NeurologySection

StrokEDGE Taskforce

Taskforce Co-chairs:

Genevieve Pinto Zipp, PT, EdD
School of Health and Medical Sciences, Seton Hall University, South Orange, NJ

Jane E. Sullivan, PT, DHS
Department of Physical Therapy and Human Movement Sciences, Northwestern University Feinberg School of Medicine, Chicago, IL

Taskforce Membership:

Dorian Rose PT, PhD
Department of Physical Therapy, University of Florida, Gainsville, FL

Patty Kluding, PT, PhD
Physical Therapy and Rehabilitation Science Department, University of Kansas Medical Center, Kansas City, KS

Diane Nichols, PT, NCS
National Rehabilitation Hospital, Washington DC

Beth Crowner, PT, DPT, NCS
Washington University School of Medicine, St. Louis, MO

Rie Yoshida, PT, DPT
Sacred Heart Medical Center at River Bend, Springfield OR

Taskforce Objectives:

1. Develop a document for clinicians, educators, and researchers to use that identifies outcome measure "core sets" for stroke
2. Make recommendations on Web-based delivery of content
3. Develop a process for other diagnostic groups to use as they identify their own "core sets"

Taskforce Process:

1. Day-long initial meeting at CSM February 2010 in San Diego
    a. Agreement on categories of outcome measures to consider
        i. ICF body structure function
            1. Motor function
            2. Sensation
        ii. Activity
            1. Gait and balance
            2. Trunk Control
            3. Arm Function
            4. Posture
            5. ADL/IADL
        iii. Participation
    b. Agreement on tools to consider
    c. All tools recommended by Stroke SIG
        i. All tools considered in Education Consensus Group[
        ii. Tools addressed in Toolbox course
        iii. Tools included in Strokengine
    d. Agreement of Examination Criteria for tools → modification of EDGE template developed by EDGE taskforce, Section on research APTA
    e. Assignment of teams (by tool category)
    f. Assignment 1^0 and 2^0 reviewers for various tools
2. Primary reviewer completes StrokEDGE document for all assigned tools
3. Primary and secondary reviewer reach consensus on recommendation
4. Primary Reviewer completes final recommendation
5. All team members complete consensus survey based on final recommendation
6. Final recommendations completed by taskforce chairs
7. Final recommendations submitted to Neurology Section Board of Directors and presented to membership at CSM, February, 2011 in New Orleans

Measures reviewed:

- ICF body structure function
  - Motor function
  - Sensation
- Activity
  - Gait and balance
  - Arm Function
  - Trunk Control
  - Posture
  - ADL/IADL
- Participation

1. 5 times sit to stand
2. 6 minute walk
3. 9 hole peg test
4. 10 meter walk
5. Action Research Arm Test
6. Activities-Specific Balance Confidence Test
7. Arm Motor Ability Test
8. Ashworth Test (Modified Ashworth)
9. Assessment of Life Habits
10. Balance Evaluation Systems Test (BEST Test)
11. Berg Balance Scale
12. Box & Blocks Test
13. Brunnel Balance Test
14. Canadian Occupational Performance Measure
15. Chedoke Arm Hand Inventory
16. Chedoke McMaster Stroke Assessment
17. Dynamic Gait Index
18. Dynomometry
19. EuroQOL
20. Functional Ambulation Categories
21. Falls Efficacy Scale
22. Functional Independence Measure
23. Fugl-Meyer Assessment of Motor Performance
24. Fugl-Meyer Sensory Assessment
25. Functional Reach
26. Goal Attainment Scale
27. Hi Mat
28. Jebsen Taylor Arm Function Test
29. Modified Fatigue Impact Scale
30. Modified Rankin Scale
31. Motor Activity Log
32. Motricity Index
33. NIH Stroke Scale
34. Nottingham Assessment of Somatosensation
35. Orpington Prognostic Scale
36. Postural Assessment Scale for Stroke Patients
37. Rate of Perceived Exertion (RPE)
38. Reintegration to Normal Living
39. Rivermead Assessment of Somatosensory Performance
40. Rivermead Motor Assessment
41. Satisfaction with Life Scale
42. Semmes Weinstein Monofilaments
43. Stroke-Adapted Sickness Impact Scale-30
44. SF-36
45. Stroke Impact Scale
46. Stroke Rehabilitation Assessment of Movement
    a. Mobility Subscale
    b. Limb Mvoement Subscales
47. Stroke –Specific Quality of Life Scale
48. Tardieu Spasticity Scale (Modified Tardieu)
49. Timed Up & Go
50. Tinetti POMA
51. Trunk Control Test
52. Trunk Impairment Scale
53. VO2 Max
54. Wolf Motor Function Scale

Rating Scale

4	**Highly Recommend**	• excellent psychometrics in a stroke population (e.g. valid and reliable and some data on responsiveness, MCD, MCID, etc.) and • excellent clinical utility (e.g. administration is $\leq$ 20 minutes, requires equipment typically found in the clinic, no copyright payment required, easy to score)
3	**Recommend**	• good- psychometrics (may lack information about reliability, validity, or responsiveness) in a stroke population and • good clinical utility (e.g. administration > 20 minutes, may require additional equipment to purchase or construct, may require payment of copyright fee or mandatory training)
2	**Unable to Recommend at this time**	Insufficient information to support a recommendation (e.g. limited psychometric data available or not available in a stroke population)
1	**Do not Recommend**	Poor psychometrics &/or poor clinical utility (time, equipment, cost, etc.)

TABLE OF CONTENTS

5 Times Sit to Stand	
Reviewer: Beth Crowner	
ICF Domain (check all that apply): _____body function/structure __X___ activity _____participation	
Type of measure: __X___ performance-based _____self-report Description: Timed test of 5 repetitions standing up and sitting down as quickly as possible from a chair with a seat 43 cm high. (Chair heights vary among studies) Designed to be a proxy test of lower limb strength[1] However, FTSTS performance was more related to balance than endurance or muscle strength in patients with chronic stroke.[2] FTSTS is a multi-dimensional task that relies on LE strength and balance.	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Intra-rater .93[3]- .97[4] Chronic stroke Inter-rater .99[4] Chronic stroke Test-retest .93[3]-98[4] Chronic stroke .89-.96[5;6] Community dwelling elderly
Validity (concurrent, criterion-related, predictive)	Concurrent: Vestibular pts: moderately correlated to TUG(r=.53) and gait speed (r=.54)[7] **Chronic stroke**: Moderately correlated to Berg Balance Scale (r=.613[8]) Discriminative and concurrent- Vestibular patients: FTSTS correctly identified 65% of fallers and was better in pts <60 y/o (ABC=80%, DGI=78%)[9]
Ceiling/ floor effects	N/A; but reference values in elderly (worse than average performance)[10] 60-69 y/o= 11.4 sec; 70-79 y/o=12.6 sec; 80-89 y/o=14.8 sec

Sensitivity to change (responsiveness, MCID, MDC)	Moderate responsiveness in patients with vestibular disorders (.58) and 2.3 sec. change predicted 49% of change on DHI [7] **Cutoff score of 12 sec. is discriminatory between healthy elderly and subjects with chronic stroke**.[4] Cutoff score of 15 sec. was predictive of fallers in elderly.[11] Was not as sensitive as ABC or DGI in identifying people with balance disorders who had vestibular dysfunction. (ability to discriminate people with balance deficits: FTSTS=65%; ABC=80%; DGI=78%)[9]
Instrument use	
Equipment required	A chair 43 cm in height (the height for which the test was developed; studies have used chairs of varying heights; a stopwatch
Time to complete	Brief-varies with the ability of the patient; Likely less than 1 minute
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Timed test (number of seconds to perform five consecutive sit to stand trial)
Level of client participation required (is proxy participation available?)	Client must be present

Limitations

Should be given when examining people with suspected balance disorders.

Reference List

(1) Csuka M, McCarty DJ. Simple method for measurement of lower extremity muscle strength. Am J Med 1985; 78(1):77-81.
(2) Ng S. Balance ability, not muscle strength and exercise endurance, determines the performance of hemiparetic subjects on the timed-sit-to-stand test. Am J Phys Med Rehabil 2010; 89(6):497-504.
(3) Weiss A, Suzuki T, Bean J, Fielding RA. High intensity strength training improves strength and functional performance after stroke. Am J Phys Med Rehabil 2000; 79(4):369-376.
(4) Mong Y, Teo TW, Ng SS. 5-repetition sit-to-stand test in subjects with chronic stroke: reliability and validity. Arch Phys Med Rehabil 2010; 91(3):407-413.
(5) Lord SR, Murray SM, Chapman K, Munro B, Tiedemann A. Sit-to-stand performance depends on sensation, speed, balance, and psychological status in addition to strength in older people. J Gerontol A Biol Sci Med Sci 2002; 57(8):M539-M543.
(6) Bohannon RW, Shore ME, Barreca SR. Five repetition performance depends on sensation, speed, balance, and psychological status in addition to strength in older people. Isokinet Exerc Sci 2007; 15:77-81.

(7) Meretta BM, Whitney SL, Marchetti GF, Sparto PJ, Muirhead RJ. The five times sit to stand test: responsiveness to change and concurrent validity in adults undergoing vestibular rehabilitation. J Vestib Res 2006; 16(4-5):233-243.
(8) Abel MF, Blanco JS, Pavlovich L, Damiano DL. Asymmetric hip deformity and subluxation in cerebral palsy: an analysis of surgical treatment. J Pediatr Orthop 1999; 19(4):479-485.
(9) Whitney SL, Wrisley DM, Marchetti GF, Gee MA, Redfern MS, Furman JM. Clinical measurement of sit-to-stand performance in people with balance disorders: validity of data for the Five-Times-Sit-to-Stand Test. Phys Ther 2005; 85(10):1034-1045.
(10) Bohannon RW. Reference values for the five-repetition sit-to-stand test: a descriptive meta-analysis of data from elders. Percept Mot Skills 2006; 103(1):215-222.
(11) Buatois S, Miljkovic D, Manckoundia P, Gueguen R, Miget P, Vancon G et al. Five times sit to stand test is a predictor of recurrent falls in healthy community-living subjects aged 65 and older. J Am Geriatr Soc 2008; 56(8):1575-1577.

5 Times Sit to Stand Recommendations

Practice Setting	4	3	2	1	Comments
Acute		X			
Inpatient Rehab		X			
Home Health		X			
Skilled Nursing		X			
Outpatient		X			
Overall Comments:	Good reliability; limited info on validity in stroke; not as sensitive as ABC or DGI in predicting balance disorders				

Patient Acuity	4	3	2	1	Comments
Acute (< 2 mos)		X			
Subacute (2-6 mos)		X			
Chronic (> 6 mos)		X			
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?		Yes/Maybe	Quick and easy measure to use as a proxy measure to assess LE strength and balance
Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	X		Has been found to be more useful when combined with other measures of postural control.

Six Minute Walk Test (6 MWT)

Reviewer: Kluding

ICF Domain (check all that apply):

_____body function/structure __x__ activity ____participation

Type of measure:

__x___ performance-based ___self-report

Instrument properties Measure of gait velocity and endurance -- distance walked in 6 minutes.

Other versions include different time duration of test (2, 3, 5, 10, and 12 minutes). A direct comparison of 2MWT, 6MWT, and 12 MWT reliability, validity and sensitivity to change in people with acute/subacute stroke was reported by Kosak.[1] High reliability was noted between tests, with 12 MWT most sensitive to change but the least efficient.

Reliability (test-retest, intra-rater, inter-rater)

Test-retest reliability: excellent with ICC 0.97-0.99.[2-5]

Intra-rater reliability: moderate (ICC = 0.74).[1]

Inter-rater reliability: moderate-good (ICC = 0.78).[1]

Validity (concurrent, criterion-related, predictive)

Concurrent validity:

Comparative measure	Correlation	Rating[6]
PARTICIPATION MEASURES		
Steps per day (via step monitor)	R=0.67, also significant predictor in regression analysis (6 MWT accounted	Moderate to Good

	for 54% of variance)[7]	
Peak activity index (via step monitor)	R=0.72[7]	Moderate to Good
Activity counts (via accelerometer)	R=0.67 to 0.73[8]	Moderate to Good
Habitual physical activity measure	R=0.22[9]	Poor
Reintegration to normal living index	R=0.35[10]	Fair
ACTIVITY MEASURES		
Functional Independence Measure (FIM)	Locomotion (walk) FIM r = 0.69, Locomotion (walk) + stairs FIM r = 0.69, Motor FIM r=0.52, Total FIM r=0.45[3]	Moderate
Berg balance scale	R=0.78[11] R=0.85, and Berg accounted for 66.5% of variance in 6 MWT in regression	Good to Excellent

		analysis[12] R=0.69[13]	
	Activities-specific balance confidence scale (ABC)	R=0.663[9]	Moderate
	BODY FUNCTION/STRUCTURE MEASURES		
	Aerobic fitness (V02 peak or max)	R=0.37[2] R=0.56[14] R=0.4[12] R=0.64[13]	Fair to Moderate
	Rate Pressure Product (RPP)	R=0.2[12] R=-0.24[11]	Poor
	Rate of Perceived Exertion (RPE)	R=0.09[12] R=-0.10[11]	Poor
	Leg strength	Paretic knee extension (r=0.4) Nonparetic knee extension (r=0.15)[12] Paretic plantar flexion (r=0.43);	Fair for paretic limb; Poor for non-paretic limb

		Nonparetic plantar flexion (r=0.22)[11] Paretic knee extension (r=0.57), nonparetic knee extension (r=0.41)[13] Paretic knee extension strength (r=0.42)[9] Difference in strength between limbs (r=-0.48)[15] Chedoke-McMaster lower extremity score (r=0.75)[11]	
	Hypertonicity (via Modified Ashworth Scale)	R=-0.37[12] R=-0.53[11] r=-0.31[9]	Fair to Moderate
	Body composition (BMI or percent body fat)	R=-0.01[12] R=-0.19)[15]	Poor
	Sensory deficits	R=0.07[15]	Poor
	Cognition (MMSE score)	R=0.06[15]	Poor

<table>
<tr><td></td><td>
<table>
<tr><td colspan="3">OTHER VERSIONS OF TEST</td></tr>
<tr><td>2 MWT</td><td>R=0.997[1]</td><td>Excellent</td></tr>
<tr><td>5MWT</td><td>R=0.89[3]</td><td>Good</td></tr>
<tr><td>12 MWT</td><td>R=0.994[1]

R=0.966{Eng, 2002 #454</td><td>Excellent</td></tr>
</table>

<u>Predictive validity:</u> Not assessed
</td></tr>
<tr><td>Ceiling/ floor effects</td><td>None reported. Score range may be 0m if unable to walk.</td></tr>
<tr><td>Sensitivity to change (responsiveness, MCID, MDC)</td><td><u>Responsiveness to change:</u>

Standardized response mean (SRM) (SRM score = 1.52), with 2.4 fold increase in walking distance after 4 weeks of inpatient rehab in patients with subacute stroke.[1]

Change of 33.6 meters reported after 12 weeks of usual care in subacute stroke in a control group.[16]

Change of 40 meters after 6-weeks of functional task training in people with stroke.[17]

Change of 62-113 meters reported in people with stroke after 12-week interventions that included aerobic training.[16, 18]</td></tr>
</table>

	MCID: Not reported for stroke. Estimated to be 54-80 meters for patients with COPD.[19] MDC: 29 meters calculated by Liu using data previously published by Eng on people with stroke.[2, 5] 54.1 meters[3]
Instrument use	
Equipment required	Course is 30m in length (flat, straight surface in a quiet setting). Mark every 3m with colored tape and a cone placed at the turnaround points. Need a stopwatch, equipment to measure vital signs pre- and post-test, chairs for rest breaks. Lap counter or pen and paper to count number of laps completed. Detailed instructions provided in a guide published by the American Thoracic Society, with a sample score sheet in the Appendix.[20]
Time to complete	6 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Primary score is distance walked in 6 minutes. May also record number and duration of rest breaks, vital sign response, use of assistive devices or need for physical assistance. No subscales
Level of client participation required (is proxy participation available?)	No proxy participation available.

Limitations: Does not involve assessment of balance or quality of movement. 30 meter course may need to be modified in home health setting

References

1. Kosak M, Smith T. Comparison of the 2-, 6-, and 12-minute walk tests in patients with stroke. *Journal of Rehabilitation Research & Development.* 2005 Jan-Feb 2005;42(1):103-107.
2. Eng JJ, Dawson AS, Chu KS. Submaximal exercise in persons with stroke: Test-retest reliability and concurrent validity with maximal oxygen consumption. *Archives of Physical Medicine and Rehabilitation.* 2004;85:113-118.
3. Fulk GD, Echternach JL, Nof L, O'Sullivan S. Clinometric properties of the six-minute walk test in individuals undergoing rehabilitation poststroke. *Physiotherapy Theory & Practice.* 2008;24(3):195-204.
4. Flansbjer U, Holmback A, Downham D, Patten C, Lexell J. Reliability of gait performance tests in men and women with hemiparesis after stroke. *J Rehabil Med.* 2005;37:75-82.
5. Liu J, Drutz C, Kumar R, et al. Use of the Six-Minute Walk Test Poststroke: Is There a Practice Effect? *Archives of Physical Medicine and Rehabilitation.* 2008;89(9):1686-1692.
6. Portney L, Watkins MP. *Foundations of Clinical Research: Applications to Practice*. 2nd ed. Upper Saddle River, NJ: Prentice Hall Health; 2000.
7. Mudge S, Stott NS. Timed Walking Tests Correlate With Daily Step Activity In Persons With Stroke. *Archives of Physical Medicine and Rehabilitation.* 2009;90(2):296-301.
8. Rand D, Eng JJ, Tang PF, Jeng JS, Hung C. How active are people with stroke? Use of accelerometers to assess physical activity. *Stroke.* 2009;40(1):163-168.
9. Pang MYC, Eng JJ. Fall-related self-efficacy, not balance and mobility performance, is related to accidental falls in chronic stroke survivors with low bone mineral density. *Osteoporosis Int.* 2008;19(7):919-927.
10. Pang MYC, Eng JJ, Miller WC. Determinants of satisfaction with community reintegration in older adults with chronic stroke: role of balance self-efficacy. *Physical Therapy.* 2007;87(3):282-291.
11. Eng JJ, Chu KS, Dawson AS, Kim CM, Hepburn KE. Functional walk tests in individuals with stroke: Relation to perceived exertion and myocardial exertion. *Stroke.* 2002;33:756-761.
12. Pang MYC, Eng JJ, Dawson AS. Relationship between ambulatory capacity and cardiorespiratory fitness in chronic stroke: Influence of stroke-specific impairments. *Chest.* 2005;127:495-501.
13. Patterson SL, Forrester LW, Rodgers MM, et al. Determinants of walking function after stroke: Differences by deficit severity. *Archives of Physical Medicine and Rehabilitation.* 2007;88:115-119.
14. Tang A, Sibley KM, Bayley MT, McIlroy WE, Brooks D. Do functional walk tests reflect cardiorespiratory fitness in sub-acute stroke? *Journal of NeuroEngineering and Rehabilitation.* 2006;3:23.
15. Kluding P, Gajewski BJ. Lower extremity strength differences predict activity limitations in people with chronic stroke. *Phys Ther.* 2009;89(1):73-81.
16. Duncan PW, Studenski S, Richards L, Gollub S, Lai SM, Reker D. Randomized clinical trial of therapeutic exercise in subacute stroke. *Stroke.* 2003;34(9):2173-2180.
17. Salbach NM, Mayo N, Wood-Dauphinee S, Hanley J, Richards CL, Cote R. A task-oriented intervention enhances walking distance and speed in the first year post stroke: A randomized controlled trial. *Clin Rehabil.* 2004;18:509-519.

18. Tanne D, Tsabari R, Checkik O, et al. Improved exercise capacity in patients after minor ischemic stroke undergoing a supervised exercise program. *Israel Medical Association Journal.* 2008;10:113-116.

19. Wise R, Brown C. Minimal clinically important differences in the six-minute walk test and the incremental shuttle walking test. *COPD.* 2005;2(1):125-129.

20. American Thoracic Society Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories. ATS Statement: Guidelines for the Six-Minute Walk Test. *Am J Respir Crit Care Med.* July 1, 2002 2002;166(1):111-117.

Practice Setting	4	3	2	1	Comments
Acute	**X**				**May be too physically demanding for patients in acute, but can be modified to allow for physical assistance**
Inpatient Rehab	**X**				
Home Health	**X**				**Standard 30 m course may need to be modified**
Skilled Nursing	**X**				
Outpatient	**X**				
Overall Comments:					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)	X				
Sub- Acute (2-6 months)	X				
Chronic (>6 months)	X				
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?	X			

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	X		

<table>
<tr><td colspan="2">9 Hole Peg Test (NHPT)</td></tr>
<tr><td colspan="2">Reviewer: Sullivan</td></tr>
<tr><td colspan="2">ICF Domain (check all that apply):

_____body function/structure ___x_ activity ____participation</td></tr>
<tr><td colspan="2">Type of measure:

__x___ performance-based ____self-report</td></tr>
<tr><td colspan="2">Instrument properties: The test uses a wooden or plastic board with 9 ¼” pegs. The score is the amount of time it takes to place and remove all 9 pegs.</td></tr>
<tr><td>Reliability (test-retest, intra-rater, inter-rater)</td><td><u>Intra-rater</u>→

• In healthy adults - <u>adequate</u> (r = 0.46; r = 0.44) for the right and left hand, respectively[1] to <u>excellent</u> agreement (r = 0.69) for the right hand and <u>adequate</u> agreement (r = 0.43) for the left [2]

• In chronic stroke - “good” (no data given),[3] r > 0.68 to 0.99[3]

<u>Inter-rater</u>→

• In healthy adults - <u>excellent</u> agreement (r > 0.97) for both hands[1, 2]

• In chronic stroke[3] r > 0.75</td></tr>
<tr><td>Validity (concurrent, criterion-related, predictive)</td><td>Criterion Validity→ One study has examined the sensitivity of the NHPT comparing it to the Frenchay Arm Test as the gold standard and reported that NHPT has a low sensitivity, with 27% of misclassified results.[4] The most sensitive measure was the Motricity Index.

