 years; Elderly adult: 65+                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| Administration Mode                 | Computer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| Diagnosis                           | Stroke; Traumatic Brain Injury                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| Populations Tested                  | Stroke<br>Traumatic Brain Injury                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                               |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| Standard Error of Measurement (SEM) | <p><b>Chronic Stroke:</b> (Fritz et al. 2009; <math>n = 96</math>; mean age = 62.3 (range, 19–90) years)</p> <ul style="list-style-type: none"><li>• Standard error of measurement (SEM) in stroke: 0.2 seconds</li></ul> <table><tr><th colspan="3">Reliability Indices for WMFT:</th></tr><tr><th>Item No.</th><th>Item Description</th><th>SEM</th></tr><tr><td colspan="2">Average WMFT time score</td><td>0.2</td></tr><tr><td>1</td><td>Forearm to table</td><td>0.8</td></tr><tr><td>2</td><td>Forearm to box</td><td>0.6</td></tr><tr><td>3</td><td>Extend elbow</td><td>0.6</td></tr></table> | Reliability Indices for WMFT: |  |  | Item No. | Item Description | SEM | Average WMFT time score |  | 0.2 | 1 | Forearm to table | 0.8 | 2 | Forearm to box | 0.6 | 3 | Extend elbow | 0.6 |
| Reliability Indices for WMFT:       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                               |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| Item No.                            | Item Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | SEM                           |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| Average WMFT time score             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.2                           |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| 1                                   | Forearm to table                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.8                           |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| 2                                   | Forearm to box                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.6                           |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |
| 3                                   | Extend elbow                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.6                           |  |  |          |                  |     |                         |  |     |   |                  |     |   |                |     |   |              |     |

|                  |                          |     |
|------------------|--------------------------|-----|
| 4                | Extend elbow with weight | 0.8 |
| 5                | Hand to table (front)    | 0.5 |
| 6                | Hand to box (front)      | 0.7 |
| 7                | Weight to box (lbs)      | 1.9 |
| 8                | Reach and retrieve       | 1.2 |
| 9                | Lift can                 | 1.2 |
| 10               | Lift pencil              | 1.1 |
| 11               | Lift paper clip          | 0.8 |
| 12               | Stack checkers           | 1.1 |
| 13               | Flip cards               | 0.4 |
| 14               | Grip strength (lbs)      | 0.0 |
| 15               | Turn key in lock         | 0.4 |
| 16               | Fold towel               | 0.4 |
| 17               | Lift basket              | 0.7 |
| Average WMFT FAS |                          | 0.1 |

**Minimal Detectable Change (MDC)**

**Chronic Stroke:** (Fritz et al, 2009)

- Average for timed items: 0.7 seconds
- Average for WMFT Functional Ability Scale: 0.1 points

| Reliability Indices for WMFT: |                  |         |
|-------------------------------|------------------|---------|
| Item No.                      | Item Description | 95% MDC |
| Average WMFT time score       |                  | 0.7     |
| 1                             | Forearm to table | 2.1     |
| 2                             | Forearm to box   | 1.6     |
| 3                             | Extend elbow     | 1.7     |

|                  |                          |     |
|------------------|--------------------------|-----|
| 4                | Extend elbow with weight | 2.4 |
| 5                | Hand to table (front)    | 1.5 |
| 6                | Hand to box (front)      | 1.9 |
| 7                | Weight to box (lbs)      | 5.2 |
| 8                | Reach and retrieve       | 3.4 |
| 9                | Lift can                 | 2.0 |
| 10               | Lift pencil              | 3.0 |
| 11               | Lift paper clip          | 2.2 |
| 12               | Stack checkers           | 3.2 |
| 13               | Flip cards               | 1.2 |
| 14               | Grip strength (lbs)      | 0.1 |
| 15               | Turn key in lock         | 1.0 |
| 16               | Fold towel               | 1.2 |
| 17               | Lift basket              | 2.0 |
| Average WMFT FAS |                          | 0.1 |