Predictive Validity →The NHPT is not able to predict functional outcomes after six months of stroke.[4]</td></tr>
</table>

<table>
<tr><td>Ceiling/ floor effects</td><td>Floor Effect →
In acute stroke, there is an adequate floor effect (less than 20 % of the participants scoring the minimal value). After 6 months, the number of participants scoring the minimal value decreased [5]
In acute stroke a poor floor effect was reported (65%) which decreased at 6 months time (no 6 month scores were reported)[6]</td></tr>
<tr><td>Sensitivity to change (responsiveness, MCID, MDC)</td><td>Responsiveness → has been examined in sub acute-chronic stroke.[5] The study authors reported a large effect size but no reference values.

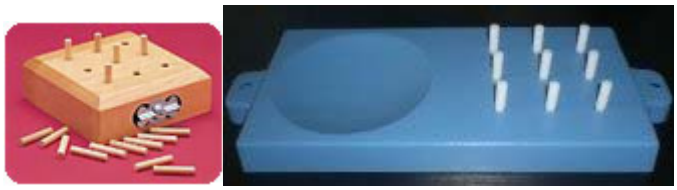
One study defined “normal” as completion in 18 s or less (0-5peg/s). [3]

Adult norms have been reported by gender:[1]

MALE NORMS

<table>
<tr><th>Age</th><th>N</th><th>M-right (seconds)</th><th>M-left (seconds)</th><th>SD-right</th><th>SD-left</th></tr>
<tr><td>21–25</td><td>41</td><td>16.41</td><td>17.53</td><td>1.65</td><td>1.73</td></tr>
<tr><td>26–30</td><td>32</td><td>16.88</td><td>17.84</td><td>1.89</td><td>2.22</td></tr>
<tr><td>31–35</td><td>31</td><td>17.54</td><td>18.47</td><td>2.70</td><td>2.94</td></tr>
<tr><td>36–40</td><td>32</td><td>17.71</td><td>18.62</td><td>2.12</td><td>2.30</td></tr>
<tr><td>41–45</td><td>30</td><td>18.54</td><td>18.49</td><td>2.88</td><td>2.42</td></tr>
<tr><td>46–50</td><td>30</td><td>18.35</td><td>19.57</td><td>2.47</td><td>2.69</td></tr>
<tr><td>51–55</td><td>25</td><td>18.93</td><td>19.84</td><td>2.37</td><td>3.10</td></tr>
<tr><td>56–60</td><td>25</td><td>20.90</td><td>21.64</td><td>4.55</td><td>3.39</td></tr>
<tr><td>61–65</td><td>24</td><td>20.87</td><td>21.60</td><td>3.50</td><td>2.98</td></tr>
<tr><td>66–70</td><td>14</td><td>21.23</td><td>22.29</td><td>3.29</td><td>3.71</td></tr>
<tr><td>71+</td><td>25</td><td>25.79</td><td>25.95</td><td>5.60</td><td>4.54</td></tr>
<tr><td>All Male Subjects</td><td>314</td><td>18.99</td><td>19.79</td><td>3.91</td><td>3.66</td></tr>
</table>

FEMALE NORMS</td></tr>
</table>

	<table><tr><th>Age</th><th>N</th><th>AVG-right (seconds)</th><th>AVG-left (seconds)</th><th>STDEV-right</th><th>STDEV-left</th></tr><tr><td>21–25</td><td>43</td><td>16.04</td><td>17.21</td><td>1.82</td><td>1.55</td></tr><tr><td>26–30</td><td>33</td><td>15.90</td><td>16.97</td><td>1.91</td><td>1.77</td></tr><tr><td>31–35</td><td>32</td><td>16.69</td><td>17.47</td><td>1.70</td><td>2.13</td></tr><tr><td>36–40</td><td>35</td><td>16.74</td><td>18.16</td><td>1.95</td><td>2.08</td></tr><tr><td>41–45</td><td>37</td><td>16.54</td><td>17.64</td><td>2.14</td><td>2.06</td></tr><tr><td>46–50</td><td>45</td><td>17.36</td><td>17.96</td><td>2.01</td><td>2.30</td></tr><tr><td>51–55</td><td>42</td><td>17.38</td><td>18.92</td><td>1.88</td><td>2.29</td></tr><tr><td>56–60</td><td>31</td><td>17.86</td><td>19.48</td><td>2.39</td><td>3.26</td></tr><tr><td>61–65</td><td>29</td><td>18.99</td><td>20.33</td><td>2.18</td><td>2.76</td></tr><tr><td>66–70</td><td>31</td><td>19.90</td><td>21.44</td><td>3.15</td><td>3.97</td></tr><tr><td>71+</td><td>31</td><td>22.49</td><td>24.11</td><td>6.02</td><td>5.66</td></tr><tr><td>All Female Subjects</td><td>389</td><td>17.67</td><td>18.91</td><td>3.17</td><td>3.44</td></tr></table>
Instrument use	
Equipment required	The test uses with a pegboard with ¼" pegs. Standardized equipment can be obtained from Sammons Preston at: http://www.sammonspreston.com/Supply/Product.asp?Leaf_Id=A8515 Cost is $38.95  A testing manual exists. [7]
Time to complete	Several minutes – varies with patient's abilities.
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Scores are typically reported in seconds to completion or pegs/second
Level of client participation required (is proxy participation available?)	The client must actively participate in the test.

Limitations: 1 study has examined the feasibility of the NHPT and reported that, on average, 52% of clients with acute stroke were not able to perform the NHPT.[5] Test requires standardized equipment

1. Grice KO, Vogel KA, Le V, Mitchell A, Muniz S, Vollmer MA. Adult norms for a commercially available nine hole peg test for finger dexterity. *American Journal of Occupational Therapy.* 2003;57:570-573.

2. Mathiowetz V, Weber K, Kashman N, Volland G. Adult norms for the nine hole peg test of finger dexterity. *Occupational Therapy Journal of Research.* 1985;5:24 -33.

3. Heller A, Wade DT, Wood VA, Sunderland A, Hewer RL, Ward E. Arm function after stroke: measurement and recovery over the first three months. *J Neurol Neurosurg Psych.* 1987;50(6):714-719.

4. Demeurisse G, Demol O, Robaye E. Motor evaluation in vascular hemiplegia. *European Neurology.* 1980;19(6):382-389.

5. Jacob-Lloyd HA, Dunn OM, Brain ND, Lamb SE. Effective measurement of the functional progress of stroke clients. *British Journal of Occupational Therapy.* 2005;68(6):253-259.

6. Sunderland A, Tinson D, Bradley L, Hewer RL. Arm function after stroke. An evaluation of grip strength as a measure of recovery and a prognostic indicator. *Journal of Neurology, Neurosurgery & Psychiatry.* 1989;52(11):1267-1272.

7. Tiffin J. Purdue Pegboard Examiner ManualChicago: Science Research Associates; 1969.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute				**x**	**Concerns about a floor effect in acute stroke**
Inpatient Rehab		**x**			
Home Health		**x**			
Skilled Nursing		**x**			
Outpatient		**x**			

Overall Comments:

Only appropriate in patients with some observable arm function. Some reports of psychometric properties in stroke but not extensive. Requires the purchase of equipment.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute (<2 months)				x	**Concerns about a floor effect in acute stroke**
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			

Overall Comments:

Only appropriate in patients with some observable arm function. Some reports of psychometric properties in stroke but not extensive. Requires the purchase of equipment.

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Comments**
Should this tool be required for entry level curricula?		x	Students should be aware this tool as it is often reported in studies.

Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	x		

Ten Meter Walk Test (10mWT)	
Reviewer: Kluding	
ICF Domain (check all that apply): _____body function/structure __x__ activity ____participation	
Type of measure: __x___ performance-based ___self-report	
Instrument properties This is a test of gait speed, with instructions for to walk at a comfortable pace or to walk as quickly as possible.	
Reliability (test-retest, intra-rater, inter-rater)	**Test-retest** Excellent reliability in patients with stroke (ICC 0.8 to 0.98) for both comfortable and fast speed.[1-4]
Validity (concurrent, criterion-related, predictive)	**Concurrent** In people with stroke: • Comfortable and fast gait speed significantly related to each other, timed up and go, stair climbing speed, and 6 minute walk tests.[3] • Comfortable gait speed significantly related to 6 minute walk test and Berg Balance scale score. Difference in lower extremity strength between the limbs and MiniMental Status Exam score were significant individual predictors of gait speed in a regression model.[5] • Strength / power of paretic knee extensors,[6, 7] hip flexors and plantar flexors,[8] and non-paretic knee extensors[6] predict gait speed in people with stroke.

	• Significantly related to dynamic gait index and functional gait assessment at 3 time points (1st week of therapy, 2 months after therapy, 5 months after therapy).[9] **Criterion-related** – N/A **Predictive** Walking speed is the best single variable to differentiate between household and community ambulatory function following stroke.[10, 11]
Ceiling/ floor effects	None reported, although subjects who are unable to walk will not be able to complete this test.
Sensitivity to change (responsiveness, MCID, MDC)	**Responsiveness** Over the first 5 weeks after stroke, SRM for comfortable pace was 0.92, with effect size of 0.74. SRM for maximum pace was 0.83 with effect size of 0.55[12] The 5 mWT was found to be more responsive to change than the 10 mWT over the first 5 weeks after stroke.[12] **MCID** For comfortable gait speed, improvement in 0.16 m/s was related to improvement in the modified Rankin Scale in people 20-60 days post stroke.[13] **MDC** MDC_{90} =0.3 m/s in subjects with stroke; MDC_{90}=0.07 m/s in subjects who required physical assistance, MDC_{90}=0.36 m/s in subjects who walked without assistance, MDC_{90}=0.18 m/s in subjects who used an assistive device.[1] These values may be overestimated because of natural recovery during subacute period of recovery as noted by Tilson et al.[13]
Instrument use	
Equipment required	Stopwatch and 14 meter walkway: 2 meters to start walking, 2 meters to slow down, and 10 meters for speed measurement.[13] Alternatively a 10 m walkway is used with analysis of speed in the middle 6 m.[10, 11]

	A systematic review of walking speed assessment in clinical research (not specific to stroke) found large variation in distance used, with a range of 3 to 30 m for neurologic studies (10 m most common).[14] Lack of consistency and reporting were noted for usual vs. fast pace, use of a static or dynamic start, and use of verbal encouragement. Recommendations were to 1) adopt 10 m walk distance, 2) use static start, 3) usual pace should be standard with fast pace if appropriate.[14]
Time to complete	1-2 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Score is calculated from time to walk 10 meters to gait speed and converted to meters/second. Use of an assistive device (cane or walker), orthotics, or physical assistance should be noted.
Level of client participation required (is proxy participation available?)	No proxy participation available.

Limitations: Gait characteristics or quality of movement not assessed.

Practice Setting	4	3	2	1	Comments
Acute	X				
Inpatient Rehab	X				
Home Health	X				
Skilled Nursing	X				
Outpatient	X				
Overall Comments:					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)	X				
Sub- Acute (2-6 months)	X				
Chronic (>6 months)	X				
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?	X			

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	X		

1. Fulk GD, Echternach JL. Test-retest reliability and minimal detectable change of gait speed in individuals undergoing rehabilitation after stroke. *J Neurol Phys Ther.* 2008;32:8-13.

2. Evans MD, Goldie PA, Hill KD. Systematic and random error in repeated measurements of temporal and distance parameters of gait after stroke. *Archives of Physical Medicine and Rehabilitation.* 1997;78(7):725-729.

3. Flansbjer U, Holmback A, Downham D, Patten C, Lexell J. Reliability of gait performance tests in men and women with hemiparesis after stroke. *J Rehabil Med.* 2005;37:75-82.

4. Maeda A, Yuasa T, Nakamura K, Higuchi S, Motohashi Y. Physical performance tests after stroke: reliability and validity. *Am J Phys Med Rehabil.* 2000;79(6):519-525.

5. Kluding P, Gajewski BJ. Lower extremity strength differences predict activity limitations in people with chronic stroke. *Phys Ther.* 2009;89(1):73-81.

6. Bohannon RW, Walsh S. Nature, reliability, and predictive value of muscle performance measures in patients with hemiparesis following stroke. *Archives of Physical Medicine and Rehabilitation.* 1992;73:721-725.

7. LeBrasseur N, Sayers S, Ouellette M, Fielding R. Muscle impairments and behavioral factors mediate functional limitations and disability following stroke. *Phys Ther.* 2006;86(10):1342-1350.

8. Nadeau S, Arsenault A, Gravel D, Bourbonnais D. Analysis of the clinical factors determining natural and maximal gait speeds in adults with stroke. *American Journal of Physical Medicine and Rehabilitation.* 1999;78(2):123-130.

9. Lin JH, Hsu MJ, Hsu HW, Wu HC, Hsieh CL. Psychometric comparisons of 3 functional ambulation measures for patients with stroke. *Stroke.* 2010;41:epub ahead of print.

10. Mulroy S, Gronley JK, Weiss W, Newsam C, Perry J. Use of cluster analysis for gait pattern classification of patients in the early and late recovery phases following stroke. *Gait and Posture.* 2003;18(114):125.

11. Perry J, Garrett M, Gronley JK, Mulroy S. Classification of walking handicap in the stroke population. *Stroke.* 1995;26:982-989.

12. Salbach NM, Mayo NE, Higgins J, Ahmed S, Finch LE, Richards CL. Responsiveness and predictability of gait speed and other disability measures in acute stroke. *Archives of Physical Medicine and Rehabilitation.* 2001;82(9):1204-1212.

13. Tilson JK, Sullivan KJ, Cen SY, et al. Meaningful gait speed improvement during the first 60 days poststroke: minimal clinically important difference. *Physical Therapy.* 2010;90(2):196-208.

14. Graham JE, Ostir GV, Fisher SR, Ottenbacher KJ. Assessing walking speed in clinical research: a systematic review. *Journal of Evaluation in Clinical Practice.* 2008;14(4):552-562.

Activities-specific Balance Confidence Scale (ABC)	
Reviewer: Sullivan	
ICF Domain (check all that apply): _____body function/structure ___x_ activity __x_participation	
Type of measure: _____ performance-based _x_self-report	
Instrument properties: 16-item questionnaire rating confidence performing a variety of in home and community based functional activities. A short version of the test, the ABC-6 has been developed but has not been tested in stroke subjects.[1]	
Reliability (test-retest, intra-rater, inter-rater)	Test-retest reliability: Excellent in individuals with stroke who live in the community[2]
Validity (concurrent, criterion-related, predictive)	The ABC has been tested in stroke survivors, with good internal consistency.[2-3] In chronic stroke, the ABC correlated with DGI: r=0.68.[4] Concurrent → In community-dwelling stroke survivors, the ABC was related to SF-36 physical functioning subscale (r=0.60), Berg Balance Scale (r=0.42), maximum walking speed (r=0.43), comfortable walking speed (r=0.42), 6Minute Walk Test (r=0.40), Barthel index (r=0.37) and the TUG (r=0.37).[3] Predictive Validity: In community dwelling stroke survivors, ABC scores were associated with walking independence, use of an assistive device, and depression. An improvement on the ABC was predictive of physical function and health, and perceived health status. [3]
Ceiling/ floor effects	No data available in stroke.

Sensitivity to change (responsiveness, MCID, MDC)	In chronic stroke, ABC Scale was reported to be effective to identify individuals with a history of multiple falls. [5] Responsiveness of the ABC has been less frequently studied in stroke, however the ABC has been found to be responsive in community dwelling seniors.[6-8]
Instrument use	
Equipment required	Score sheet
Time to complete	10-15 minutes Short version(ABC-6) is available[1] The stem of survey was changed to: "up to what point are you confident that you will maintain your balance when you do the following activities" Scoring changed to ordinal scale: 0=not confident at all, 1=slightly confident, 2=moderately confident, 3=very confident
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Each item is rated on a 0 – 100% scale of confidence. Higher scores indicate greater balance confidence. The final score is the average of the item scores and ranges from 0-100%.
Level of client participation required (is proxy participation available?)	Self-report survey or can be administered by a tester.

Limitations:
Comments: Not appropriate to administer to a client who has not been in the community since stroke. Chinese, French Canadian, Dutch versions available. Normative data available based on 213 community dwelling older women (>70) mean score: 78.2 (16.7).[9] Quick and easy to administer. Could be administered by support staff. Can be used in multiple populations besides stroke. The ABC scale has been used in intervention trials post stroke and provides unique information on the subject's perception of balance, which can be compared/contrasted with performance-based clinical measures.

1. Schepens S, Goldberg A, Wallace M. The short version of the Activities-specific Balance Confidence (ABC) scale: its validity, reliability, and relationship to balance impairment and falls in older adults. *Archives of Gerontology & Geriatrics.* 2010;51(1):9-12.
2. Botner EM, Miller WC, Eng JJ. Measurement properties of the Activities-specific Balance Confidence Scale among individuals with stroke. *Disabil Rehabil.* Feb 18 2005;27(4):156-163.
3. Salbach NM, Mayo NE, Robichaud-Ekstrand S, Hanley JA, Richards CL, Wood-Dauphinee S. Balance self-efficacy and its relevance to physical function and perceived health status after stroke. *Arch Phys Med Rehabil.* Mar 2006;87(3):364-370.
4. Jonsdottir J, Cattaneo D. Reliability and validity of the dynamic gait index in persons with chronic stroke. *Archives of Physical Medicine & Rehabilitation.* 2007;88(11):1410-1415.
5. Beninato M, Portney LG, Sullivan PE. Using the International Classification of Functioning, Disability and Health as a Framework to Examine the Association Between Falls and Clinical Assessment Tools in People With Stroke. *Phys Ther.* August 1, 2009 2009;89(8):816-825.
6. Powell LE, Myers AM. The Activities-specific Balance Confidence (ABC) Scale. *J Gerontol A Biol Sci Med Sci.* January 1, 1995 1995;50A(1):M28-34.
7. Myers AM, Fletcher PC, Myers AH, Sherk W. Discriminative and Evaluative Properties of the Activities-specific Balance Confidence (ABC) Scale. *J Gerontol A Biol Sci Med Sci.* July 1, 1998 1998;53A(4):M287-294.
8. Lajoie Y, Gallagher SP. Predicting falls within the elderly community: comparison of postural sway, reaction time, the Berg balance scale and the Activities-specific Balance Confidence (ABC) scale for comparing fallers and non-fallers. *Archives of Gerontology & Geriatrics.* Jan-Feb 2004;38(1):11-26.
9. Talley KM, Wyman JF, Gross CR, Talley KMC, Wyman JF, Gross CR. Psychometric properties of the activities-specific balance confidence scale and the survey of activities and fear of falling in older women. *Journal of the American Geriatrics Society.* Feb 2008;56(2):328-333.

Practice Setting	4	3	2	1	Comments
Acute				x	Not appropriate to administer to a client who has not been in the community since stroke.
Inpatient Rehab		x			
Home Health		x			
Skilled Nursing		x			
Outpatient		x			

Overall Comments:

Somewhat limited psychometric data in stroke. Clinical utility is excellent.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute (<2 months)				x	Not appropriate to administer to a client who has not been in the community since stroke.
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			
Overall Comments:					

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Comments**
Should this tool be required for entry level curricula?	s	x	This tool is widely used clinically and in research and students should know how to administer the test..

Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	x		

Action Research Arm Test	
Reviewer: Dorian Rose	
ICF Domain (check all that apply): _____body function/structure ___x__ activity _____participation	
Type of measure: __x___ performance-based _____self-report Description: 19 upper extremity functional tasks/movements with four subscales: grasping, gripping, pinching and gross movement.	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Intra-rater: ICC = 0.99[1] Inter-rater: ICC =0.99[1] Inter-rater: ICC = 0.98 [2] Inter-rater: ICC=0.99 [3] Test-retest reliability ICC =0.97[3]
Validity (concurrent, criterion-related, predictive)	Concurrent validity: *r*=0.96 w/UE Motor Assessment Scale; *r*=0.87 w/arm subscore of the motricity index; *r*=0.94 w/UE movements of the modified motor assessment chart [2] Construct validity: *r*=0.6 w/sh. Flexor, elbow flexor and wrist extensor strength; *r*=0.58 w/reach speed; *r*=0.39 w/ grasp speed; *r*=0.41 w/UE FIM [4] Construct validity: *r*=0.73 w/UE FMA; *r*=0.63 w/WMFT-Time; r=0.77 w/WMFT FAS; *r*=0.27 w/ FIM-motor[5] Construct validity: *r*=0.93 w/UE Fugl-Meyer Motor; *r*=0.95 w/ Box and Block Test; *r*=0.81 w/Motricity Index[3] Predictive validity: *r*=0.22 w/FIM-Total; *r*=0.26 w/FIM-Motor[5]
Ceiling/ floor effects	Has significant floor effects at 14 days post-stroke (> 21% of participants) and notable ceiling effects (> 21% of participants) at 30, 90 and 180 days post-stroke[6].

Sensitivity to change (responsiveness, MCID, MDC)	Responsiveness (single population effect size method): = 1.02 (0-14 days post-stroke)[4] Responsiveness (single population effect size method) = 1.39 (0-90 days post-stroke)[4] Responsiveness (single population effect size method): 0.51 (in chronic stroke following 2 wks intensive treatment)[7] Responsiveness as measured by Standardized Response Mean (SRM) = 0.95[5] (SRM > 0.8 is considered large) Responsiveness (single population effect size method): 0.55 (1-3 months post-stroke); 0.63 (1-6 months post-stroke) (both values indicate moderate responsiveness)[8] MCID if dominant hand is affected: 12[9] MCID if non-dominant hand is affected: 17[9]
Instrument use	
Equipment required	4 wooden blocks (10 cm, 2.5 cm, 5 cm, 7.5 cm), cricket ball, sharpening stone, tumbler, washer, ball bearing, marble, 2 alloy tubes (2.25 cm diameter, 1 cm diameter), 2 tumblers (drinking glasses), 39" shelf, 2 wooden platforms with 2 sizes of wooden bolts, wooden platform with 1 wooden bolt. Specifications for equipment and scoring are available in Yozbatiran, 2009[10].
Time to complete	5-20 minutes depending on ability
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Ordinal scoring on 19 items, where 0 indicates no movement and 3 indicates normal movement. Items in each subscale are summed for grasping (18 point maximum), gripping (12 point maximum), pinching (18 point maximum), and gross movement (9 point maximum), with a total scale score of 57, indicating normal.
Level of client participation required (is proxy participation available?)	Client participation required

Limitations

Was not explicitly developed for the stroke population. Requires the purchase of construction of equipment.

Should this tool be required for entry level curricula? Yes __x_ No _____

Comments:

This is an easy test to administer. Students could be taught to use it rather easily. This is a tool that students should be exposed to at a minimum as it is often seen in the literature.

References

1. Van der Lee JH, De Groot V, Beckerman H, et al. 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. 2001; 82:14-19.
2. Hsieh C, Hsueh I, Chiang F, Lin P. Inter-rater reliability and validity of the Action Research Arm Test in Stroke Patients. Age and Ageing. 1998;27:107-113.
3. Platz T, Pinkowski C, van Wijck F, et al. 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. Clin Rehabil. 2005;19:404-411.
4. Lang CE, Wagner JM, Dromerick AW, Edwards DF. Measurement of Upper-Extremtiy Function Early After Stroke: Properties of the Action Research Arm Test. Arch Phys Med Rehabil. 2006; 87:1605-1610.
5. Hsieh Y, Wu C, Lin K, Chang Y, Chen C, Liu J. Responsiveness and Validity of Three Outcome Measures of Motor Function after Stroke Rehabilitation. Stroke. 2009;40:1386-1391.
6. Lin J, Hsu M, Sheu C, Wu T, Lin R, Chen C, Hsieh C. Psychometric Comparisons of 4 Measures for Assessing Upper-Extremity Function in People with Stroke. Phys Ther. 2009;89:84-850.
7. Van der Lee JH, De Groot V, Beckerman H, et al. The responsiveness of the Action Research Arm Test and the Fugl-Meyer Assessment scale in chronic stroke patients. J Rehabil Med. 2001;33:110-113.
8. Beebe JA and Lang CE. Relationships and Responsiveness of Six Upper Extremity Function Tests during the First Six Months of Recovery after Stroke. JNPT. 2009;33:96-103.
9. Lang CE, Edwards DF, Birkenmeier RL, Dromerick AW. Estimating Minimally Clinically Important Differences of Upper-Extremity Measures Early After Stroke. Arch Phys Med Rehabil. 2008; 89:1693-700.
10. Yozbatiran N, Der-Yeghianian L, Cramer S. A Standardized Approach to Performing the Action Research Arm Test. Neurorehabilitation Neural Repair. 2008;22:78-90.

Practice Setting	4	3	2	1	Comments
Acute		x			
Inpatient Rehab		x			
Home Health		x			
Skilled Nursing					
Outpatient		x			

Overall Comments: Would highly recommend but equipment does need to be purchased and "kit" assembled. This UE Activity assessment is quicker to administer than the WMFT and is highly correlated with it and the UEFM impairment measure. Has significant floor effects at 14 days post-stroke (> 21% of participants) and notable ceiling effects (> 21% of participants) at 30, 90 and 180 days post-stroke6.

Practice Setting	4	3	2	1	Comments
Acute (<2 months)		x			
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			

Overall Comments:

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?	x			

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		

Assessment of Life Habits (LIFE-H)	
General Information:	
Target Client Population	Individuals with disabilities
Topic / Content area / Domain :	Participation-level- general
Instrument components (including scoring, type of measure [e.g. performance-based, self-report]	The Assessment of Life Habits (LIFE-H) was developed to evaluate social participation of people with disabilities. [1] It is based on one's perception of difficulty and assistance required. The LIFE-H 3.0 (1998) general short form evaluates 69 items and the long form evaluates 242 items. The LIFE-H 3.1 (2001) has 77 items and is often referred to as the short form. The LIFE-H encompasses 12 different categories. These categories are divided between *daily activities and social roles*. There are versions for self-administration, but usually it is used in an interview form. There is a 5 point scale for satisfaction, however, it is used less frequently. A scoring grid is used to calculate the score.

Taken from: Measuring social participation: reliability of the LIFE-H in older adults with disabilities NOREAU,(2004) [2]

Nomenclatures of life habits

Daily activities (# of items)	*Social roles (#of items)*
Nutrition (3)	Responsibility (6)
Fitness (3)	Interpersonal Relationships (7)
Personal Care (7)	Community Life (7)
Communication (7)	Education (3)
Housing (8)	Employment (7)
Mobility (5)	Recreation (6)

Description of the scale of accomplishment related to the performance of life habits

Score Level of difficulty	*Type of assistance*
9 Performed with no difficulty	No assistance
8 Performed with no difficulty	Technical aid (or adaptation)
7 Performed with difficulty	No assistance
6 Performed with difficulty	Technical aid (or adaptation)
5 Performed with no difficulty	Human assistance
4 Performed with no difficulty	Technical aid (or adaptation) and human assistance
3 Performed with difficulty	Human assistance
2 Performed with difficulty	Technical aid (or adaptation) and human assistance
1 Performed by a substitute	
0 Not performed	
N/A Not applicable	

Instrument properties	
Reliability (test-retest, intra-rater, inter-rater)	From Noreau Test-retest on *Participation scale*: total score ICC=.95 Daily activities subscore ICC 0.96 Social roles subscore ICC=0.76 Inter-rater[2]: total score ICC ≤89 Daily activities subscore ICC =0.91 Social roles subscore ICC=0.64 95% CI From Poulin: Test-retest on *Participation scale*: Daily activites subscsore ICC=.93 Social roles subscore ICC=.94 Test-retest on *Satisfaction scale* Daily activites subscore ICC=.84 Social roles subscore ICC=.85 CI 95% Relationship between Participation and Satisfaction : Daily activities r=0.36 Social roles r=0.24
Validity (concurrent, criterion-related, predictive)	**Discriminant:** The LIFE-H was able to discriminate between individuals living in the community, private nursing homes or long-term care centers. This variation was supported by differing levels of disability.

	Convergent: • SMAF vs LIFE-H[4] r=.70 • LIFE-H vs FIM[7] r=.71-.88 @ 6 months r= .57-.85 @ 2 weeks (SMAF= Functional Autonomy Measurement System) **Predictive:** No studies with predictive validity but Dessrosier et al have done numerous studies to see which variables could predict decreased participation at different time points. In 2006 study, they found age, fewer co-morbidities, UE ability, LE coordination, absence of depression were able to predict LIFE-H participation scores at 6 months, 2 and 4 years post-stroke.
Responsiveness to change (e.g., MCD, MCID)	• MDC=.5 • Rochette looked at the responsiveness of the measure, and noted greatest change in the first 2 weeks post-stroke (large effect size) when compared to 6 months post-stroke (moderate effect size) Largest changes were for personal relations, employment and recreation.[10,11,12]
Ceiling/ floor effects	Unknown
Potential sources of bias	Studies involving elderly subjects recruited those with intact cognition for obtaining valid results- may reduce generalizability of results
Availability of normative data	Daily activities= 8.1 Social roles= 8.2
Extent of use in target and other populations	LIFE-H has been studied with the elderly, pediatric, stroke, TBI and SCI populations
Instrument use	
Equipment required	None
Time to complete	LIFE-H 3.0 (long) 20-120 minutes LIFE-H 3.1 (short) 20-40 minutes

Effect of tester experience (expertise/training)	Scoring grid needed to complete the assessment[13]
Level of client participation required	• Self appraisal • Reliability of interview by proxy for those with cognitive impairment[9]
Benefits	• Easy to administer • Reliable with stroke and elderly • Has been shown to correlate with quality of life, suggesting a decrease in activity associates with a decrease in quality of life
Limitations	• Studies involving elderly subjects recruited those with intact cognition, for obtaining valid results- may reduce generalizability of results • Questionnaire is long • Validation studies ongoing, has shown good construct validity • Form available for purchase and training via INDCP (see below footnotes)
Comments:	• Available in French, English, Dutch • Short version 3.1 does not include *education* and *employment* under *social roles*, this form may be more applicable with older adults
References (including websites):	1. Fougeyrollas et al. Social consequences of long term impairments and disabilities: conceptual approach and assessment of handicap. International Journal of Rehabilitation Research 1998; 21: 127 – 141. 18 2. NOREAU et al. Measuring social participation: reliability of the LIFE-H in older adults with disabilities. DISABILITY AND REHABILITATION, 2004; 26:346–352. 3. Poulin V, Desrosiers J. Reliability of the Life-H satisfaction scale and the relationship between participation and satisfaction of older adults with disabilities. Disability and Rehabil 2009;31:1311-1317. 4. Desrosiers et al. VALIDITY OF THE ASSESSMENT OF LIFE HABITS IN OLDER ADULTS. J Rehabil Med 2004; 36: 177–182 5. Desrosiers et al. Long-Term Changes in Participation After Stroke. Top Stroke Rehabil 2006;13(4):86–96. 6. Levasseur M, Desrosiers J, St-Cyr Tribble. Do quality of life, participation and environment of older adults differ according to level of activity? Health and Quality of Life Outcomes 2008, 6:30

	7. Desrosiers J, Rochette A, Noreau L, Bravo G, Hébert R, Boutin C. Comparison of two functional independence scales with a participation measure in post-stroke rehabilitation. Arch Gerontol Geriatr 2003;37:157–172. 8. Desrosier et al. Predictors of long-term participation after stroke. Disability and Rehabilitation, February 2006; 28(4): 221 – 230 9. Poulin V, Desrosiers J. Participation after stroke: comparing proxies' and patients' perceptions. J Rehabil Med, 2008; 40, 28-35. 10.Rochette et al. Changes in participation after a mild stroke: quantitative and qualitative perspectives. Top Stroke Rehabil. 2007, 14(3): p. 59-68. 11.Rochette et al. Changes in participation level after spouse's first stroke and relationship to burden and depressive symptoms. Cerebrovascular Diseases. 2007; 24(2-3), 255-260. 12. StrokEngine 13. Information on the LIFE-H can be obtained by emailing the coordinator of the International Network of Disability Creation Process (INDCP), Mr. Charrier at francis.charrier@idrpq.qc.ca

2nd Reviewer comments:
This is a nice, reliable measure that captures a variety of constructs at the participation level. However, it takes a great deal of time (for all versions) to complete and appears to have greater convergent validity months (vs. weeks) post-CVA. It would likely be best used for research studies interested in measuring impact on participation and possibly in the outpatient setting. Client's need to have intact cognition, or the survey would need to be completed by a proxy.

Practice Setting	4	3	2	1	Comments
Acute				**x**	
Inpatient Rehab		**x**			
Home Health		**x**			
Skilled Nursing		**x**			
Outpatient		**x**			

Overall Comments:

quite lengthy even in its short version

costs money to use and train

reliability established with stroke and elderly populations

reliability established for for interview by proxy for those with decreased cognition

validity studies ongoing - good convergent validity with SMAF

as 2nd reviewer notes: captures a variety of constructs

requires copyright payment

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				x	
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			

Overall Comments:

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Do not recommend**	**Comments**
Should this tool be required for entry level curricula?		x		

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?	x		

Arm Motor Ability Test (AMAT)	
Reviewer: Sullivan	
ICF Domain: (check all that apply): _____body function/structure ___x_ activity ____participation	
Type of measure: ___x__ performance-based ___self-report	
Instrument properties: The AMAT consists of 28 unilateral and bilateral activities arm activities incorporating manipulation of everyday objects.	
Reliability (test-retest, intra-rater, inter-rater)	Interrater reliability - .95 to .99[1] Test-retest reliability - .93 to .99.[1]
Validity (concurrent, criterion-related, predictive)	The were moderate correlations with the Motricity-Index-Arm (r=0.45 to .61)[1] and high correlations with the Fugl-Meyer Assessment (*r* = 0.92-0.94).[2]
Ceiling/ floor effects	The AMAT time of performance exhibited significant ceiling and floor effects with respect to the Fugl-Meyer Assessment.[2]
Sensitivity to change (responsiveness, MCID, MDC)	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.[1]
Instrument use	
Equipment required	Numerous objects are used in the test (e.g. shoe, telephone, shirt), some of which must have very specific in dimensions. 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
Time to complete	30-40 minutes

How is the instrument scored? (e.g. total score, are there subscales, etc.)	Each of the 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.

Limitations: Very lengthy to complete

Client should have some active movement capacity in the involved arm

The AMAT has been used in post stroke UE intervention trials examining constraint induced movement therapy, electrical stimulation, and repetitive task training.

1. Kopp B, Kunkel A, Flor H, et al. The Arm Motor Ability Test: reliability, validity, and sensitivity to change of an instrument for assessing disabilities in activities of daily living. *Archives of Physical Medicine & Rehabilitation.* 1997;78(5):615-620.

2. Chae J, Labatia I, Yang G. Upper limb motor function in hemiparesis: concurrent validity of the Arm Motor Ability Test. *American Journal of Physical Medicine & Rehabilitation.* Jan 2003;82(1):1-8.

Practice Setting	4	3	2	1	Comments
Acute				**x**	**Ceiling and floor effects, administration time may preclude it's use in acute care.**
Inpatient Rehab		**x**			
Home Health		**x**			
Skilled Nursing		**x**			
Outpatient		**x**			

Overall Comments:

Client must demonstrate some distal arm function. Good psychometrics but reported ceiling and floor effects. Poor clinical utility (30-40 minute administration time and equipment required).

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				x	**Ceiling and floor effects, administration time may preclude it's use in acute care.**
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			
Overall Comments: See above.					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?		x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		

Ashworth Scale (*AS*)[1]

Modified Ashworth Scale (*MAS*)[2]

Reviewer: Beth Crowner

ICF Domain (check all that apply):

__X__body function/structure _____ activity _____participation

Type of measure:

__X__ performance-based _____self-report

Description: The scale is used to assign a subjective rating of the amount of resistance or tone perceived by the examiner as a limb is moved through its full range of motion.

Instrument properties (please use footnotes)

Reliability (test-retest, intra-rater, inter-rater)	Reliability: (**Population Diagnosis**)		
	Inter-rater (Internal consistency):		
	Kappa	*MAS* Overall:	0.16-0.42[3] **(Brain Inj incl. Stroke)**
		MAS Overall:	0 .74[4] (**Stroke**)
		MAS Elbow:	0.84 [5](**Acute Stroke**)
		AS Elbow:	0.17 [6](**Stroke**)
		MAS Elbow:	0.21 [6](**Stroke**)
	Weighted kappa	*MAS* Elbow:	0.96 [7](**Acute Stroke**)
		MAS Wrist:	0.89 [7]
		MAS Knee:	0.79[7]
		MAS Ankle:	0.51[7]
	Kendall's tau-b	*MAS* Overall:	0.85 [8](**Stroke**)
		MAS Overall:	0.06 [9](**Acute Stroke**)
		MAS Calf:	0.15 [9]

		MAS Soleus:	0.19 [9]
		MAS Quads:	0.28 [9]
		MAS Elbow:	0.85 [2] **(Intracranial Lesions)**
		MMAS Elbow:	0.87 [10] **(Ischemic Stroke)**
	Spearman's rho:	*MAS* Elbow:	0.56-0.90 [11] (**Stroke**)
		MAS Knee:	0.26-0.62 [11]
	Intra-rater (Test-retest):		
	Kappa	*MAS* Overall:	0.47-0.62[3] **(Brain Inj incl. Stroke)**
		MAS Shoulder Flex: 0.55 [3]	
		MAS Shoulder Ext Rot: 0.47 [3]	
		MAS Elbow Flexor: 0.47	Extensor: 0.53 [3]
		MAS Wrist Flexor: 0.58	Extensor: 0.51 [3]
		MAS Hip Flexor: 0.53	Extensor: 0.49 [3]
		MAS Knee Flexor: 0.52	Extensor: 0.55 [3]
		MAS Ankle Ext (with knee flexed): 0.62 [3]	
		MAS Ankle Ext (with knee extended): 0.47 [3]	
	Weighted kappa:	*MAS* Elbow:	0.83 [5] (**Acute Stroke**)
		MAS Elbow:	0.83 [12]
		MAS Wrist:	0.88 [12]
		MAS Knee:	0.94 [12]
		MAS Ankle:	0.64 [12]
	Kendall's tau-b:	*MAS* Overall:	0.57 [9](**Acute & Chronic Stroke**)
		MAS Calf:	0.44 [9]
		MAS Soleus:	0.58 [9]
		MAS Quads:	0.66 [9]

Validity (concurrent, criterion-related, predictive)	No significant correlation between the quantitative measures of neural and muscular components of joint dynamic stiffness with MAS scores, for either the upper extremity or the lower extremity. MAS inconsistent with more objective measures of spasticity. [13] (**Stroke**) **Criterion** Concurrent Validity*: MAS* Spearman's rho: vs Surface Electromyography 0.21[14](**Stroke**) Predictive Validity. No studies at this time **Construct** No correlation between pain and MAS at the elbow and wrist.[15] **(Stroke)** Convergent validity*: MAS* Pearson's r: vs. Fugl-Meyer -0.94[16](**Stroke**) Electromyography -0.79 [16] Pendulum Test -0.67 [16] Torque (Not Significant) [16] H/M ratio (Not Significant) [16] Spearman's rho: vs. Electromyography 0.77 to 0.80 [17] (**Chronic Stoke**) Torque Response -0.25 at rest, 0.26-0.21 active [17] Velocity Sensitivity 0.52 to 0.57 [17] Fugl-Meyer -0.83 to -0.76 [17] Box and Block Test -0.83 to -0.73 [17] Active ROM -.74 to -0.62 [17] Grip Strength -0.86 to -0.85 [17] Passive ROM Elbow 0.51[18]**(Stroke)**

	Known Groups*: MAS* is not able to distinguish between different values of H-reflex latency and different levels of stiffness, using student t-test and ANOVA. [19, 20] **(Stroke)**
Ceiling/ floor effects	No studies found at this time.
Sensitivity to change (responsiveness, MCID, MDC)	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. [21]
Instrument use	
Equipment required	Therapy mat, paper
Time to complete	Not reported, varies depending on number of limbs/muscles tested
How is the instrument scored? (e.g. total score, are there subscales, etc.)	A graded rating of spasticity is made from 0 – 4, using the guidelines to describe the resistance perceived while moving a limb passively about a joint, through its full range of motion, for one second. Lower scores represent normal or low muscle tone, higher scores represent increased resistance to passive movement.
Level of client participation required (is proxy participation available?)	Client presence required.

Limitations

- Author's opinion that the scale (in either form) is a descriptive assessment of resistance to passive motion and therefore reflects only an aspect of spasticity rather than providing a comprehensive measurement. [7,18,22]
- Reliability of the MAS is dependent upon the muscle being assessed. In general, the MAS may be best suited to assessments of the elbow, wrist and knee flexors. [7, 22]
- While Ashworth scales give us one ordinal score to define joint spasticity, they certainly can't represent the joint dynamic stiffness and position and velocity dependency of both intrinsic and reflex components.[13]
- 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. [23]
- Intra-rater agreement increased with decreasing scores (score of 0 indicated 60% agreement) while decreased agreement was seen on higher scores (score of 2 indicated 12% intra-rater agreement). [9, 18,22]
- Inter-rater had agreement of 40.8% for a score of 0 and 0% for a score of 2. Poor inter-rater reliability despite written guidelines, suggesting training may be necessary. [9]
- No distinction between spasticity and contracture and is confounded by contracture. [24]
- Repeated stretching may introduce variability and make reliable grading of spasticity more difficult. [6]
- Decreased reliability in the MAS due to disagreement around 1 and 1+ ratings. Lack of sensitivity in grades 1, 1+, and 2. These grades are not discriminative of change. Not valid for spasticity at lower grades but may provide a measure of resistance to passive movement. [18, 22]

Comments:

The MAS is the gold standard for assessment of spasticity. It has questionable reliability and better validity. Caution is required when stating that the MAS is a measure of spasticity since evidence suggests that the resistance to passive movement is not an exclusive measure of spasticity. Ambiguity of wording and lack of standardized procedures limit the scales' usefulness for comparison across studies as well as reliability.