**Chronic Stroke:** (Lin et al., 2009;  $n = 57$ ; mean age = 54.6(11.5) years > 6 mo post-stroke)

- MCD at 90% confidence:
  - o WMFT Time = 4.36 (SD = 5.91,  $r = 0.90$ , SEM = 1.87)
  - o WMFT FAS = 0.37 (SD = 0.73,  $r = 0.90$ , SEM = 0.16)

**Minimally Clinically Important Difference (MCID)**

**Acute Stroke:** (Lang et al, 2008;  $n = 52$ ; mean age = 64 (14) years; < 28 days post-stroke)

- MCID (Functional Ability):

- o 1.0 points (Dominant Side Affected)
- o 1.2 points (Non-dominant Side Affected)
- o 17% change (Dominant Side Affected)
- o 20% change (Non-dominant Side Affected)
- MCID (time):
  - o -19.0 seconds (Dominant Side Affected)
  - o 16% change (Dominant Side Affected)

**Chronic Stroke:** (Lin et al., 2009)

- MCID (time):
  - o 1.5 - 2 seconds (Anchor based = 1.64; 0.2 SD = 1.37)
- MCID (FAS):
  - o 0.2 - 0.4 points (Anchor based = 0.33; 0.2 SD = 0.14)

**Cut-Off Scores**

Not established

**Normative Data**

**Chronic Stroke:** (Wing et al, 2006;  $n = 35$ ; mean age = 60.2 (14.1) years; rehab = 3–6 hours/day, 4–5 days/week,  $\geq 2$  weeks; mean time since stroke = 40.9 (29.1) months)

**Outcome measure:**

| Measure                         | $n$ | Pretest mean | Posttest mean |
|---------------------------------|-----|--------------|---------------|
| Wolf Motor Function Test (mean) | 29  | 55.6 s       | 45.2 s        |
| TUG                             | 30  | 31.0 s       | 20.2 s        |
| Berg Balance                    | 32  | 46.5         | 47.2          |
| Fugl-Meyer (m)                  | 34  | 31.8         | 37.0          |
| Box and Block                   | 11  | 11.2         | 18.0          |