References:

1. Ashworth B. Preliminary trial of carisoprodol in multiple sclerosis. *Practitioner.* 1964; 1 92: 540-2.
2. Bohannon RW, Smith MB. Interrater reliability of a Modified Ashworth scale of muscle spasticity. *Phys Ther*. 1987;67:206-207. (**Intercranial Lesions**)
3. Mehrholz J, Wagner K, MeiBner D, Grundmann K, Zonge C, Koch R, Pohl M. Reliability of the Modified Tardieu scale and the Modified Ashworth scale in adult patients with severe brain injury: a comparison study. *Clin Rehabil*. 2005;19:751-759. (**Traumatic Brain Injury**)
4. Bodin PG, Morris ME. Inter-rater reliability of the Modified Ashworth Scale for wrist flexors spasticity following stroke. *World Federation of Physiotherapy*, 11th Congress. 1991:505-507. (**Stroke**)
5. Gregson JM, Leathley M, Moore P, Sharma AK, Smith TL, and Watkins CL. Reliability of the Tone Assessment Scale and the Modified Ashworth Scale as clinical tools for assessing poststroke spasticity. *Archives of Physical Medicine and Rehabilitation*. 1999;80:1013-1016. (**Acute Stroke**)
6. Ansari NN, Naghdi S, Moammeri H, Jalaie S. Ashworth Scales are unreliable for the assessment of muscle spasticity. *Physiotherapy theory and practice.* 2006;22:119-125. (**Acute Stroke**)
7. Gregson JM, Leathley M, Moore P, Smith TL, Sharma AK, and Watkins CL. Reliability of measurements of muscle tone and muscle power in stroke patients. *Age and Ageing*. 2000;29:223-228. (**Acute Stroke**)
8. Bodin PG, Morris ME. Inter-rater reliability of the Modified Ashworth Scale for wrist flexors spasticity following stroke. *World Federation of Physiotherapy*, 11th Congress. 1991:505-507. (**Stroke**)
9. Blackburn M, van Vliet P, Mockett SP. Reliability of measurements obtained with the Modified Ashworth Scale in the lower extremities of people with Stroke. *Phys Ther*. 2002;82:25-33. (**Chronic and Acute Stroke)**
10. Ansari NN, Naghdi S, Younesian B, Shayeghan M . Inter- and intrarater reliability of the Modified Modified Ashworth Scale in patients with knee extensor poststroke spasticity. *Physiotherapy Theory and Practice*. 2008;24:205-213.
11. Sloan RL, Sinclair E, Thompson J, Taylor S, Pentland B. Inter-rater reliability of the Modified Ashworth Scale for spasticity in hemiplegic patients. *Int J Rehabil Res*. 1992;15:158-161. (**Stroke**)
12. Gregson, J.M., Leathley, M., Moore, P., Smith, T.L., Sharma, A.K. & Watkins, CL. Reliability of measurements of muscle tone and muscle power in stroke patients. *Age and Ageing*. 2000; 29, 223-228.
13. Alibiglou L, Rymer WZ, Harvey RL, Mirbagheri MM. The relationship between Ashworth scores and neuromechanical measurements of spasticity following stroke. *Journal of NeuroEngineering and Rehabilitation*. 2008;5:18-31. (**stroke**)
14. Cooper A, Musa IM, van Deursen, Wiles CM. Electromyography characterization of stretch responses in hemiparetic stroke patients and their relationship with the Modified Ashworth Scale. *Clin Rehabil*. 2005;19:760-766. (**Stroke**)

15. Pizzi A, Calucci G, Falsini C, Verdesca S, Grippo A. Evaluation of upper-limb spasticity after stroke: a clinical and neurophysiologic study. *Archives of Physical Medicine and Rehabilitation.* 2005;86:410-415. (**Stroke**)
16. Katz RT, Rovai GP, BraitC, Rymer Z. Objective quantification of spastic hypertonia: correlation with clinical findings. *Archives of Physical Medicine and* Rehabilitation. 1992;73:339-347. (**Stroke**)
17. Lin FM, Sabbahi M. Correlation of spasticity with hyperactive stretch reflexes and motor dysfunction in hemiplegia. *Archives of Physical Medicine*. 1999;80:526-530. (**Stroke**)
18. Pandyan AD, Price CM, Barnes MP, Johnson GR. A biomechanical investigation into the validity of the Modified Ashworth scale as a measure of elbow spasticity. *Clin Rehabil*. 2003;17:290-294. (**Stroke**)
19. Bakheit AMO, Maynard VA, Curnow J, Hudson N, Kodapala S. The relationship between Ashworth scale scores and the excitability of the alpha motor neurons in patient with post-stroke muscle spasticity. *Journal Neurol and Neurosurg Psychiatry.* 2003;74:646-648. (**Stroke**)
20. Kumar RTS, Pandyan AD, Sharma AK. Biomechanical measurement of post-stroke spasticity. *Age and Ageing*. 2006;35:371-375. (**Stroke**)
21. Shaw L, Rodgers H, Price C, van Wijck F, Shackley P, Steen N, Barnes M, Ford G, Graham L. BoTULS: a multicentre randomized controlled trial to evaluate the clinical effectiveness and cost-effectiveness of treating upper limb spasticity due to stroke with botulinum toxin type A. *Health Technology Assessment.* 2010;14:1-113. (**Stroke**)
22. Pandyan AD, Johnson GR, Price CM, Curless RH, Barnes MP, Rodgers H. A review of the properties and limitations of the Ashworth and Modified Ashworth scales as measurements of spasticity. *Clin Rehabil.* 1999;13:373-383.
23. Kamper DG, Schmit BD, Rymer WZ. Effect of muscle biomechanics on the quatification of spasticity. *Ann Biomed Eng*. 2001;29:1122-1134.
24. Patrick E, Ada L. The Tardieu scale differentiates contracture from spasticity whereas the Ashworth scale is confounded by it. *Clin Rehabil.* 2006;20:173-182. (**Chronic Stroke**)

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute		**X**			May not be as useful in the first few days post CVA when patients have not yet developed hypertonicity
Inpatient Rehab		**X**			
Home Health		**X**			
Skilled Nursing		**X**			
Outpatient		**X**			
Overall Comments:	The measure can be administered in any setting and is quick to administer. Reliability and validity are variable among muscle groups and between				

	studies. The operational definitions for how to move the limb (speed) is poor which can lead to variation in reliability. However, it is still the "gold standard" that is used in the clinic and in research.

Patient Acuity	4	3	2	1	Comments
Acute (< 2 mos)		X			
Subacute (2-6 mos)		X			
Chronic (> 6 mos)		X			
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?	X		Because it is still considered the gold standard for assessing/grading hypertonicity, students should learn to administer the measure
Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	X		It is already widely used in research; However, operational definitions should be established *a priori* to improve its reliability

Berg Balance Scale	
Reviewer: Pinto Zipp	
ICF Domain (check all that apply): _____body function/structure ____x_ activity _____participation	
Type of measure: ____x_ performance-based _____self-report	
Instrument properties	
Reliability (test-retest, intra-rater, inter-rater)	• *Liston and Brouwer (1996) reported excellent **test-retest reliability** (ICC=0.98) in a sample of 20 subjects with chronic stroke.*[1] • *Mao et al (2002) found excellent **interrater reliability**, ICC of 0.95 for the BBS in a sample of 123 patients at 14 days post stroke.* [2] • *Berg et al (1992) found excellent **interrater reliability**, ICC of 0.98 for the BBS in a sample of 35 patients with stroke.* [3] • *Berg et al (1992) found excellent **intrarater reliability**, ICC of 0.97 for the BBS in a sample of 35 patients with stroke.*[3]
Validity (concurrent, criterion-related, predictive)	• Berg et al (1992)found the following **correlations:** between the BBS and the Barthel Index (r=.80 to .94) and BBS and FM-B (r=.62 TO .94) in 70 patients with acute stroke.[3] • Chou et al (2006) found the following **correlations:** between the BBS and the Barthel Index (r=.88) and BBS and the motor subscale of the Fugl-Meyer Assessment (r=.71) at 14 days post stroke.[4] • Wee et al (1999) found the following **correlation:** between the BBS and the FIM on admission (r=.76) in 128 patients in an inpatient stroke rehabilitation unit.[5] • Juneja et al (1998) found the following **correlation:** between the BBS and the FIM (r=.70) in 15 patients in an inpatient stroke rehabilitation unit.[6] • Liston and Brouwer (1996) found the following **correlation:** between the BBS and various dynamic measures on the Balance Mater to range from (r=-.48 to -.67) in patients with stroke.[1] • Mao et al (2002) found the following **correlations:** between the BBS and FM-B (r=90 to .92) and BBS and the PASS (r=.92 to .95) at various data points post stroke (14, 30, 90 and 180).[2] • Tyson and DeSouza (2004) found **correlations** between the BBS

	and various dynamic measures in 48 patients with stroke and found that following: BBS and the step up test (r=.19), and the BBS and weight shift test (r=.26).[7] • Smith et al (2004) found the following **correlation:** between the BBS and the Functional Reach Test in 75 patients with stroke (Spearman rho=.78) with higher correlations (r=.80) noted for patients with moderate motor impairments when compared to those with more severe motor impairments (r=.24).[8] • Hsueh et al (2001) found the following **correlation:** between the BBS and the Barthel Index in patients with stroke (r≥=.78)at day 14, 30, 90 and 180 poststroke.[9] • *Richards et al (1995) found the following **correlation:** between the BBS and a test of gait speed in 18 patients with stroke (r=.60)at 6 weeks poststroke.*[10] • *Stevenson and Garland (1996) examined the BBS' to assess anticipatory postural adjustments to voluntary movements. Examining the center of pressure excursion during self-initiated rapid arm flexion in 24 subjects with* chronic stroke *the BBS was found to be **correlated** highly (r= .81) with measurements of center of pressure.*[11] • Berg et al (1992) found that at 12 weeks poststroke that the BBS **discriminated** between patients based upon their current service location (home, rehab etc).[3] • Au-Yeung et al (2003) found that in 20 patients 12 months poststroke that the BBS **discriminated** among 3 patients groups based upon their current functional level (walkers with and without assistance and a control group).[12] • Teasell et al (2002) assessed the **predictive validity** of the BBS in the acute stroke population and found that in a sample of 238 patients with stroke in an acute rehabilitation facility, admission BBS scores were significantly lower for patients who fell during their course of rehabilitation (19.0/56 for fallers, vs. 30.7/56 for non-fallers). [13] • Juneja et al (1998) found that in patients with stroke the BBS was **predictive** of length of stay (r=-.39) such that a higher BBS score was associate with a shorter length of stay.[6] • Wee et al (2003, 1999) found that the admission BBS score in the acute stroke population was moderately correlated with length of stay (LOS) (r= -.53). They also used the BBS as a **predictor** of discharge destination, and found that patients with an admission BBS score above 20 were more likely to be discharged home (p<.001).[5] • Mao et al. (2002) found that the BBS at 14, 30, and 90 days post stroke **predicted** (Spearman correlations .82 to .91) in patient scores on the Motor Assessment Scale 180 days

	poststroke.[2] • Wang et al (2004) found that the BBS at 14 and 30 days poststroke **predicted** disability level at 90 days poststroke (Spearman rho= .76 and .81 respectively).[14] • Wang et al (2004) found that the shortened version of BBS at 14 and 30 days poststroke **predicted** disability level at 90 days poststroke (Spearman rho= .75 and .81 respectively).[14]
Ceiling/ floor effects	• In Mao et al. (2002) a significant **floor effect** was detected in the BBS and the balance subscale of the Fugl- Meyer 14 days after stroke onset in patients with severe impairments A significant **ceiling effect** at 90 and 180 days after stroke onset for those with higher-level function was also noted with the BBS [2] • English et al (2006) found the BBS to have a negligible **floor effect** and a minimal **ceiling effect** in 61 subjects with acute stroke.[15] • Chou et al (2006) found that the BBS had a large **floor effect** (23.9 %) when administered 14 days poststroke, conversely no **ceiling effect** was noted (2.7%).[4] • Salbach et al (2001) found that the BBS had a large **ceiling effect** (26 %) when administered 38 days poststroke.[16]
Sensitivity to change (responsiveness, MCID, MDC)	• Mao et al. (2002) assessed the **responsiveness** of the BBS and found it to be moderately responsive in detecting changes before 90 days after stroke, with the ES between 14 and 30 days (0.80) and between 30 to 90 days after stroke, ES = 0.69, and poor at 90-100 days after stroke (ES = 0.40).[2] • Wood-Dauphinee et al (1997) reported an **ES** of 0.66 for initial 6-week post-stroke evaluation period, **ES** = 0.25 for 6-12 weeks post-stroke, and an overall ES = 0.97.[19] • Salbach et al. (2001) used **standardized response mean** (SRM = mean change/standard deviation of change) and found that from 8-38 days post-stroke for the SRM for the BBS was 1.04 and thus recommend its use in patients who have suffered a severe stroke.[16] • English et al (2006) investigated the **sensitivity** of the BBS in 78 subjects receiving inpatient rehabilitation within one week of admission and one week of discharge and found it to be sensitive to change with large ES (d = 1.01).[15] • Stevenson (2001) determined the **MDC** of the BBS in an acute stroke population to be 6 points. However, the author warned that the methodology used to determine the MDC might have overestimated this value.[17] • Liaw et al (2008) determined the **smallest real difference** (SRD) of the BBS in the chronic stroke population. In a study of 52 individuals with chronic stroke, the SRD was calculated to be 6.68 affirming a change of 7 points is necessary on the BBS for

	the clinician to conclude that the patient has improved his balance.[18] • Wood-Dauphinee et al (1997) in a study of 60 patients with acute stroke, stratified across three general functional levels of severity, found the BBS to be as **responsive** to change as the Barthel Index.[19]
Instrument use	
Equipment required	• Chair with arm rests and without, 6 in stepstool, yard stick, tape, paper pencil, object to pick up (slipper), stopwatch
Time to complete	• 20-30 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	• 5 point ordinal scale, with scores ranging from 0-4 • Descriptive criteria is provided with 4 being able to perform independently and 0 unable to perform • Max score 56, score of 45 or below associated with high fall risk
Level of client participation required (is proxy participation available?)	• Proxy is not available

Limitations

- May not be appropriate for high functioning clients
- BBS has currently not been found to be predictive of falls in individuals with chronic stroke or in the acute period following stroke.

References

1. Liston, R.A., Brouwer, B.J. (1996). Reliability and validity of measures obtained from stroke patients using the Balance Master. Arch Phys Med Rehabil, 77, 425-430.
2. Mao, H., Hsueh, I., Tang, P., Sheu, C., & Hsieh, C. (2002). Analysis and comparison of the psychometric properties of three balance measures for stroke patients. *Stroke, 33*, 1022-1027.
3. Berg, K. O., Maki, B., Williams, J. I., Holliday, P. J., & Wood-Dauphinee, S. L. (1992). Clinical and laboratory measures of postural balance in and elderly Population. *Arch Phys Med Rehabil., 73*, 1073-1080.
4. Chou, C., Chien, C., Hsueh, I., Sheu, C., Wang, C., & Hsieh, C. (2006). Developing a short form of the berg balance scale for people with stroke. *Phys Ther, 86*(2), 195-204.
5. Wee, J. Y., Bagg, S.D., & Palepu, A. (1999). The berg balance scale as a predictor of length of stay and discharge destination in an acute stroke rehabilitation setting. *Arch Phys Med Rehabil, 80*, 448-452.
6. Juneja, G., Czyrny, J. J., & Linn, R. T. (1998). Admission balance and outcomes of patiens admitted for acute inpatient rehabilitation. *Am J Phys Med Rehabil, 77*, 388-393.

7. Tyson, S. F., & DeSouza, L. H. (2004). Reliability and validity of functional balance tests post stroke. *Clin Rehabil, 18*, 916-923.
8. Smith, P. S., Hembree, J. A., & Thompson, M. E. (2004). Berg balance scale and functional reach: Determining the best clinical tool for individuals post acute stroke. *Clin Rehabil, 18*, 811-818.
9. Hsueh, I., Lee, M.M., & Hsieh, C.I. (2001). Psychometric characterisitcs of the Barthel Activities of Daily Living Index in stroke patients. J Formos Med Assoc., *100*, 526-532.
10. Richards, C.L., Malouin, F., Dumas, F., & Tardif, D. (1995). Gait veloicity as an outcome measure of locomotor recovery after stroke. In: Craik, R., Oatis, C.A., eds. Gait Analysis: Theory and Applications. St. Louis, Mo: Mosby, 355-364.
11. Stevenson, T. J., & Garland, S. J. (1996). Standing balance during internally produced perturbations in subjects with hemiplegia: Validation of the balance scale. *Arch Phys Med Rehabil, 77*, 656-662.
12. Au-Yeung, S., Ng, J., & Lo, S. K. (2003). Does balance or motor impairment of limbs discriminate the ambulatory status of stroke survivors? *American Journal of Physical Medicine & Rehabilitation, 82*(4), 279-283.
13. Teasell R, McRae M, Foley N, Bhardwaj A. (2002). The incidence and consequences of falls in stroke patients during inpatient rehabilitation: factors associated with high risk. Arch Phys Med Rehabil 2002; 83:329-333
14. Wang, C.H, Hsueh, I.P., Sheu, C.F. & et al. (2004). Psychometric prosperities of 2 simpllified 3-level balance scales used for patients with stroke. Physical Therapy, 84,430-438.
15. English, C. K., & Hillier, S. L. (2006). The sensitivity of three commonly used outcome measures to detect change amongst patients receiving inpatient rehabilitation following stroke. *Clin Rehabil, 20*, 52-55.
16. Salbach, N. M., Mayo, N. E., Higgins, J., Ahmed, S., Finch, L. E., & Richards, C. L. (2001). Responsiveness and predictability of gait speed and other disability measures in acute stroke. *Arch Phys Med Rehabil, 82*, 1204-1212.
17. Stevenson, T. J. (2001). Detecting change in patients with stroke using the berg balance scale. *Australian J Physiotherapy, 47*, 29-38.
18. Liaw, L., Hsieh, C., Lo, S., Chen, H., Lee, S., & Lin, J. (2008). The relative and absolute reliability of two balance performance measures in chronic stroke patients. *Disability & Rehabilitation, 30*(9), 656-661.
19. Wood-Dauphinee, S., Berg, K., Bravo, G., & Williams, J. I. (1997). The balance scale: Responsiveness to clinically meaningful changes. *Canadian J Rehabil, 10*(1), 35-50.

Practice Setting	4	3	2	1	Comments
Acute		**x**			
Inpatient Rehab	**X**				
Home Health	**X**				
Skilled Nursing	**X**				
Outpatient	**X**				
Overall Comments: Major concern in inconsistency with regard to ceiling and floor effects observed. Requires use of equipment such as chair, stepstool, yard stick, slipper, stopwatch.					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)		x			
Sub- Acute (2-6 months)	x				
Chronic (>6 months)	x				
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?	x	x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		

BALANCE EVALUATION-SYSTEMS TEST	
Reviewer: PINTO ZIPP	
ICF Domain (check all that apply): _____body function/structure ___X__ activity _____participation	
Type of measure: ___X__ performance-based _____self-report	
Instrument properties	
Reliability (test-retest, intra-rater, inter-rater)	• In subjects with and without balance disorders between the ages of 50 and 88, ICC for interrater reliability for the test as a whole was .91, with the 6 section ICCs ranging from .79 to .96 (Horak et al, 2009).[1] • Section II ICC=.79 with FR ICC=.98 • Section V ICC=.96 with CTSIB ICC= .74 • Section VI ICC= .88 with DGI kappa= .64 and TUG ICC= .99
Validity (concurrent, criterion-related, predictive)	• Concurrent validity of the correlation between the BEST Test and the Activities-specific Balance Confidence Scale was r=.636, p<.01
Ceiling/ floor effects	• Not available
Sensitivity to change (responsiveness, MCID, MDC)	• Not available

Instrument use	
Equipment required	• Stop watch • Measuring tape mounted on wall for Functional Reach test • Approximately 60 cm x 60 cm (2 X 2 ft) block of 4-inch, medium-density, Tempur® foam • 10 degree incline ramp (at least 2 x 2 ft) to stand on • Stair step, 15 cm (6 inches) in height for alternate stair tap • 2 stacked shoe boxes for obstacle during gait • 2.5 Kg (5-lb) free weight for rapid arm raise • Firm chair with arms with 3 meters in front marked with tape for Get Up and Go test • Masking tape to mark 3 m and 6 m lengths on the floor for Get Up and Go
Time to complete	• Minimum of 30 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	• 27 tasks with some items consisting of 2 to 4 sub-items for a total of 36 item grouped into 6 systems • Each item is scored on a 4-level, ordinal scale from 0 (worst performance) to 3 (best performance) • Obtain a total score and subtest scores
Level of client participation required (is proxy participation available?)	• Proxy not available

Limitations

- Requires purchase
- Limited psychometric testing= construct, concurrent validity, sensitivity, specificity
- Lack of evidence of its utility in directing treatment
- Tested in subjects with and without balance disorders between the ages of 50-88
- No testing available in stroke population to date

Reference:

1. Horak, F.B., Wrisley, D.M., & Frank, J. (2009) The Balance Evaluation Systems Test (BESTest) to Differentiate Balance Deficits, *Physical Therapy*, Vol 89, 5, 484-49
2. Franchignoni F, Horak F, Godi M, Mardone A, Giordano A (2010). Using psychometric techniques to improve the Balance Evaluation Systems Test: the mini-BESTest. J Rehabil Med, 42(4), 323-31.8.

Practice Setting	4	3	2	1	Comments
Acute			**X**		
Inpatient Rehab			**X**		
Home Health			**X**		
Skilled Nursing			**X**		
Outpatient			**x**		
Overall Comments: Currently psychometric in stroke population unknown					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)			X		
Sub- Acute (2-6 months)			X		
Chronic (>6 months)			x		
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?			Not at this time for entry level education in stroke

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	X		For balance disorders

Box and Block Test	
Reviewer: Dorian Rose	
ICF Domain (check all that apply): _____body function/structure __x___ activity _____participation	
Type of measure: __x___ performance-based _____self-report Description: The BBT consists of wooden blocks placed in a wooden box that has 2 equal-sized compartments. Patient moves the blocks (2.54 cm x 2.54 cm) one by one from one compartment to another in 1 minute.	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Test-retest: Able-body subjects: ICC = 0.89-0.90; subjects with impairment: ICC=0.96-0.97[1] Test-retest in stroke: ICC= 0.98 for affected hand; ICC=0.93 for unaffected hand [2]
Validity (concurrent, criterion-related, predictive)	Discriminant validity: with the Minnesota Rate of Manipulation Test-Placing; *r*=0.91. With the General Aptitude Test Batter; *r* = 0.86[3] Construct validity: *r*=0.80-0.82 (Action Research Arm Test); *r*=0.42-0.54 (Functional Autonomy Measurement System)[1]
Ceiling/ floor effects	Not assessed
Sensitivity to change (responsiveness, MCID, MDC)	Standard Real Difference (SRD): affected hand = 5.5; unaffected hand = 7.8 [2]
Instrument use	
Equipment required	Wooden box constructed for this assessment and wooden cubes available commercially
Time to complete	1 minute

How is the instrument scored? (e.g. total score, are there subscales, etc.)	# of blocks moved from one partition to the other in 1 minute is counted. Normative data is available[1,4].
Level of client participation required (is proxy participation available?)	Client participation is required

Comments: **This is a tool that I think entry-level PT students should be exposed to since it is often reported in the literature (not so much with stroke subjects). No real training needed to administer the measure.**

References

1. Desrosiers J, Bravo G, Hebert R, Dutil E, Mercier L. Validation of the Box and Block Test as a Measure of Dexterity of Elderly People: Reliability, Validity, and Norms Studies. Arch Phys Med Rehabil. 1994;75:751-5.
2. Chen HM, Chen CC, Hsueh IP, Huang SL, Hsieh CL. Test-Retest Reproducibility and Smallest Real Difference of 5 Hand Function Tests in Patients with Stroke. Neurorehabil Neural Repair. 2009;23:435-440.
3. Cromwell FS: Occupational Therapist's Manual for Basic Skill Assessment;Primary Prevocational Evaluation. Altadena, CA: Fair Oaks Printing, 1976, pp29-30c.
4. Mathiowetz V, Volland G, Kashman N, Weber K. Am J Occup Ther. 1985;39:386-391.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute		**x**			
Inpatient Rehab		**x**			
Home Health		**x**			
Skilled Nursing		**x**			
Outpatient		**x**			
Overall Comments: The ARAT and WMFT have more ecological validity than the BBT. BBT is simpler and quicker to administer.					

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute (<2 months)		x			
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			
Overall Comments:					

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Do not recommend**	**Comments**
Should this tool be required for entry level curricula?		x		

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?	x		

Brunel Balance Assessment (BBA)	
Reviewer: Rie	
ICF Domain (check all that apply): _____body function/structure ___x_ activity _____participation	
Type of measure: ___x_ performance-based _____self-report	
Instrument properties: 12-point hierarchical ordinal scale designed to assess functional balance for people with a wide range of abilities and has been tested specifically for use post-stroke.	
Reliability (test-retest, intra-rater, inter-rater)	All psychometric information gathered from stroke population. Internal consistency: High (Chronbach alpha coefficient=0.93)[1] Test-retest reliability: 100% agreement (kappa coefficient=1.0)[1] found Inter-tester reliability: High (kappa coefficient=1.0)[1]

Validity (concurrent, criterion-related, predictive)	All psychometric information gathered from stroke population. Criterion-related validity: Good for testing balance disability (Spearman's correlation coefficients were 0.83 for sitting Motor Assessment Scale, 0.97 with Berg Balance Test, 0.95 with Rivermead Mobility Index)[1] Predictive validity: Good-initial balance disability is a strong predictor of function and recovery after stroke[2]
Ceiling/ floor effects	No research available at this time
Sensitivity to change (responsiveness, MCID, MDC)	Minimal detectable change: 1 point[1,3]
Instrument use	
Equipment required	Ruler and stand, step-up block, stopwatch[1,4]
Time to complete	Approximately 10 minutes[1]
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Total score=12 (0 to 12) Subscales: 3 sections including sitting, standing, and stepping. Hierarchical scale so you can assume that if the client can pass an item that is higher in hierarchy, he/she can also pass a lower item without testing[4].
Level of client participation required (is proxy participation available?)	Client must physically perform the test items.

Limitations: Not feasible with clients who have difficulty following commands. This measure is relatively new (introduced in 2004) with only a couple of studies looking at the psychometrics. And all psychometric studies are done by the group that invented this measure, so it is not certain how reproducible these psychometric values are if done by other groups. Test is copyrighted.

References:

1. Tyson SF, DeSouza LH. Devemopment of the Brunel Balance Assessment: a new measure of balance disability post stroke. *Clin Rehabil*. 2004;18:801-810.
2. Tyson SF, Hanley M, Chillala J, et al. The relationship between balance, disability, and recovery after stroke: predictive validity of the Brunel Balance Assessment. *Neurorehabil Neural Repair*. 2007;21:341-346.
3. Tyson SF. How to measure balance in clinical practice. A systematic review of the psychometrics and clinical utility of measures of balance activity for neurological conditions. *Clin Rehabil*. 2009;23:824-840.
4. Tyson SF. Brunel Balance Assessment. Retrieved March 23, 2010, from http://www.heathcare.salford.ac.uk/research/neurologicalrehabilitation/new%20BBA%20manual.pdf
5. Tyson SF, Hanley M, Chillala J, et al. Balance disability after stroke. *Phys Ther*. 2006; 86:30-38.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute			**x**		
Inpatient Rehab			**x**		
Home Health			**x**		
Skilled Nursing			**x**		
Outpatient			**x**		
Overall Comments: Not enough psychometric data available, all studies done in the same lab so reproducibility of psychometric properties still in question.					

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute (<2 months)			x		
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		
Overall Comments:					

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Do not recommend**	**Comments**
Should this tool be required for entry level curricula?			x	

Research Use	YES	NO	**Comments:** Only used by one group so far-may be good to use in research if this outcome measure becomes better known/utilized.
Is this appropriate for research?		x	

Chedoke Arm and Hand Activity Inventory	
Reviewer: Dorian Rose	
ICF Domain (check all that apply): _____body function/structure __x___ activity _____participation	
Type of measure: __x___ performance-based _____self-report Description: 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)	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Inter-rater reliability: ICC = 0.98 [1]
Validity (concurrent, criterion-related, predictive)	Convergent cross-sectional validity: with the ARAT, *r*=0.93;with the Chedoke-McMaster Stroke Assessment Arm/Hand, *r*=0.89, Cross-Sectional discriminant validity: higher correlations with the CMSA Arm/Hand than the CMSA shoulder pain scale (*r*=0.89 vs. *r*=0.47)[1]
Ceiling/ floor effects	Not reported
Sensitivity to change (responsiveness, MCID, MDC)	MDC(90): 6.3 points [1]
Instrument use	
Equipment required	Jar of coffee, phone, rule and pen, toothpaste and toothbrush, knife, fork , putty, glass of water, wet washcloth, eyeglasses, jacket w/zipper, shirt w/5 buttons, towel, Rubbermaid 38 Liter container (50x37x27 cm)w/10 lb. wt, plastic grocery bag with 4 lb weight
Time to complete	30 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Thirteen items are each scored on a scale from 1-7. The 13 items are summed for a total score (range 13-91).

Level of client participation required (is proxy participation available?)	Client Participation required

Limitations

- Scoring is on a 1-7 "FIM-like" scale which is challenging to apply to the UE activities in the assessment.
- Test is copyrighted

Comments: *Therapist needs equipment "kit"

Practice Setting	4	3	2	1	Comments
Acute					
Inpatient Rehab				x	
Home Health				x	
Skilled Nursing				x	
Outpatient				x	

Overall Comments:

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				x	
Sub- Acute (2-6 months)				x	
Chronic (>6 months)				x	

Overall Comments: The bilateral nature of many of the tasks makes this assessment unique from other UE Activity measures. The scoring system (FIM-like; 1-7) is difficult to assign to the UE tasks. Administration time is a 2nd drawback.

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Do not recommend**	**Comments** It is used by the Canadian groups so is in the literature, although not as frequently as WMFT or ARAT.
Should this tool be required for entry level curricula?		x		

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?		x	

References

1. Barreca SR, Stratford PW, Lambert CL et al. 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. 2005; 86:1616-22.
2. Barreca SR, Gowland, C, Stratford PW, et al. Development of the Chedoke Arm and Hand Activity Inventory: Theoretical Constructs, Item Generation and Selection. Topics in Stroke Rehabil. 2004; 11:31-42.

Chedoke-McMaster Stroke Assessment	
General Information:	
Target Client Population	Stroke (and acquired brain injury)
Topic / Content area / Domain :	Body Function / Structure– motor function
Instrument components (including scoring, type of measure [e.g. performance-based, self-report])	The Chedoke-McMaster Stroke Assessment is a performance-based measure consisting of two parts: an Impairment Inventory and an Activity Inventory. The purpose of the Impairment Inventory is to be able to stratify patients by level of severity to help plan intervention and evaluate effectiveness of the intervention. The Activity Inventory (originally the Disability Inventory) was designed to measure clinically important change in function mobility and to be used in conjunction with the FIM.[1,2]

Impairment Inventory
This section has 6 subscales (arm, hand, leg, foot, postural control and shoulder pain) affected by stroke. Scoring for motor recovery uses a 7-point scale based on Brunnstrom's stages of recovery.[4] A separate scale for was developed to assess shoulder pain. The minimum score is 6 points and the maximum is 42.

1 - is flaccid paralysis
2 - spasticity is present and felt as a resistance to passive movement
3 - marked spasticity but voluntary movement present within synergistic patterns
4 - spasticity decreases
5 - spasticity wanes but is evident with rapid movement at the extremes of range
6 - coordination and patterns of movement are near normal
7 - normal movement.

Activity Inventory (Formerly Disability Inventory) has 2 subscales:
Gross Motor Index:
1 - supine to side lying on strong side
2 - supine to side lying on weak side
3 - side lying to long sitting through strong side
4 - side lying to sitting on side of the bed through strong side
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
Walking Index:
11 - walking indoors
12 - walking outdoors, over rough ground, ramps, and curbs
13 - walking outdoors several blocks
14 – stairs
*15 - age and sex appropriate walking distance in meters for 2 minutes

Scoring: Maximum Activity Inventory total score=100.
The Activity Inventory utilizes the 7-point FIM scale[2] for scoring items 1-14. Total score on items 1-14 has a minimum of 14 and maximum of 98.
*An extra 2 points are added for item 15 if the individual is able to ambulate according to the norms set for the 2-minutes walk [3,] (Huijbregts at al., 2000)

Instrument properties	
Reliability (test-retest, intra-rater, inter-rater)	Gowland et al (1993) Test –Retest: • Gross Motor- excellent - ICC= 0.96, 95%CI • Walking- excellent - ICC=0.98, 95%CI Inter-rater: • Impairment Inventory excellent – ICC=0.97, 95% CI • Activity Inventory excellent – ICC=0.99, 95% CI Intra-rater: • Impairment Inventory-excellent – ICC=0.98, 95% CI • Activity Inventory-excellent- ICC=0.98, 95% CI

Validity (concurrent, criterion-related, predictive)	Gowland et al. (1993)[1] Concurrent: • Total score of Impairment Inventory correlated with the FMA, r=0.95, p< 0.001 • Total Activity (Disability)Inventory correlated with the FIM, r=.79, p<0.05 Th Predictive: Assessment scores taken between day 7-10 days post-stroke can be used to predict outcomes * at days 27-30[5]. *Predictive equations are available for acute and rehab setting patients on the McMaster University website: http://www.chedokeassessment.ca/Default.aspx?tabid=531 a
Responsiveness to change (e.g., MCD, MCID)	MCID for the Activity Inventory is 7. [1]
Ceiling/ floor effects	not known
Potential sources of bias	
Availability of normative data	not known
Extent of use in target and other populations	appears to have greater use in Canada than US
Instrument use	
Equipment required	• An adjustable table • A chair with armrests • A floor mat • Pillows • Pitcher with water • Measuring cup • A ball 2.5 inches in diameter

	• A footstool • 2m line marked on the floor • A stopwatch
Time to complete	45-60 minutes
Effect of tester experience (expertise/training)	• A detailed training manual can be obtained from McMaster University for $15. Training workshop is also available.
Level of client participation required	performance-based
Benefits	• Appropriate for clinical and research use. • Provides both impairment and functional mobility data to be able to plan treatment and evaluate effectiveness of interventions. • Manual available for training and interpretation of data. Manual includes suggested interventions and goals based on impairment and functional level.
Limitations	Time and training to use the measure
Comments:	• -With acquired brain injury, tool has been shown to be able to discriminate between those individuals who have small FIM changes (<20) vs larger (>20) FIM changes, has good concurrent validity with FIM and high inter-rater reliability (ICC- 0.99)(Crowe et al. 1996)[7] • Has not been validated with clients under 19 years old. Finch et al., 2002[8]
References	1. C Gowland, et al. Measuring physical impairment and disability with the Chedoke-McMaster Stroke Assessment Stroke 1993;24;58-63. 2.Data Management Service of the Uniform Data System for Med- ical Rehabilitation and the Centre for Functional Assessment Research: Guide for Use of the Uniform Data Set for Medical Rehabilitation, ed 3. Buffalo, NY, State University of New York at Buffalo, 1990 3. Miller PA, Moreland J, Stevenson TJ. Measurement Properties of a Standardized Version of the Two-Minute Walk Test for Individuals with Neurological Dysfunction. Physiotherapy Canada 2002, 54(4): 241-248, 257. 4.Brunnstrom S: Movement Therapy in Hemiplegia: A Neurophysiolog-ical Approach.

	New York, Harper & Row Publishers, Inc, 1970 5. Miller P, Gowland C, Crowe J, et al. Predicting impairment and disability in clients with acute stroke. 1997. Canadian Physiotherapy Association Congress, Winnipeg, Manitoba, Canada. 6. Gowland C, Van Hullenaar S, Torresin W, et al. Chedoke-McMaster Stroke Assessment - Development, validation, and administration manual. Hamilton , Ontario , Canada : School of Occupational Therapy and Physiotherapy, McMaster University , Hamilton , Ontario ; 1995. 7. Crowe, J., Harmer, D., & Sharpe, D. (1996). Reliability of the Chedoke-McMaster Disability Inventory in acquired brain injury. Physiotherapy Canada, 48(1), 25. 8. Finch, E., Brooks, D., Stratford, P.W, & Mayo, N.E. (2002). Physical Outcome Measures: A guide to enhance physical outcome measures. Ontario, Canada: Lippincott, Williams & Wilkins. 9. Huijbregts MPJ, Gowland C, Gruber RA. Measuring clinically-important change with the activity inventory of the Chedoke-McMaster Stroke Assessment. Physiotherapy Canada 2000, 2(4):295-304. http://www.medicine.mcgill.ca/strokengine-assess/module_cmmsa_quick-en.html Additional resources: • To order the manual please contact Donna Johnston at 905-525-9140, extension 27846 or email: djohnstn@mcmaster.ca. • Information about training can be obtained by emailing: pmiller@mcmaster.ca • The administration and scoring guidelines are now available on CD-ROM in French. It is available from the Canadian Physiotherapy Association through their e-Store. Use this link: http://www.physiotherapy.ca/?WCE=C=39|K=223533

2nd Reviewer Comments:

This is a reliable tool that is primarily used in stroke. It has domains that capture info both at the body/structure/function and activity levels of the ICF. There is some overlap with the FIM but also contains several unique items. It's highly correlated with the Fugl-Myer and moderately with the FIM. It could be used in acute and chronic stroke (all settings) and in research. However, it is VERY time consuming (45-60') to administer, decreasing its clinical utility. It appears that it needs to be purchased (?) and not readily available. Additionally, it is not currently used widely in the U.S and is used more often in Canada.

Practice Setting	4	3	2	1	Comments
Acute		x			
Inpatient Rehab		x			
Home Health		x			potential equipment issues
Skilled Nursing			x		time factor and may not tolerate length of treatment
Outpatient		x			

Overall Comments:

- **Test is copyrighted**
- **developed for the stroke population**
- **excellent psychometric properties**
- **comprehensive- includes impairment, functional and pain related information to provide data on effectiveness of intervention for different levels of stroke severity and to measure change in functional mobility;**
- **Scoring of Impairment Inventory data based on Brunstrom's levels of recovery (as was FMA) and scoring of Activity Inventory data based on the FIM scale**

Great Tool but:

- **copyright for use; a one-day workshop is recommended for training in the administration and scoring of the tool, must pass a competency in scoring the tool**
- **used primarily in Canada**

equipment readily available in the clinic but not easily portable

45-60 minutes to complete

Practice Setting	4	3	2	1	Comments
Acute (<2 months)		x			
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?		x		

Research Use	YES	NO	Comments
Is this appropriate for research?	x		

Canadian Occupational Performance Measure (COPM)	
Reviewer: Beth Crowner	
ICF Domain (check all that apply): _____body function/structure _____ activity __X__[1] participation	
Type of measure: _____ performance-based __X__ self-report Description: Client-centered tool designed to detect client self-perceptions of performance and satisfaction in self care, productivity, and leisure occupations over time. This measure is designed to measure individualized patient goal achievement. 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.	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Reliability: Adequate[1] Test-Retest (**Study Population**) • Performance .63[2] (**Unspecified Population – [UP]**) • Satisfaction .84[2] • Performance .89[3] (**Stroke**) • Satisfaction .88[3] • Whole Test .90-.92[4] (**COPD**) Intra-class correlations • Performance .63[5,] (**Schezophrenia**) • Satisfaction .69[5] • Performance.67[6] (**UP**) • Satisfaction .69[6] Internal Consistency • Performance .41-.56[7] (**UP**) • Satisfaction .71[7] High degree of correlation between performance and satisfaction scores (.68).[7] • Italian Version: Whole Test α=.774[8] (**Ankylosing Spondylitis**) Internal Consistency (Pediatric Version) • Performance .73[9] (**Pediatric Cerebral Palsy**) • Satisfaction .82[9]

Validity (concurrent, criterion-related, predictive)	Validity*: Adequate.[1] (**UP**) • RNL .72-.93[10] (**CVA, TBI, SCI**) • Dash – DLV[11] (**Unilat UE disorders**) • HAQ .37-.67[12] (**Rheumatoid Arthritis**) • WQL .46, WPP .53[5] (**Schezophrenia**) • SPSQ .17-.39, RNL .22-.38, LSS .21-.46[13] (**UP**) • FIM[14] (**SNF population incl. Stroke**) • D-AIMS2[15] (**Hemophelia**) • Klein-Bell Not Significant, SPSQ .22-.39, FIM .14-.32[16] (**Stroke and Orthopedic**) • SPSQ and RNL most alike conceptually to COPM, measuring the largest components of the same domain as the COPM.[17] (**UP**) • Italian Version: BASFI -.566, BASDAI -.491[8] (**Ankylosing Spondylitis**) Discriminant Validity: None of the standardized functional measures (Barthel Index, Frenchay Activities Index, SA-SIP30, EQ-5D) significantly correlated with the COPM, but they all significantly correlated with each other.[3] (**Stroke**) Convergent Validity: 63% of problems corresponded with DIP, 74% corresponded with SIP68.[18] (**UP**)
Ceiling/ floor effects	N/A.[1]
Sensitivity to change (responsiveness, MCID, MDC)	Responsiveness:Poor.[1] • Swedish version responsive to change with 73% of problems identified having a change in score of 2 points or more.[19] (**Neurologic and Orthopedic**) • Standardized Response Mean 1.43, Effect Size 1.8[20] (**Musculoskeletal**) • Initial and final scores for both performance and satisfaction for COPM show significant change over time (p<.0001 to .001).[2] (**UP**) MCID: Change of 2 points or more represents ¾ of a standard deviation which is considered to be clinically important difference as judged by clients and family members.[21,22] (**Stroke, TBI**) Pediatric version: 2 points[9] (**Pediatric Cerebral Palsy**) Predictive: 65% accuracy of for discharge status using COPM and FIM vs 29% accuracy with FIM alone.[14] (**SNF population incl. Stroke**)
Instrument use	
Equipment required	Questionnaire

Time to complete	20-40 min.[23] 20-30min.[5] 15 min if no supplementary conversation.[17] • But may depend on pt cognition and cooperation.[10] • Older individuals require more time and more explanation, and were not familiar with the process of self-rating as compared to younger patients.[10]
How is the instrument scored? (e.g. total score, are there subscales, etc.)	The five most important identified problems from step 2 form the scale items. The pt is asked to rate each on a scale of 1 – 10 in terms of a) ability to perform the activity (1 = not able to 10 = able to perform with excellence) and b) satisfaction with their present performance (1 = not satisfied to 10 = extremely satisfied). Item ratings are multiplied by their corresponding importance rating to determine baseline scores for each activity (ranging from 0 – 100). Satisfaction & performances scores for all activities summed separately and then divided by the number of rated activities (usually 5). Summary performance and satisfaction scores are used as the basis for comparisons over time. Interviewer may need to supplement information gathered during interview through other means such as observation, administration of special tests, and assessment of patient environments.[1]
Level of client participation required (is proxy participation available?)	5-step semi-structured interview conducted by an occupational therapist or other trained provider.[1] 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 option in regard to the importance of activities.[17]

Limitations

- Test is copyrighted.
- The semi-structured character of the COPM may result in a somewhat different interview on different occasions. On every single day a patient may experience different problems. In addition, perceptions of problems change such that, while the same problem may be identified on 2 occasions, priorities shift and rating of importance change. It is therefore not surprising that the item pool is not completely stable.[3]
- Interview process is not standardized and both the quality and adequacy of information obtained from interview may vary considerably between interviewers.[1]
- Interviewer must be comfortable with client-centered approach to both assessment and practice.[17]
- There is a fixed list of activities for the client to discuss, which may not be relevant to the individual and therefore does not always reflect the individual's role expectation.[24]
- Patients with R CVA reported higher satisfaction with performance of ADL's than patients with L CVA.[22]

Comments: Would be good to educate the use of this tool as one that can address a wide range of constructs that the patient is interested in (it's a tool that is individualized to the patient's goals and abilities) and may be useful for detecting change in low functioning individuals that is difficult to assess in most measures; However, time to administer is lengthy

Comments: For research purposes, the reliability of the COPM item pool is doubtful. However, the test–retest reliability of the performance and satisfaction scores is good.[3] (**Stroke**) This tool is widely used in

research in Canada.