s = seconds; all means were significant

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          | <p>TUG = Timed Up &amp; Go Test</p> <p>Fugl-Meyer (m) = 66-point Fugl-Meyer motor assessment</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Test-retest Reliability</b>           | <p><b>Chronic Traumatic Brain Injury:</b> (Shaw et al., 2005; <math>n = 22</math>; Mean age = 39.3 (14.4) years, onset at least 1 year prior to assessment; relative hemiparesis)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> ICC = 0.97 (range = 0.89 - 0.97); agreement between the self-report and objective measures</li> </ul> <p><b>Chronic Stroke:</b> (Morris et al, 2001; <math>n = 24</math>; mean age 61; mean time since one set = 6 years; Whithall et al, 2006; <math>n = 66</math>; mean age = 58 (14) years; &gt;6 months post-stroke)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> test-retest reliability, Functional ability and performance tests (<math>r = 0.95</math>; 0.90, respectively)</li> <li>• <b>Excellent</b> overall total score (<math>n = 66</math>; ICC = 0.97)</li> </ul>                                |
| <b>Interrater/Intrarater Reliability</b> | <p><b>Chronic Stroke:</b> (Morris et al, 2001; Whithall, 2006; Wolf et al, 2001; <math>n = 19</math>, mean age = 61.4 (9.5) years; mean time since stroke = 4.9 (6.4) years)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> inter-rater reliability: <ul style="list-style-type: none"> <li>o Study1: <math>n = 24</math>: ICC = 0.93; 0.99, functional ability and performance test respectively.</li> <li>o Study 2: <math>n = 10</math>; ICC = 0.99</li> <li>o Study 3: <math>n = 19</math>; ICC = 0.97</li> </ul> </li> </ul> <p><b>Subacute Stroke:</b> (Nijland et al, 2010; <math>n = 40</math>; mean age = 60.0 (13.6) years; mean time since stroke = 0.41 (0.25-0.77) years)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> inter-rater reliability (ICC=0.94)</li> <li>• <b>Excellent</b> intra-rater reliability (ICC=0.95)</li> </ul> |
| <b>Internal Consistency</b>              | <p><b>Chronic Stroke:</b> (Morris et al, 2001, Nijland et al, 2010)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> Internal Consistency <p>Study 1: <math>n=24</math>; Cronbach's alpha = 0.92</p> </li> </ul> <p><b>Subacute Stroke:</b> (Nijland et al, 2010)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> Internal Consistency (Cronbach's alpha = 0.98)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|                                                         | <p><b>Acute Stroke:</b> (Edwards et al, 2012; <math>n = 51</math>; mean age = <math>63.7 \pm 13.6</math> years; mean time since stroke = <math>9.5 \pm 4.5</math> days and tested at day 0, 14 and 90)</p> <ul style="list-style-type: none"><li>• <b>Excellent</b> internal consistency (Cronbach’s alpha = 0.96 (day 0); 0.97 (day 14); 0.98 (day 90).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |        |        |        |               |       |       |       |                 |        |        |        |                 |       |       |       |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|--------|--------|---------------|-------|-------|-------|-----------------|--------|--------|--------|-----------------|-------|-------|-------|
| <b>Criterion Validity<br/>(Predictive/Concurrent)</b>   | <p><b>Chronic Stroke:</b> (Wolf et al., 2001; Whithall et al., 2006; Chen et al., 2012; <math>n = 191</math>; mean age = <math>55.17 \pm 11.14</math> years; mean time since stroke = <math>17.19 \pm 15.29</math> months)</p> <ul style="list-style-type: none"><li>• <b>Adequate</b> concurrent validity with:<ul style="list-style-type: none"><li>o Upper Extremity Fugl-Meyer Assessment<br/>Study 1: <math>n = 19</math> (<math>r = -0.57</math>)<br/>Study 2: <math>n = 66</math> (<math>r = -0.88</math>)</li></ul></li><li>• <b>Strong</b> correlation with the 9-item version Arm Motor Ability Test (AMAT-9) <math>n=32</math> (<math>r=.78</math>; <math>p=0.001</math>) (O’Dell et al., 2013)</li><li>• <b>Moderate to good</b> predictive validity between the ARAT and the WMFT-TIME: Spearman <math>\rho = -.66</math>; (95% CI: <math>-0.57</math>- <math>-0.73</math>)</li><li>• <b>Good to excellent</b> predictive validity between the ARAT and the WMFT-FAS (<math>\rho = 0.76</math>)</li></ul> <p><b>Acute Stroke:</b> (Edwards et al, 2012)</p> <ul style="list-style-type: none"><li>• <b>High</b> concurrent validity with ARAT total score</li></ul> <table><tr><th>Variable</th><th>Day 0</th><th>Day 14</th><th>Day 90</th></tr><tr><td>WMFT FA score</td><td>0.745</td><td>0.827</td><td>0.863</td></tr><tr><td>WMFT time score</td><td>-0.641</td><td>-0.825</td><td>-0.772</td></tr><tr><td>WMFT grip score</td><td>0.702</td><td>0.631</td><td>0.553</td></tr></table> | Variable | Day 0  | Day 14 | Day 90 | WMFT FA score | 0.745 | 0.827 | 0.863 | WMFT time score | -0.641 | -0.825 | -0.772 | WMFT grip score | 0.702 | 0.631 | 0.553 |
| Variable                                                | Day 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Day 14   | Day 90 |        |        |               |       |       |       |                 |        |        |        |                 |       |       |       |
| WMFT FA score                                           | 0.745                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.827    | 0.863  |        |        |               |       |       |       |                 |        |        |        |                 |       |       |       |
| WMFT time score                                         | -0.641                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | -0.825   | -0.772 |        |        |               |       |       |       |                 |        |        |        |                 |       |       |       |
| WMFT grip score                                         | 0.702                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.631    | 0.553  |        |        |               |       |       |       |                 |        |        |        |                 |       |       |       |
| <b>Construct Validity<br/>(Convergent/Discriminant)</b> | <ul style="list-style-type: none"><li>• Wolf et al (2001) evaluated whether the WMFT was able to distinguish between individuals with impairment secondary to stroke (<math>n = 19</math>) from those without impairment (<math>n = 19</math>).</li><li>• Known group's validity, as calculated using Wilcoxon test, showed that the WMFT scores for the dominant and the non-dominant hand of individuals without impairment were</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |        |        |        |               |       |       |       |                 |        |        |        |                 |       |       |       |