* RNL - Reintegration to Normal Living Index, DASH-DLV – Dutch version of Disabilities of Arm, Shoulder, and Hand Questionnaire. FIM – Functional Independence Mesasure, HAQ – Health Assessment Questionnaire, Klein-Bell – Klein Bell ADL Activity Subscale, LSS – Life Satisfation Scale, D-AIMS2 - Dutch version of the Arthritis Impact Measurement Scale 2, SPSQ – Satisfaction with Performance Scaled Questionnaire, WQL – Wisconsin Quality of Life-Client Questionnaire, WPP – Work Personality Profile, BASFI – Bath Ankylosing Spondylitis Functional Index, BASDAI – Bath Ankylosing Spondylitis Disease Activity, DIP – Disability and Impact Profile, SIP68 – Sickness Impact Profile.

References:

1. Salter K, Jutai J, Zettler L, Moses M, Foley N, Teasell R. 21. Outcomes measures in stroke rehabilitation. The Evidence-Based Review of Stroke Rehabilitation (EBRSR). http://www.ebrsr.com. Accessed March 15, 2010.
2. Finch E, Brooks D, Mayo NE, Stratford PW. *Physical Rehabilitation Outcome Measures: A Guide to Enhanced Clinical Decision-Making*. 2nd edition. Philadelphia: Lippincott Williams & Wilkins; 2002.
3. Cup EHC, Scholte op Reimer WJM, Thijssen MCE, van Kuyk-Minis MAH. Reliability and validity of the Canadian Occupational Performance Measure in stroke patients. *Clinical Rehabilitation.* 2003;17:402–409.
4. Sewell L, Singh S, Williams J, Collier R, Morgan MD. Can individualized rehabilitation improve functional independence in elderly patients with COPD? *Chest*. 2005;128:1194-1200.
5. Boyer G, Hachey R, Mercier C. Perceptions of occupational performance and subjective quality of life in persons with severe mental illness. *Occupational Therapy in Mental Health.* 2000;15:1-15.
6. Eyssen IC, Beelen A, Dedding C, Cardol M, Dekker J. The reproducibility of the Canadian Occupational Performance Measure. *Clin Rehabil*. 2005;19:888-894.
7. Bosch J. The reliability and validity of the Canadian Occupational Performance Measure [thesis]. Hamilton, (ON): McMaster Univ; 1995.
8. Spadaro A, Lubrano E, Massimiani MP, Gaia P, Perrotta WJ, Ferrara N, Valesini G. Validity, responsiveness and feasibility of an Italian version of the Canadian Occupational Performance Measure for patients with ankylosing spondylitis. *Clin Exp Rheumatol.* 2010;28:215-222.
9. Cusick A, Lannin NA, Lowe K. Adapting the Canadian Occupational Performance Measure for use in a paediatric clinical trial. *Disability & Rehabilitation*. 2007;29:761-766.
10. Chen YH, Rodger S, Polatjko H. Experiences with the COPM and client-centered practice in adult neurorehabilitation in Taiwan. *Occup Ther Int.* 2002;9:167-184.
11. Veehof MM, Sleegers EJA, van Veldhoven NHM, van Meeteren HLU. Psychometric qualities of the Dutch language version of the Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH-DLV). *J of Hand Ther*. 2002;15:347-354.
12. Ripat J, Etcheverry E, Cooper J, Tate R. A comparison of the Canadian Occupational Performance Measure and the Health Assessment Questionnaire. *Canadian Journal of Occupational Therapy.* 2001;65:247-253.
13. McColl MA, Paterson M, Davies D, Doubt L, Law M. Validity and community utility of the Canadian Occupational Performance Measure. *Canadian Journal of Occupational Therapy*. 2000;67:22-30.

14. Simmons DC, Crepeau EB, White BP. The predictive power of narrative data in occupational therapy evaluation. *Am J Occup Ther*. 2000;54:471-476.
15. Van Meeteren NLU, Strato IHM, van Veldhoven NHMJ, de Kleijn P, van den Berg HM, Helders JM. The utility of the Dutch Arthritis Impact Measurement Scales 2 for assessing health status in individuals with Haemophilia: A pilot study. *Haemophilia*. 2000;6:664-671.
16. Chan CCH, Lee TMC. Validity of the Canadian Occupational Performance Measure. *Occup Ther Int*. 1997;4:229-247.
17. Law M, Baptiste S, Carswell-Opzoomer A, McColl MA, Polatajko H, Pollack N. Canadian Occupational Performance Measure. 4th edition. Ottawa (ON): CAOT Publications ACE; 2005.
18. Dedding C, Cardol M, Eyssen I, Beelen A. Validity of the Canadian Occupational Performance Measure: a client-centered outcome measure. *Clin Rehabil*. 2004;18:660-667.
19. Wressel E, Samuelsson K, Henriksson C. Responsiveness of the Swedish version of the Canadian Occupational Performance Measure. *Scand J Occup Ther.* 1999;6:84-89.
20. Marshall JK, Kingston SP. Comparative validity and responsiveness of the hand function sort in evaluating change in disability and impairment in hand therapy. *J of Hand Ther*. 2006;19:452-453.
21. Law M, Polatajko H, Pollock N, McColl MA, Carswell A, Baptiste S. Canadian Occupational Performance Measure: results of pilot testing. *Canadian Journal of Occupational Therapy.* 1994;61:191-197.
22. Phipps S, Richardson P. Occupational therapy outcomes for clients with traumatic brain injury and stroke using the Canadian Occupational Performance Measure. *American Journal of Occupational* Therapy. 2007;61:328-334.
23. Law M, Baptiste S, McColl MA, Opzoomer A, Polatajko H, Pollack N. The Canadian Occupational Performance Measure: An outcome measure for occupational therapy. *Canadian Journal of Occupational Therapy.* 1990;57:82-87.
24. Bodiam C. The use of the Canadian Occupational Performance Measure for the assessment of outcome on a neurorehabilitation unit. *British Journal of Occupational Therapy.* 1999;62:123-126.

Practice Setting	4	3	2	1	Comments
Acute				**X**	Lengthy to administer and no psychometrics in acute patients
Inpatient Rehab			**X**		
Home Health			**X**		
Skilled Nursing			**X**		
Outpatient			**X**		
Overall Comments:	Psychometric data is limited in the stroke population. It is lengthy to administer but is client specific. May be useful to demonstrate change in lower functioning individuals. Test is copyrighted.				

Patient Acuity	4	3	2	1	Comments
Acute (< 2 mos)			**X**		
Subacute (2-6 mos)			**X**		
Chronic (> 6 mos)			**X**		
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?	No	Yes	While more commonly used in Canada (and in OT vs PT) it may be useful as a tool to demonstrate change important to the specific client and change not reflected in "typical" outcome measures.
Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	X		Only as an adjunct to other measures; can capture nuances and changes specific to individual patients; may be more sensitive to detect changes in clients that are not obtained in more routinely administered measures.

Dynamic Gait Index	
Reviewer: Pinto Zipp	
ICF Domain (check all that apply): _____body function/structure ___x__ activity _____participation	
Type of measure: ____x_ performance-based _____self-report	
Instrument properties	
Reliability (test-retest, intra-rater, inter-rater)	• Jonsdottir and Cattaneo (2007) reported in a sample of 25 ambulatory subjects with stroke (at least 3 months post stroke) that the **test-retest** reliability was .96 (95% confidence interval) for the total test score. Single item scores ranged from moderate to good: item 5 (gait/pivot turns .56), item 1 (gait), item 3 (gait/horizontal head turn), and item 4 (gait/vertical head turn) ranging from .64 to .77. Item 2 (Gait speed changes), item 6 (obstacle step over), and item 8 (step climbing) ranged from .84 to .100.[1] • Jonsdottir and Cattaneo (2007) found for the total score **interrater reliability**, ICC of 0.96. The ICCs for single item scores ranged from 0,55 to 1.00 with item 3 having the lowest reliability and item 4 having acceptable reliability while the other items showed good reliability.[1]
Validity (concurrent, criterion-related, predictive)	• Jonsdottir and Cattaneo (2007) showed a moderate positive **correlation** between the BBS and the DGI (r=.83) and between the ABC and the DGI (r=.68). A moderate negative correlation was found between the timed walking test and the DGI (r=-.73) and between the TUG and the DGI (r=-.77)[1] • **Predicative** ability not known in the stroke population.
Ceiling/ floor effects	Not known in the stroke population.
Sensitivity to change (responsiveness, MCID, MDC)	Not known in the stroke population.

Instrument use	
Equipment required	Tape, obstacles to step over, stairs
Time to complete	10-15 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	0-3 scale (0=poor to 3= excellent) Measures 8 tasks including gait on even surfaces, while changing speed, with head turns, stepping over obstacles, with pivot turns
Level of client participation required (is proxy participation available?)	Proxy not available

Limitations

- The Dynamic Gait Index (DGI) is used extensively as a method to evaluate and document a patient's ability to modify gait in response to changing task demands in ambulatory patients with balance impairments (Shumway-Cook et al., 2000).[2] The findings currently available in the stroke population can only be generalizable to a similar population of patients who primarily did not rely on assistive devices for walking.
- Sensitivity to change not known in the stroke population.
- Predictability not known in the stroke population
- Ceiling and floor effect not known in the stroke population.
- Requires subjective judgment on some items questions. Potential differences in clinician level of subjective skill assessment not known.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute	**x**				**Depends on functional level of the patient**
Inpatient Rehab	**x**				
Home Health	**x**				
Skilled Nursing	**x**				
Outpatient	**x**				

Overall Comments:

Only appropriate in patients who primarily did not rely on assistive devices for walking. Some reports of psychometric properties in stroke but not extensive. Requires the utilization of equipment such as obstacles and stairs.

Practice Setting	4	3	2	1	Comments
Acute (<2 months)	x				**Depends on functional level of the patient**
Sub- Acute (2-6 months)	x				
Chronic (>6 months)	x				

Overall Comments:

Only appropriate in patients who primarily did not rely on assistive devices for walking. Some reports of psychometric properties in stroke but not extensive. Requires the utilization of equipment such as obstacles and stairs.

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?	x	x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		

<table>
<tr><td colspan="2">Dynamometry</td></tr>
<tr><td colspan="2">Reviewer: Beth Crowner</td></tr>
<tr><td colspan="2">ICF Domain (check all that apply):

__X___body function/structure _____ activity _____participation</td></tr>
<tr><td colspan="2">Type of measure:

__X___ performance-based _____self-report

Examiner uses a hand-held dynamometer and can perform a “make” or “break” test to assess force production in muscles of interest</td></tr>
<tr><td colspan="2">Instrument properties (please use footnotes)</td></tr>
<tr><td>Reliability (test-retest, intra-rater, inter-rater)</td><td><u>Intra –rater</u>

.88-.98[1] (Stroke and TBI; wrist, elbow, shoulder, hip, knee, ankle)

.98[2] (healthy subjects-shoulder)

.89-.96[3] (SCI shoulder IR/ER)

.63-.96[4] (Children with CP; ankle PF, quads, hip flex, hip ext; <u>quads-.63</u>, HS, ankle DF and PF)

.91-.99[5] (Children with TBI; hip and knee muscles)

.79-.99[6] (SCI trunk/sitting bal.)

<u>Inter-rater</u>

.84-.94[7] (healthy subjects-shoulder musc.);

.96-.99[6] (SCI trunk/sitting bal.)

<u>Test-retest</u>

.79-.97[1] (Stroke and TBI wrist, elbow, shoulder, hip, knee, ankle)

.97-.98[8] (Stroke, TBI, SCI, and Periph Neurop.; wrist, elbow, shoulder, hip, knee, ankle)

.60-.98[9] (Children with myelomeningocele; shoulder elbow, wrist)

.81-.96[10] (Children with CP; ankle PF, quads, hip flex, hip AB , hip ext;</td></tr>
</table>

	quads-.81[10],) .26-.89[4] (Children with CP; LE muscles-no stabilization) .62-.91[4] (Children with CP; LE muscles-stabilization)
Validity (concurrent, criterion-related, predictive)	Hand held dynamometry compared to isokinetic dynamometry: Convergent : Valid in patients with Huntington's disease-LE muscles (Spearman's r correlations to UHDRS motor.49-.74 and functional indep .59-.74)[11] ;**Stroke** (affected quadriceps) Pearson r=.99[12]
Ceiling/ floor effects	N/A
Sensitivity to change (responsiveness, MCID, MDC)	Not reported
Instrument use	
Equipment required	Hand held dynamometer (cost $800 Microfet 2; $900 Lafayette MMT system; $1,100 JTechCommander Power Track II); ie. expensive and many clinics do not have the equipment (beyond grip dynam.)
Time to complete	Variable depending on the number of muscles being tested and the number of trials performed. Standard is up to 5 seconds per muscle tested.
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Dynamometer records the number of pounds, Newtons or kilograms of force ; Patients are asked to maintain an isometric contraction (for either a make or break test) for 2-5 seconds. During a make test, the patient pushes the body segment into the dynamometer, "making" the contraction/force. During a "break" test, the examiner asks the patient to maintain a static position while the examiner applies resistance to try to "break" the contraction/position.
Level of client participation required (is proxy participation available?)	The client must be present and able to follow simple commands commensurate with MMT

Limitations

Cost of equipment-most clinics don't own; Gender, body weight, and grip strength can affect a rater's ability to stabilized a hand-held dynamometer and can influence reliability when "smaller" testers are testing stronger muscle groups.[13] Proper stabilization needs to be performed in order to improve reliability.[4]

Reference List

(1) Riddle DL, Finucane SD, Rothstein JM, Walker ML. Intrasession and intersession reliability of hand-held dynamometer measurements taken on brain-damaged patients. Phys Ther 1989; 69(3):182-194.

(2) Sullivan SJ, Chesley A, Hebert G, McFaull S, Scullion D. The validity and reliability of hand-held dynamometry in assessing isometric external rotator performance. J Orthop Sports Phys Ther 1988; 10(6):213-217.

(3) May LA, Burnham RS, Steadward RD. Assessment of isokinetic and hand-held dynamometer measures of shoulder rotator strength among individuals with spinal cord injury. Arch Phys Med Rehabil 1997; 78(3):251-255.

(4) Crompton J, Galea MP, Phillips B. Hand-held dynamometry for muscle strength measurement in children with cerebral palsy. Dev Med Child Neurol 2007; 49(2):106-111.

(5) Katz-Leurer M, Rottem H, Meyer S. Hand-held dynamometry in children with traumatic brain injury: within-session reliability. Pediatr Phys Ther 2008; 20(3):259-263.

(6) Larson CA, Tezak WD, Malley MS, Thornton W. Assessment of postural muscle strength in sitting: reliability of measures obtained with hand-held dynamometry in individuals with spinal cord injury. J Neurol Phys Ther 2010; 34(1):24-31.

(7) Bohannon RW, Andrews AW. Interrater reliability of hand-held dynamometry. Phys Ther 1987; 67(6):931-933.

(8) Bohannon RW. Test-retest reliability of hand-held dynamometry during a single session of strength assessment. Phys Ther 1986; 66(2):206-209.

(9) Effgen SK, Brown DA. Long-term stability of hand-held dynamometric measurements in children who have myelomeningocele. Phys Ther 1992; 72(6):458-465.

(10) Taylor NF, Dodd KJ, Graham HK. Test-retest reliability of hand-held dynamometric strength testing in young people with cerebral palsy. Arch Phys Med Rehabil 2004; 85(1):77-80.

(11) Busse ME, Hughes G, Wiles CM, Rosser AE. Use of hand-held dynamometry in the evaluation of lower limb muscle strength in people with Huntington's disease. J Neurol 2008; 255(10):1534-1540.

(12) Piao C, Yoshimoto N, Shitama H, Makino K, Wada F, Hachisuka K. Validity and reliability of the measurement of the quardriceps femoris muscle strength with a hand-held dynamometer on the affected side in hemiplegic patients. J UOEH 2004; 26(1):1-11.

(13) Wadsworth C, Nielsen DH, Corcoran DS, Phillips CE, Sannes TL. Interrater reliability of hand-held dynamometry: effects of rater gender, body weight, and grip strength. J Orthop Sports Phys Ther 1992; 16(2):74-81.

(14) Andrews AW, Thomas MW, Bohannon RW. Normative values for isometric muscle force measurements obtained with hand-held dynamometers. Phys Ther 1996; 76(3):248-259.

Practice Setting	4	3	2	1	Comments
Acute				X	May not be clinically feasible in the acute setting due to time constraints and lack of equipment (particularly in a hospital providing PT at the bedside)
Inpatient Rehab		X			
Home Health				X	Not equipment typically available and used in this setting
Skilled Nursing				X	Not equipment typically available and used in this setting
Outpatient		X			
Overall Comments:	Very objective/quantifiable and reliable tool to assess strength. Good psychometrics. However, dynamometers are expensive and not available in every setting.				

Patient Acuity	4	3	2	1	Comments
Acute (< 2 mos)		X			
Subacute (2-6 mos)		X			
Chronic (> 6 mos)		X			
Overall Comments:	Clients must be able to follow commands;				

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?		X	May be difficult to have a lab (enough dynamometers) for all students to learn/practice/become proficient
Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	X		

EuroQOL (EQ-5D)

<table>
<tr><td colspan="2">Reviewer: Kluding</td></tr>
<tr><td colspan="2">ICF Domain (check all that apply):

_____body function/structure ____ activity __X__participation</td></tr>
<tr><td colspan="2">Type of measure:

_____ performance-based __X_self-report</td></tr>
<tr><td colspan="2">Instrument properties This health-related quality of life measure includes 5 dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression), with a 20-cm visual analog scale for individual rating of current health-related quality of life.</td></tr>
<tr><td>Reliability (test-retest, intra-rater, inter-rater)</td><td>Test-retest reliability:

In patients with stroke:

• Overall ICC 0.86 when completed by patient, 0.74 when completed by proxy. Range of reliability for individual domains from 0.66 to 0.85 when completed by patient; range of 0.31 to 0.63 when completed by proxy.[1]

• Moderate agreement between self-administered and proxy scores, best agreement in self-care domain, poorest agreement for psychological domain. Patients tended to rate their own health as higher than their proxies.[2]</td></tr>
<tr><td>Validity (concurrent, criterion-related, predictive)</td><td>In people with stroke, significant correlations between domains and total scores of EuroQol and SF-36, except for mental health domain of SF-36 which had poor correlations to all EuroQol domains.[3]

Valuation models have been developed EQ-5D to derive measures of quality-adjusted life expectancy (QALE) and quality-adjusted life years (QALY) to compare cost-effectiveness of interventions. Several articles have examined these models for people with stroke, e.g. using algorithms to map the modified Rankin Scale into the EQ-5D.[4] Another study concluded that the lifelong health burden due to stroke</td></tr>
</table>

	was 9.5 QALYs.[5]
Ceiling/ floor effects	In comparison with SF-36 in people with stroke living in the community, more subjects had the maximum score "no problems" for the 5 domains, range of 16-39%. However, EuroQol visual analog overall estimate of quality of life and utility scores did not suggest ceiling or floor effect. [3]
Sensitivity to change (responsiveness, MCID, MDC)	Not reported
Instrument use	
Equipment required	A copy of the test (must register at website).[6]
Time to complete	"A few minutes" according to the website.[6]
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Descriptive questions in functional domains of mobility, self-care, usual activities, pain, psychological, along with 20 cm visual analog scale.
Level of client participation required (is proxy participation available?)	Proxy completion of the measure is possible, although test-retest reliability is much lower, and may not be acceptable for research purposes.[1, 2]

Limitations: Requires registration on website and licensing fee for access to copyrighted forms.[6]

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute				**X**	**Assessment may not be appropriate for acute stroke setting**
Inpatient Rehab		**X**			
Home Health		**X**			
Skilled Nursing		**X**			
Outpatient		**X**			**Possible ceiling effect for people with stroke living in community**
Overall Comments: **Although measure appears to be useful for participation-level outcomes after stroke, licensing fee and copyright issue may be a barrier to use in clinical practice.**					
Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute (<2 months)				X	**Assessment may not be appropriate for patients with recent stroke**
Sub- Acute (2-6 months)		X			
Chronic (>6 months)		X			**Possible ceiling effect for people with stroke living in community**
Overall Comments: **Although measure appears to be useful for participation-level outcomes after stroke, licensing fee and copyright issue may be a barrier to use in clinical practice.**					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments Licensing fee and copyright issue may be a barrier to use in education
Should this tool be required for entry level curricula?		X?		