|                                       | <p>significant higher when compared to the most and to the least affected upper extremities of clients with stroke.</p> <ul style="list-style-type: none"><li>• Edwards et al. (2012) compared WMFT scores to measures of sensorimotor status, kinematic assessments of reach and grasp, and disability as measured by the FIM.</li><li>• UE strength and spasticity were more highly correlated with functional ability (FA) and time scores than with light touch or pain. UE strength and the kinematics of reach and grasp had a moderate correlation at 0, 14 and 90 days.</li><li>• Correlations among WMFT scores and the FIM motor and UE scores were higher for FA and strength scores than for time.</li><li>• FIM_correlation coefficients ranged from moderate (.40) to high (.70) and increased in magnitude from day 0 to day 90.</li></ul> |                                       |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|--|--|------------|--------------|-----------------------|-----------|-------------------|-------|----------|-------------------|-------|-----------|-------------------|-------|-----------|-------------------|-------|-----|-------------------|-------|
| Content Validity                      | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                       |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |
| Face Validity                         | Not Established                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                       |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |
| Floor/Ceiling Effects                 | <p><u>Subacute Stroke:</u> (Nijland et al., 2010; n=40; mean age 60 (13.6) years; Netherlands sample)</p> <ul style="list-style-type: none"><li>• None found with floor established &lt; 4 points (5% of sample) and ceiling &gt;71 points (17% of sample). Presence of floor/ceiling effect if &gt;20% of sample scored above and/or below cut-offs.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                       |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |
| Responsiveness                        | <p><u>Acute Stroke:</u> (Hsieh et al, 2009; n = 57; mean age = 54.56 (11.52) years; Taiwanese sample)</p> <table><tr><th colspan="3">Responsiveness of 3 Outcome Measures:</th></tr><tr><th>Scale Name</th><th>SRM (95% CI)</th><th>Wilcoxon Test Z-Value</th></tr><tr><td>WMFT-TIME</td><td>0.38 (0.22, 0.59)</td><td>5.97*</td></tr><tr><td>WMFT-FAS</td><td>1.30 (1.03, 1.67)</td><td>5.59*</td></tr><tr><td>FIM-total</td><td>0.36 (0.17, 0.59)</td><td>3.39*</td></tr><tr><td>FIM-motor</td><td>0.37 (0.17, 0.58)</td><td>3.18*</td></tr><tr><td>FMA</td><td>1.42 (1.19, 1.80)</td><td>6.33*</td></tr></table>                                                                                                                                                                                                                                       | Responsiveness of 3 Outcome Measures: |  |  | Scale Name | SRM (95% CI) | Wilcoxon Test Z-Value | WMFT-TIME | 0.38 (0.22, 0.59) | 5.97* | WMFT-FAS | 1.30 (1.03, 1.67) | 5.59* | FIM-total | 0.36 (0.17, 0.59) | 3.39* | FIM-motor | 0.37 (0.17, 0.58) | 3.18* | FMA | 1.42 (1.19, 1.80) | 6.33* |
| Responsiveness of 3 Outcome Measures: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                       |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |
| Scale Name                            | SRM (95% CI)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Wilcoxon Test Z-Value                 |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |
| WMFT-TIME                             | 0.38 (0.22, 0.59)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 5.97*                                 |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |
| WMFT-FAS                              | 1.30 (1.03, 1.67)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 5.59*                                 |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |
| FIM-total                             | 0.36 (0.17, 0.59)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3.39*                                 |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |
| FIM-motor                             | 0.37 (0.17, 0.58)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3.18*                                 |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |
| FMA                                   | 1.42 (1.19, 1.80)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 6.33*                                 |  |  |            |              |                       |           |                   |       |          |                   |       |           |                   |       |           |                   |       |     |                   |       |