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?	X		Useful for economic analysis and comparison of quality-adjusted life years.

1. Dorman P, Slattery J, Farrell B, Dennis M, Sandercock P. Qualitative comparison of the reliability of health status assessments with the EuroQol and SF-36 questionnaires after stroke. United Kingdom Collaborators in the International Stroke Trial. *Stroke.* 1998;29(1):63-68.

2. Dorman P, Waddell F, Slattery J, Dennis M, Sandercock P. Are proxy assessments of health status after stroke with the EuroQol questionnaire feasible, accurate, and unbiased? *Stroke.* 1997;28(10):1883-1887.

3. Dorman P, Dennis M, Sandercock P. How do scores on the EuroQol relate to scores on the SF-36 after stroke? *Stroke.* 1999;30(10):2146-2151.

4. Rivero-Arias O, Ouellette M, Gray A, Wolstenholme J, Rothwell P, Luengo-Fernandez R. Mapping the modified Rankin Scale (mRS) measurement into the generic EuroQol (EQ-5D) health outcome. *Med Decis Making.* 2010;30:341-354.

5. Lee HY, Hwang J, Jeng JS, Wang J. Quality-adjusted life expectancy (QALE) and loss of QALE for patients with ischemic stroke and intracerebral hemorrhage: a 13-year follow-up. *Stroke.* 2010;41(4):739-744.

6. EuroQOL Group. http://www.euroqol.org/home.html. Accessed September 11, 2010.

Functional Ambulation Category (FAC)	
Reviewer: Rie	
ICF Domain (check all that apply): _____body function/structure __x_ activity _____participation	
Type of measure: __x_ performance-based _____self-report	
Instrument properties: FAC is a classification system that categorizes participants according to basic motor skills necessary for functional ambulation, without assessing the factor of endurance. Participants are asked to ambulate 10ft or more outside parallel bars with or without physical assistance from one person and with or without assistive device. Participants need to show ambulation skill on level surface, non-level surface, stairs, and incline and scored at their most independent level of function[1].	
Reliability (test-retest, intra-rater, inter-rater)	All psychometric information gathered from stroke population. Test-retest reliability: high (κ=0.950) in 55 subjects in inpatient rehab setting[2] Inter-rater reliability: good (κ =0.72) when tested by 9 therapists on 5 subjects[3], fair (κ=0.36) in 25 subjects with chronic stroke[4], high (κ=0.905) in 55 subjects in inpatient rehab setting[2]
Validity (concurrent, criterion-related, predictive)	All psychometric information gathered from stroke population. Concurrent validity: • significant correlation with temporal-distance measures including velocity (rho=0.59), cadence (rho=0.53), step length (rho=0.53), stride length (rho=0.54), stride length to lower extremity length ratio (rho=0.52), and involved extremity step length (rho=0.55) in 37 subjects with hemiplegia[1] • significant correlation with changes in the RMI (rho=0.841), 6MWT (rho=0.795), walking velocity (rho=0.767), and step

	length (rho=0.805) in 55 subjects in inpatient rehab setting[2] • high correlation with total score of Mobility Scale for Acute Stroke (rho=0.83), Motor Assessment Scale (rho=0.81), FIM-Motor (rho=0.90), and BI(rho=0.84) in 106 subjects at rehabilitation unit[5] • moderate and statistically significant association with gait speed (rho=0.58), walking distance (rho=0.55), gait energy cost (rho=-0.64), and FIM (rho=0.72) in 20 participants with acute stroke[6] Predictive validity: FAC cutoff of 4 or higher had sensitivity of 100% and specificity of 78% in predicting community ambulation 6 months after end of study when tested in 55 subjects in inpatient rehab setting[2]
Ceiling/ floor effects	Ceiling effect: FAC had the largest ceiling effect (at 46%)[7]
Sensitivity to change (responsiveness, MCID, MDC)	Responsiveness: good-when evaluating change in ambulation over a period of 6 months[2]; may lack responsiveness, especially if using it to distinguish between groups at lower levels of functioning[4,8]
Instrument use	
Equipment required	No special equipment needed-only uses stairs and 15m of indoor floor[2]
Time to complete	Minimal, especially if mobility level of subject already known. Less than 10 minutes if mobility evaluated by observation.
How is the instrument scored? (e.g. total score, are there subscales, etc.)	6-point scale [3] • 0=nonfunctional ambulatory • 1=ambulatory, dependent on physical assistance (level II) • 2=ambulatory, dependent on physical assistance (level I) • 3=ambulator, dependent for supervision • 4=ambulator, independent, level surface only • 5=ambulatory, independent
Level of client participation required (is proxy participation available?)	Could be done with observation, interviewing therapist/participant/caregiver, or medical record (ie-PT note)[9]

Limitations: FAC has high ceiling effect and is not very practical for use in patients who are higher functioning.
Comments: I think it is important for students to be able to assess how much assist a patient needs during ambulation and stair negotiation but not specifically this scale.
Comments: There is research that uses FAC to categorize walking ability. However, due to concern for limited responsiveness, especially at lower end of the scale, it may be too crude to be use in research setting[4]. One research study reported that FAC had less discrimination, less ability to detect changes in ambulation level when contrasted with specific gait parameters[10].

References:

1. Holden MK, Gill KM, Magliozzi MR. Gait assessment for neurologically impaired patients. Standards for outcome assessment. *Phys Ther*. 1986;66:1530-1539.
2. Mehrholz J, Wagner K, Rutte K, et al. Predictive validity and responsiveness of the functional ambulation category in hemiparetic patients after stroke. *Arch Phys Med Rehabil*. 2007;88:1314-1319.
3. Holden MK, Gill KM, Magliozzi MR, et al. Gait assessment for neurologically impaired patients. Reliability and meaningfulness. *Phys Ther*. 1984;64:35-40.
4. Collen FM, Wade DT, Bradshaw CM. Mobility after stroke: reliability of measures of impairment and disability. *Int Disabil Stud*. 1990;12:6-9.
5. Simondson JA, goldie P, Greenwood KM. The mobility scale for acute stroke patients: concurrent validity. *Clin Rehabil*. 2003;17:558-564.
6. Cunha IT, Lim PAC, Henson H, et al. Performance-based gait tests for acute stroke patients. *Am J Phys Med Rehabil*. 2002;81:848-856.
7. Brock KA, Goldie PA, Greenwood KM. Evaluating the effectiveness of stroke rehabilitation: choosing a discriminative measure. *Arch Phys Med Rehabil*. 2002;83:92-99.
8. Lord SE, McPherson K, McNaughton HK, et al. Community ambulation after stroke: how important and obtainable is it and what measures appear predictive? *Arch Phys Med Rehabil*. 2004;85:234-239.
9. Kollen B, Kwakkel G, Lindeman E. Time dependency of walking classification in stroke. *Phys Ther*. 2006;86:618-625.
10. da Cunha IT, Lim PA, Qureshy H, et al. Gait outcomes after acute stroke rehabilitation with supported treadmill ambulation training: a randomized controlled pilot study. *Arch Phys Med Rehabil*. 2002;83:1258-1265.

General information on FAC was gathered by looking at the following:
Outcome Measures in Stroke Rehabilitation-pages 52-54, by Evidence Based Review of Stroke Rehabilitation. http://ebrsr.com/uploads/chapter_21_SREBR12.pdf. Accessed August 1, 2010.

Practice Setting	4	3	2	1	Comments
Acute			**x**		
Inpatient Rehab		**x**			
Home Health			**x**		
Skilled Nursing			**x**		
Outpatient			**x**		

Overall Comments: developed for use in inpatient rehab setting, so most amount of research in this setting.

Practice Setting	4	3	2	1	Comments
Acute (<2 months)		x			
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		

Overall Comments: again, studies mostly done in inpatient rehab setting where subjects are most likely in acute time period

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?			x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?		x	limited responsiveness, especially at lower end of the scale

Fall Efficacy Scale

Reviewer: Rie

ICF Domain (check all that apply):

_____body function/structure __x__ activity __x__participation

Type of measure:

____ performance-based __x__self-report

Instrument properties: 10-item rating scale that assesses confidence in performing daily activities without falling.

Several different versions have been developed: modified FES (MFES) incorporates 4 items to assess outdoor activities in addition to original FES[1], Swedish modification of the FES (FES(S)) incorporates 3 items in addition to original FES to cater to subjects with stroke with considerable impairments and disabilities[2], FES-International (FES-I) incorporates 6 items in addition to original FES to maximize its suitability for translation and use in a wide range of different languages and cultural contexts[3], short FES-I to make the 16 item FES-I into 7 item abbreviated version[4].

Reliability (test-retest, intra-rater, inter-rater)	Only test-retest reliability studied in stroke population. Test-retest reliability: • in 30 participants post stroke, using FES(S)-high with ICC=0.97[2] • in participants at postacute rehab facility, using French FES- high with ICC=0.97[5] • in elderly participants, using MFES-high (ICC=0.93)[1] Internal consistency: • in participants at postacute rehab facility, using French FES-optimal (Cronbach α=0.90)[5] • in elderly participants, using MFES- high (Cronbach's α=0.95)[1] • in community-dwelling older adults, using Chinese FES-high (Cronbach's α=0.98)[6]

Validity (concurrent, criterion-related, predictive)	Only concurrent and predictive validity studied in stroke population. <u>Concurrent validity</u>: • in 62 participants post stroke, using FES(S)-changes in scores between admission and discharge to rehab center correlated significantly with changes in BBS (ρ =0.58), Fugl-Meyer balance subscale (ρ =0.48), and motor function and ambulation scores (ρ =0.58)[7] • in community-dwelling older adults, using Chinese FES- significantly correlated to ABC (ρ=0.88) and Geriatric Fear of Falling Measurement (ρ=-0.55)[6] <u>Predictive validity</u>: • in 50 people with chronic stroke, using FES(S)-those who reported falling once had lower levels of self efficacy (ρ =0.04)[8] • in participants at postacute rehab facility, using French FES-length of stay at rehabilitation correlated inversely with FES score (ρ=-0.51)[5] <u>Construct validity</u>: • in participants at postacute rehab facility, using French FES- significant correlation with POMA (ρ=0.40), MMSE (ρ=0.37), basic ADLs (ρ=0.43), and Geriatric Depression Scale (ρ=-0.53)[5]
Ceiling/ floor effects	No study done in stroke population. -in community-dwelling older adults, using Chinese FES[6] Demonstrated ceiling effects

Sensitivity to change (responsiveness, MCID, MDC)	Responsiveness: • in 62 participants post stroke, using FES(S)-highly responsive to changes from admission to discharge and from admission to 10 months follow-up (but not for discharge to follow-up)[7] • in community-dwelling older adults, using Chinese FES-no significant changes in FES score in 8 week period[6] Sensitivity and specificity: • in 50 people with chronic stroke, using FES(S)-sensitivity and specificity for identifying faller from non-faller=0.90 and 0.53, respectively[8]. This study also found FES(S) to be the best outcome measure (out of FES-S, TUG, BBS, STS, FMA, SIS) to discriminate subjects who had fallen from those who had not.
Instrument use	
Equipment required	Score sheet and instruction, writing implement
Time to complete	Approximately 3-5 minutes to complete FES(S)[7]
How is the instrument scored? (e.g. total score, are there subscales, etc.)	For original FES: rating from 1 to 10, with higher scores indicating greater confidence in maintaining balance. For MFES and FES(S): using visual analog scale ranging from 0 to 10, where 0=not confident at all, 5=fairly confident, and 10=completely confident. Total score varies among different versions: original FES=0-100, MFES=0-140, FES(S)=0-130 -score of 17.5 on FES(S) was found to be threshold for subjects who had fallen vs. those who had not[8]
Level of client participation required (is proxy participation available?)	Either self-completion format or by structured interview

Limitations: All research on stroke population done using FES(S), mostly by the same group from Sweden so questionable reproducibility in different research groups. As in other questionnaire-type outcome measures, this cannot be completed with those with significant aphasia.

References:

1. Hill KD, Schwarz JA, Kalogeropoulos AJ, Gibson SJ. Fear of falling revisited. *Arch Phys Med Rehabil*. 1996;77:1025-1029.
2. Hellstrom K, Lindmark B. Fear of falling in patients with stroke: a reliability study. *Clin Rehabil*. 1999;13:509-517.
3. Yardley L, Beyer N, Hauer K, et al. Development and initial validation of the falls efficacy scale-international. *Age Ageing*. 2005;34:614-619.
4. Kempen GI, Yardley L, Van Haastregt JCM, et al. The short FES-I: a shortened version of the falls efficacy scale-international to assess fear of falling. *Age Ageing*. 2008;37:45-50.
5. Bula CJ, Martin E, Rochat S, Piot-Ziegler C. Validation of an adapted falls efficacy scale in older rehabilitation patients. *Arch Phys Med Rehabil*. 2008;89:291-296.
6. Huang TT, Wang WS. Comparison of three established measures of fear of falling in community-dwelling older adults: psychometric testing. *Int J Nurs Stud*. 2009;46:1313-1319.
7. Hellstrom K, Lindmark B, Fugl-Meyer A. The falls-efficacy scale, Swedish version: does it reflect clinically meaningful changes after stroke? *Disabil Rehabil*. 2002;24:471-481.
8. Belgen B, Beninato M, Sullivan PE, Narielwalla K. The association of balance capacity and falls self-efficacy with history of falling in community-dwelling people with chronic stroke. *Arch Phys Med Rehabil*. 2006;87:554-561.

Practice Setting	4	3	2	1	Comments
Acute			**x**		
Inpatient Rehab		**x**			
Home Health			**x**		
Skilled Nursing			**x**		
Outpatient			**x**		

Overall Comments: for stroke population, evidence found only from inpatient rehab population. Also, all studies in stroke population used Swedish version of FES, which has additional items specifically for stroke population.

Practice Setting	4	3	2	1	Comments
Acute (<2 months)		x			
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		

Overall Comments: studies done in all acuity level (usually started in inpatient rehab setting then follow-up assessment 6-12 months after discharge from inpatient rehab) but most consistently in acute phase.

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?			x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		

Functional Independence Measure (FIM)

Reviewer: Rie

ICF Domain (check all that apply):

_____body function/structure _x__ activity _____participation

Type of measure:

__x_ performance-based __x__self-report

Instrument properties: the FIM consists of 18 items assessing 6 areas of function falling in two domains: motor (13 items) and cognitive (5 items).

Motor Domain:

1. Self-care (6 items)
   - Eating
   - Grooming
   - Bathing
   - Dressing-upper body
   - Dressing-lower body
   - Toileting
2. Sphincter control (2 items)
   - Bladder management
   - Bowel management
3. Transfers (3 items)
   - Bed/chair/wheelchair
   - Toilet
   - Tub/shower
4. Locomotion (2 items)
   - Walk/wheelchair
   - Stairs

Cognitive Domain:

5. Communication (2 items)
   - Comprehension
   - Expression
6. Social cognition (3 items)
   - Social interaction
   - Problem solving
   - Memory

<table>
<tr><td colspan="2">Several alternative versions of FIM were developed. One is WeeFIM to assess functional abilities in the pediatric population. Another is modified 5-level FIM, which was created for its use in large population studies[1]. There is also AlphaFIM, which is a shorter, 6-item version of FIM designed for acute setting and found to have adequate reliability and validity in patients with stroke in acute care stroke unit[2].</td></tr>
<tr><td>Reliability (test-retest, intra-rater, inter-rater)</td><td>All psychometric information gathered from stroke population.

<u>Internal consistency</u>: Excellent (Crombach α of 0.88 at admission and 0.91 at discharge-Motor-FIM only)[3]

<u>Inter-rater reliability</u>: Excellent (ICC=0.96)[4] in rehab setting, adequate to excellent for motor items (ICC between 0.62-0.88) and adequate for social and cognitive items (ICC between 0.60-0.72) for home/clinic interview[5]</td></tr>
<tr><td>Validity (concurrent, criterion-related, predictive)</td><td>All psychometric information gathered from stroke population.

<u>Concurrent validity</u>: Adequate to excellent at admission (r=0.74, ICC=0.55) and excellent at discharge (r=0.92, ICC=0.86) in rehab setting, looking at Motor-FIM with original 10-item and 5-item short Barthel Index[3]. Excellent between Barthel Index and Motor-FIM (r=0.95) and between Motor-FIM and Modified Rankin Scale (r=-0.89)[6]

<u>Predictive validity</u>: FIM admission scores was the strongest predictor of total FIM discharge scores[7,8].

Admission FIM scores and length of stay were the most significant predictors of functional gain[9]

FIM score was used to predict discharge destination-no patients with admission FIM score <36 went home while all patients with admission FIM score >96 were discharged home[10], patients with a discharge FIM score >80 had high probability of being discharged home[11], patients with discharge FIM score of 78 or above most likely discharge to community setting after inpatient rehab[12], admission FIM and FIM cognitive portion were the most significant predictors for patient returning home[13]</td></tr>
</table>

Ceiling/ floor effects	All psychometric information gathered from stroke population. Ceiling effect: Adequate (16%-Motor-FIM only) at time of discharge from inpatient rehab[14], no ceiling effect (0%) at admission and discharge from inpatient rehab[3,15] Floor effect: Small (5.8% at admission, 3.5% at discharge-Motor-FIM only)[3] to no (0%) floor effect at admission and discharge from inpatient rehab[15]
Sensitivity to change (responsiveness, MCID, MDC)	All psychometric information gathered from stroke population. Responsiveness: Motor FIM exhibited high responsiveness (standardized response mean or SRM=1.3)[3], SRM of FIM superior to that of the Barthel Index (2.18 vs 1.72)[15] FIM was found to be the most sensitive measure, detecting change in 91/95 sujbects, including change in 18 patients in whom the Barthel Index detected no change[15] MCID: Determined to be 22 points for total FIM, 17 points for Motor-FIM, and 3 points for cognitive FIM[16]
Instrument use	
Equipment required	Any items that the subject uses to carry out their activities of daily living.
Time to complete	Between 30-45 minutes to administer and score
How is the instrument scored? (e.g. total score, are there subscales, etc.)	All items on the FIM are measured on a 7-point scale ranging from 1 (total assistance) to 7 (complete independence). Scores range from 18 to 126. Subscale scores for the Motor and Cognitive domains can also be calculated to range from 13 to 91 for motor and 5 to 35 for cognitive FIM.
Level of client participation required (is proxy participation available?)	Although ratings are based on performance, FIM scoring can be done by observation, patient interview, telephone interview or looking at medical records.

Limitations: the FIM must be administered by a trained and certified evaluator and ideally scored by consensus with a multi-disciplinary team. Although FIM was originally developed to address issues of sensitivity and comprehensiveness for Barthel Index (BI), subsequent studies demonstrated that psychometric properties of FIM and BI are similar[3]. Test is copyrighted.
Comments: used most commonly in inpatient rehab setting as admission FIM ratings are used to formulate Medicare reimbursement under to prospective payment system since 2002[2,12,17]. Perhaps the least feasible in acute setting due to time consuming nature of FIM rating.
Comments: As most students are required to do internship in inpatient rehabilitation setting, knowing FIM would be very beneficial before starting internships.