|                                                                                                                                                                                                                                                |                   |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------|
| <b>ARAT</b>                                                                                                                                                                                                                                    | 0.95 (0.75, 1.20) | 4.64* |
| *P<0.001                                                                                                                                                                                                                                       |                   |       |
| WMFT-TIME = performance time of the Wolf Motor Function Test<br>WMFT-FAS = functional ability scale of the Wolf Motor Function Test<br>FIM = Functional Independence Measure<br>FMA = Fugl-Meyer Assessment<br>ARAT = Action Research Arm Test |                   |       |
| SRM = standardized response mean<br>CI = confidence interval                                                                                                                                                                                   |                   |       |

**Acute Stroke:** (Edwards et al., 2012; n=51; mean age=63.7 (13.6) ≤90 days post stroke)

- Moderate to large responsiveness (using Cohen criteria: coefficients ≥.80 large; .50-.80 moderate; ≤.50 small)
- Functional Ability scores (day 0-14=1.09; day 0-90=1.63) more responsive than time (day 0-14=0.61; day 0-90=0.85) and strength (day 0-14=0.69; day 0-90=0.84)

#### Professional Association Recommendations

Recommendations for use of the instrument from the Academy of Neurologic Physical Therapy of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEdge), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokeEdge II), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: <http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations>

#### Abbreviations:

**HR** Highly Recommend

|                |                                                                               |
|----------------|-------------------------------------------------------------------------------|
| <b>R</b>       | Recommend                                                                     |
| <b>LS / UR</b> | Reasonable to use, but limited study in target group /<br>Unable to Recommend |
| <b>NR</b>      | Not Recommended                                                               |

Recommendations for use based on acuity level of the patient:

|                     | <b>Acute</b><br><br>(CVA < 2 months post)<br><br>(SCI < 1 month post)<br><br>(Vestibular < 6 weeks post) | <b>Subacute</b><br><br>(CVA 2 to 6 months)<br><br>(SCI 3 to 6 months) | <b>Chronic</b><br><br>(> 6 months) |
|---------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|------------------------------------|
| <b>StrokEDGE II</b> | <i>HR</i>                                                                                                | <i>HR</i>                                                             | <i>HR</i>                          |

Recommendations based on level of care in which the assessment is taken:

|                     | <b>Acute Care</b> | <b>Inpatient Rehabilitation</b> | <b>Skilled Nursing Facility</b> | <b>Outpatient Rehabilitation</b> | <b>Home Health</b> |
|---------------------|-------------------|---------------------------------|---------------------------------|----------------------------------|--------------------|
| <b>StrokEDGE II</b> | <i>NR</i>         | <i>R</i>                        | <i>UR</i>                       | <i>R</i>                         | <i>UR</i>          |
| <b>TBI EDGE</b>     | <i>NR</i>         | <i>LS</i>                       | <i>LS</i>                       | <i>LS</i>                        | <i>NR</i>          |

Recommendations for use based on ambulatory status after brain injury:

|                 | <b>Completely Independent</b> | <b>Mildly dependent</b> | <b>Moderately Dependent</b> |
|-----------------|-------------------------------|-------------------------|-----------------------------|
| <b>TBI EDGE</b> | <i>N/A</i>                    | <i>N/A</i>              | <i>N/A</i>                  |

Recommendations for entry-level physical therapy education and use in research:

|                  | Students should learn to administer this tool? (Y/N) | Students should be exposed to tool? (Y/N) | Appropriate for use in intervention research studies? (Y/N) | Is additional research warranted for this tool (Y/N) |
|------------------|------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------------------------------------|
| <b>StrokEDGE</b> | No                                                   | No                                        | Yes                                                         | Not reported                                         |
| <b>TBI EDGE</b>  | No                                                   | No                                        | Yes                                                         | Not reported                                         |

#### Considerations

Observer plots were a less stable method of scoring the WMFT, suggesting relatively higher measurement error for the WMFT than the ARAT. (Nijland, 2010)

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