References:

1. Gosman-Hedstrom G, Blomstrand C. Evaluation of a 5-level functional independence measure in a longitudinal study of elderly stroke survivors. *Disabil Rehabil*. 2004;26:410-418.
2. Stillman G, Granger C, Niewczyk P. Projecting function of stroke patients in rehabilitation using the AlphaFIM instrument in acute care. *PMR*. 2009;1:234-239.
3. Hsueh IP, Lin JH, Jeng JS, Hsieh CL. Comparison of the psychometric characteristics of the functional independence measure, 5 item Barthel index, and 10 item Barthel index in patients with stroke. *J Neurol Neurosurg Psychiatry*. 2002;73:188-190.
4. Segal ME, Schall RR. Determining functional/health status and its relation to disability in stroke survivors. *Stroke*. 1994;25:2391-2397.
5. Daving Y, Andren E, Nordholm L, Grimby G. Reliability of an interview approach to the functional independence measure. *Clin Rehabil*. 2001;15:301-310.
6. Kwon S, Hartzema AG, Duncan PW, Min-Lai S. Relationship among the Barthel index, the functional independence measure, and the modified Rankin scale. *Stroke*. 1994;35:918-923.
7. Inouye M, Kishi K, Ikeda Y, et al. Prediction of functional outcome after stroke rehabilitation. *Am J Phys Med Rehabil*. 2000;79:513-518.
8. Tur BS, Gursel YK, Yavuzer G, et al. Rehabilitation outcome of Turkish stroke patients: in a team approach setting. *Int J Rehabil Res*. 2003;26:271-277.
9. Ring H, Feder M, Schwartz J, Samuels G. Functional measures of first-stroke rehabilitation inpatients: usefulness of the functional independence measure total score with a clinical rationale. *Arch Phys Med Rehabil*. 1997;78:630-635.
10. Oczkowski WJ, Barreca S. The functional independence measure: its use to identify rehabilitation needs in stroke survivors. *Arch Phys Med Rehabil*. 1993;74:1291-1294.
11. Black TM, Soltis T, Bartlett C. Using the functional independence measure instrument to predict stroke rehabilitation outcomes. *Rehabil Nurs*. 1999;24:109-114,121.

12. Reistetter TA, Graham JE, Deutsch A, et al. Utility of functional status for classifying community versus institutional discharges after inpatient rehabilitation for stroke. *Arch Phys Med Rehabil*. 2010;91:345-350.
13. Denti L, Agosti M, Franceschini M. Outcome predictors of rehabilitation for first stroke in the elderly. *Eur J Phys Rehabil Med*. 2008;44:3-11.
14. Brock KA, Goldie PA, Greenwood KM. Evaluating the effectiveness of stroke rehabilitation: choosing a discriminative measure. *Arch Phys Med Rehabil*. 2002;83:92-99.
15. Dromerick AW, Edwards DF, Diringer MN. Sensitivity to changes in disability after stroke: a comparison of four scales useful in clinical trials. *J Rehabil Res Dev*. 2003;40:1-8.
16. Beninato M, Gill-Body KM, Salles S, et al. Determination of the minimal clinically important difference in the FIM instrument in patients with stroke. *Arch Phys Med Rehabil*. 2006;87:32-39.
17. Chumney D, Nollinger K, Shesko K, et al. Ability of functional independence measure to accurately predict functional outcome of stroke-specific population: systematic review. *J Rehabil Res Dev*. 2010;47:17-30.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute			**x**		
Inpatient Rehab	**x**				I gave it a 4 even though FIM takes >20 minutes to administer since FIM is administered regularly in this setting per Medicare reimbursement rule
Home Health			**x**		
Skilled Nursing			**x**		
Outpatient			**x**		
Overall Comments: vast majority of studies done in inpatient rehab setting.					

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute (<2 months)	x				
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		
Overall Comments: as most studies done in inpatient rehab setting, subjects likely in acute time period.					

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Do not recommend**	**Comments** Most students do internships in inpatient rehab setting, and being familiar with FIM would be very useful for this
Should this tool be required for entry level curricula?		x		

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?	x		

Fugl-Meyer Sensory Exam (FM-S)	
Reviewer: Sullivan	
ICF Domain (check all that apply): __x__body function/structure ____ activity ___participation	
Type of measure: __x___ performance-based _ self-report	
Instrument properties: The FMA-S contains 12 items, 4 for light touch and 8 for position sense. Light touch is tested on bilaterally using the examiner's fingertips on the palmar surface of the hands, both legs and the soles of the feet. Proprioception is tested in the UE at the interphalangeal joint of the thumb, the wrist, the elbow and the shoulder, and in the LE at the great toe, the ankle joint, the knee and the hip.	
Reliability (test-retest, intra-rater, inter-rater)	Inter-rater excellent, ICC = 0.93[1] however there was poor to moderate inter-rater reliability for light touch items (weighted kappa ranging from 0.30 to 0.55) Internal consistency – excellent, Cronbach's 4 time points after stroke ranged from 0.94 to 0.98
Validity (concurrent, criterion-related, predictive)	Validity was low to moderate when the FM-S was compared to the Barthel Index and the Fugl-Meyer Motor Assessment - Spearman's rho 0.29 to 0.53[1]
Ceiling/ floor effects	A significant ceiling effect has been reported at 14, 30, 90 and 180 days after stroke.[1]
Sensitivity to change (responsiveness, MCID, MDC)	Low to moderate responsiveness has been reported - standardized response mean ranging from 0.27 to 0.67 at 14, 30, 90 and 180 days following stroke.[1]
Instrument use	
Equipment required	none

Time to complete	5 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Each of the 12 items is scored on a 3 point ordinal scale (0-2) for a total score of 24.
Level of client participation required (is proxy participation available?)	Active participation is required – the client must respond when touched and to movement during the proprioception test

Limitations: Ceiling effect, limited precision/sensitivity to measure sensory change following stroke

Comments:

The lack of precision/sensitivity/responsiveness does not support the use of this tool in a research setting. One study that examined the tool's psychometric properties did not recommend it's use.[1] There are alternative measures with greater responsiveness and functional significance.

Attachments:

- Score Sheets: ____ Uploaded on website _____Available but copyrighted _____Unavailable
- Instructions: _____ Uploaded on website _____Available but copyrighted _____Unavailable
- Reference list: _____Uploaded on website

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute				**x**	
Inpatient Rehab				**x**	
Home Health				**x**	
Skilled Nursing				**x**	
Outpatient				**x**	
Overall Comments: Clinical Utility is acceptable but psychometrics are poor. The clinician is encouraged to seek ways to standardize their own exam. Efforts in this regard are underway.					

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute (<2 months)				x	
Sub- Acute (2-6 months)				x	
Chronic (>6 months)				x	
Overall Comments: Clinical Utility is acceptable but psychometrics are poor. The clinician is encouraged to seek ways to standardize their own exam. Efforts in this regard are underway.					

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Comments**
Should this tool be required for entry level curricula?		x	Students should be aware of this and standardized sensory outcome measures. Entry-level curricula should seek ways to help students conduct more standardized, yet efficient sensory exams/screening.

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?		x	

1. Lin JH, Hsueh IP, Sheu CF, Hsieh CL. Psychometric properties of the sensory scale of the Fugl-. Meyer Assessment in stroke patients. *Clin Rehabil.* 2004;18(4):391-397

Fugl-Meyer Assessment Scale	
Reviewer: Dorian Rose	
ICF Domain (check all that apply): ___x__body function/structure _____ activity _____participation	
Type of measure: __x___ performance-based _____self-report	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	**Total Fugl-Meyer** Intra-rater: *r* = 0.98-0.99[1] Inter-rater: ICC=0.96[2] **Upper Extremity - Motor** Intra-rater: *r* = 0.98-0.99[1] Inter-rater: *r* = 0.98-0.99[1] Inter-rater: ICC = 0.97[2] Inter-rater: ICC = 0.99 [3] Inter-rater: ICC = 0.96[4] Test-retest: ICC = 0.97[3] Test-retest: ICC = 0.99[4] Test-retest: ICC = 0.98[5] **Upper Extremity - Sensation** Inter-rater: ICC = 0.98 for sensation[3] Test-retest: ICC = 0.81 for sensation[3]

	Upper Extremity – Pain/ROM Inter-rater: ICC = 0.98 for PROM/pain[3] Test-retest: ICC = 0.95 for PROM/pain[3] **Lower Extremity - Motor** Intra-rater: *r* = 0.96[1] Inter-rater: *r* = 0.89-0.95[1] Inter-rater: ICC = 0.92 for motor[2] Test-retest: ICC = 0.95[5] **Balance** Intra-rater: *r* = 0.89-0.98[1] Inter-rater: ICC = 0.93[2] **Sensation** Intra-rater: *r* = 0.95-0.96[1] Inter-rater: ICC = 0.85[2] Inter-rater: ICC=0.93[6] **Range of Motion** Intra-rater: *r* = 0.865-0.996[1] Inter-rater: ICC = 0.85 for motor[2] **Pain** Intra-rater: *r* = 0.865-0.996[1] Inter-rater: ICC = 0.61 for motor[2]
Validity (concurrent, criterion-related, predictive)	**Total Fugl-Meyer** Convergent validity: *r* = 0.67 w/Barthel Index[7]

	Convergent validity: *r* = 0.63 w/FIM-total[8] Predictive Validity: The admission FM motor score predicted LOS in rehabilitation (*r*=0.42) better then the FIM[9] **Upper Extremity - Motor** Construct validity: *r*=0.93 w/ARAT; *r*=0.92 w/BBT; *r*=0.86 w/Motricity Index[3] Construct validity: *r*=0.73 UEFM motor w/ARAT; *r*=0.76 UEFM motor w/WMFT-TIME; *r*=0.71 UEFM motor w/WMFT FAS; r=0.49 UEFM motor w/FIM-motor[10] Convergent validity: r=0.75 w/Barthel Index[7] Convergent validity: r=0.75 w/Barthel Index 3-5 days post-stroke[11] Convergent validity: r=0.82 w/Barthel Index 5 weeks post-stroke[11] Convergent validity: *r* = 0.61 w/FIM-self-care[8] Convergent validity: *r* = 0.91 w/ARAT at 2 wks post-stroke[12] Convergent validity: *r* = 0.94 w/ARAT at 8 wks post-stroke[12] Concurrent validity: *r* = 0.96 (14 days post-stroke), *r* = 0.94 (30 days post-stroke), *r*=0.93 (90 days post-stroke); *r*=0.94 (180 days post-stroke) w/ UE-STREAM[4] Concurrent validity: *r* = 0.90 (14 days post-stroke), *r* = 0.90 (30 days post-stroke), *r*=0.82 (90 days post-stroke); *r*=0.92 (180 days post-stroke) w/ ARAT[4] Concurrent validity: *r* = 0.93 (14 days post-stroke), *r* = 0.96 (30 days post-stroke), *r*=0.85 (90 days post-stroke); *r*=0.94 (180 days post-stroke) w/ WMFT[4] Predictive validity: *r*=0.42 w/FIM-Total; *r*=0.42 w/FIM-Motor[10] Predictive validity: r = 0.66 w/Barthel Index[5] **Lower Extremity - Motor** Predictive: The LEFM admission score at 6 wks post-stroke predicted rehabilitation discharge FIM-mobility (*r* = 0.63) and

	FIM-locomotion scores (*r*=0.74)[9]. Predictive validity: r = 0.72 w/Barthel Index[5] Convergent validity: r=0.77 w/Barthel Index 3-5 days post-stroke[11] Convergent validity: r=0.89 w/Barthel Index 5 weeks post-stroke[11] Convergent validity: *r* = 0.74 w/FIM-mobility[8] **Balance** Convergent validity: r=0.76 w/Barthel Index[7] **Sensation** Predictive validity: *r*=0.29 at 14 days post-stroke w/Barthel Index at 180 days post-stroke; *r*=0.34 at 30 days post-stroke w/Barthel Index at 180 days post-stroke; *r*=0.38 at 90 days post-stroke w/Barthel Index at 180 days post-stroke[6] Convergent validity: *r*=0.53 w/Barthel Index; *r*=0.44 w/FM-Motor at 14 days post-stroke; *r*=0.48 w/Barthel Index; r=0.36 w/FM-Motor at 30 days post-stroke; *r*=0.42 w/Barthel Index; r=0.32 w/FM-Motor at 90 days post-stroke; *r*=0.38 w/Barthel Index; r=0.31w/FM-Motor at 180 days post-stroke[6]
Ceiling/ floor effects	**Upper Extremity Motor** Does not exhibit floor or ceiling effects when measured between 14-180 days post-stroke[4] Ceiling effect at inpatient rehabilitation discharge[5] **Sensation** Significant ceiling effects were found for patients at 14 (44.4%), 30 48.9%), 90 (62.7%) and 180 (72.1%) days post-stroke. (Ceiling

	effects exceeding 20% are considered to be significant)[6].
Sensitivity to change (responsiveness, MCID, MDC)	**Upper Extremity -Motor** Responsiveness: Standardized Response Mean (SRM) = 1.42[10(Hsieh,] 2009) (SRM > 0.8 is considered large) Minimal Detectable Change = 5.2[4] Effect Size (14-180 days post-stroke) = 0.52 (moderate)[4] Effect Size =0.34[5] (during inpatient rehabilitation;small) Responsiveness: Responsiveness ratio = 0.41. When compared directly with the ARAT (Responsiveness Ratio=2.03), the ARAT was more responsive to improvement in chronic stroke patients compared to the UE FM[13]. **Lower Extremity-Motor** Effect Size =0.41[5] (during inpatient rehabilitation;small) Responsiveness: a change of greater than 5 points reflects a change greater than measurement error[14] **Balance** Critical value of change is 4 points[14] **Sensation** Responsiveness[6] 14-30 days post-stroke: SRM=0.42 (low) 30-90 days post-stroke: SRM=0.43 (low) 90-180 days post-stroke: SRM=0.27 (low) 14-180 days post-stroke: SRM=0.67 (moderate)

Instrument use	
Equipment required	A chair, bedside table, reflex hammer, cotton ball, stop watch, blindfold, tennis ball, scrap of paper, pencil, small can
Time to complete	UE motor: 20 min; LE motor: 15 min; Sensation: 10 min; Balance: 5 min; Joint Motion/Pain: 10 min Total test takes approximately 45 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Total score = 226. It contains the following subscales: 1. Upper Extremity Motor: 66 points; 2. Lower Extremity Motor: 34 points; 3. Balance: 14 points; 4. Sensation: 24 points; 5. Joint ROM: 44 points; 6. Joint Pain: 44 points.
Level of client participation required (is proxy participation available?)	The client must participate.

Limitations
Length to complete. Psychometrics - UE motor have been studied the most extensively.
Students should be taught at least 1 motor function tool and be competent in administering same. Students should all know what the FM is given the frequency it is used in studies.

1. Duncan PW, Propst M, Nelson SG. Reliability of the Fugl-Meyer Assessment of Sensorimotor Recovery following Cerebrovascular Accident. Phys Ther.1983;63:1606-1610.
2. Sanford J, Moreland J, Swanson L, Statford PW, Gowland C. Reliability of the Fugl-Meyer Assessment for Testing Motor Performance in Patients following Stroke. Phys Ther. 1993;73:447-454.
3. Platz T, Pinkowski C, van Wijck F, et al. 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. Clin Rehabil. 2005;19:404-411.
4. Lin J, Hsu M, Sheu C, Wu T, Lin R, Chen C, Hsieh C. Psychometric Comparisons of 4 Measures for Assessing Upper-Extremity Function in People with Stroke. Phys Ther. 2009;89:84-850.

5. Hseuh I, Hsu M, Sheu C, Lee S, Hsieh C, Lin J. Psychometric comparisons of 2 versions of the Fugl-Meyer Motor Scale and 2 Versions of the Stroke Rehabilitation Assessment of Movement. Neurorehabil Neural Repair. 2008;22:737-744.

6. Lin J, Hsueh I, Sheu C, Hsieh C. Psychometric properties of the sensory scale of the Fugl-Meyer Assessment in stroke patients. Clinical Rehabil. 2004;18:391-397.

7. Dettman MA, Linder MT, Sepic SB. Relationships among walking performance, postural stability, and functional assessments of the hemiplegic patient. Amer J Phys Med. 1987;66:77-90.

8. Shelton FNAP, Volpe BT, Reding MJ. The effect of motor impairment on disability following stroke. Stroke. 2000;31:291.

9. Malouin F, Pichard L, Bonneau C, Durand A, Corriveau C. Evaluating motor recovery early after stroke: comparison of the Fugl-Meyer and the Motor Assessment Scale. Arch Phys Med Rehabil. 1994;75:1206-12.

10. Hsieh Y, Wu C, Lin K, Chang Y, Chen C, Liu J. Responsiveness and Validity of Three Outcome Measures of Motor Function after Stroke Rehabilitation. Stroke. 2009;40:1386-1391.

11. Wood-Dauphinee SL, Williams JI, Shapiro SH. Examining outcome measures in a clinical study of stroke. Stroke. 1990;21:731-9.

12. De Weerdt WJG, Harrison MA. Measuring recovery of arm-hand function in stroke patients: a comparison of the Brunnstrom-Fugl-Meyer test and Action Research Arm Test. Physiother Can 1985;37:65-70.

13. van der Lee, Beckerman J, Lankhorst GJ, Bouter LM. The Responsiveness of the Action Research Arm Test and the Fugl-Meyer Assessment Scale in Chronic Stroke Patients. J Rehab. Med. 2001;33:110-113.

14. Beckerman, Vogelaar TW, Lankhorst GJ, Verbeek AL. A criterion for stability of the function of the lower extremity in stroke patients using the Fugl-Meyer Assessment Scale. Scand J Rehabil Med. 1996;28:3-7.

Practice Setting	4	3	2	1	Comments
Acute	x				
Inpatient Rehab	x				
Home Health	x				
Skilled Nursing	x				
Outpatient	x				

Overall Comments: UE Motor: "3" across all settings secondary to length to administer. LE Motor: "4" across all settings. Balance: "1" as there are more functional balance assessments available. Sensation: "3": quick to administer; psychometrics have been studied and are adequate. ROM/Pain: 1: psychometric have not been studied.

Practice Setting	4	3	2	1	Comments
Acute (<2 months)		x			
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			

Overall Comments: Lengthy to administer at first but with practice/experience administration time can be decreased to 15 minutes in patients with movement throughout UE. In patients with little to no movement administration time can be 5 minutes. Administration time depends on participant's motor return.

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?	x	x		Recommend students learn *some* measure of UE stroke impairment. (rationale for checking both columns). The length of the UEFM is a drawback.

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		

FUNCTIONAL REACH	
Reviewer: PINTO ZIPP	
ICF Domain (check all that apply): _____body function/structure ____x_ activity _____participation	
Type of measure: __x___ performance-based _____self-report	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	• ICC across days was 0.01 in healthy adult subjects (Duncan, et al, 1992)[2] • Reliability (ICC), interrater= .98, intrarater=.92 in health adult subjects (Duncan, et al,1992)[2] • Test-retest reliability= .89 in health adult subjects (Weiner, et al,1992)[3] • Katz-Leyrer et al. found high **reliability** for the Modified Functional Reach Test (allows patient to sit) in sub-acute stage poststroke patients (ICC=0.09 to 0.97)[4]
Validity (concurrent, criterion-related, predictive)	• Content validity: expert consensus • Concurrent validity in health adult subjects: Duke mobility= .65, Gait speed= .71, Tandem walking and FR (r=0.67), SLS and FR (r=0.64) (Weiner, et al, 1992)[3] • FR and center of pressure in health adult subjects correlated (r=0.71) (Duncan, et al,1990)[1] • Smith & Hembree (2004) found an excellent **correlation** between the BBS and the Functional Reach Test (Spearman rho=.78) in 75 people poststroke (minimum of one week post stroke).[5] • Katz-Leyrer et al. found for the Modified Functional Reach Test to be moderately **correlated** with the Balance Master in sub-acute stage poststroke patients.[4]

Ceiling/ floor effects	• Not noted in stroke population
Sensitivity to change (responsiveness, MCID, MDC)	• Katz-Leyrer et al. found that the **responsiveness** to the paretic side was high (effect size0.80) and moderate for the forward and non-paraetic side (effect size 0.57-0.60) for the Modified Functional Reach Test.[4]
Instrument use	
Equipment required	• Masking tape and yard stick attached to a wall at about shoulder height.
Time to complete	• 5 minutes or less
How is the instrument scored? (e.g. total score, are there subscales, etc.)	• Position patient sideways in front of yard stick placed on wall at shoulder height • Ask patient to flex the shoulder to 90 degrees with feet still and hands fisted • Measure maximum distance (in inches) patient can reach forward without taking a step or losing balance. • 2 measurements are taken
Level of client participation required (is proxy participation available?)	• Proxy not available

Limitations

Functional reach affected by age and height with no available scores from birth to 19, and beyond 87 yrs old, or with modified standing and reaching positions used

- Only measures one functional movement, reaching in the forward direction
- Patient must be able to stand, raise arm to 90 degrees and fist hand
- Limited psychometric testing available in the stroke population
- Limited psychometric testing available in the stroke population for the MFRT

Age related norms for the functional reach test:

Age	Men (in inches)	Women (in inches)
20-40yrs	16.7 ± 1.9	14.6 ± 2.2
41-69yrs	14.9 ± 2.2	13.8 ± 2.2
70-87	13.2 ± 1.6	10.5 ± 3.5

Requirements:
The patient must be able to stand independently for at least 30 seconds without support, and be able to flex the shoulder to at least 90 degrees.

Equipment and Set up:
A yard stick is attached to a wall at about shoulder height. The patient is positioned in front of this so that upon flexing the shoulder to 90 degrees, an initial reading on the yard stick can be taken. The examiner takes a position 5-10 feet away from the patient, viewing the patient from the side.

References:
1. Duncan, PW, Weiner DK, Chadler J, Studenske S. Functional reach: A new clinical measure of balance. J Gerontol. 1990; 45:M192.

2. Duncan, PW, et al: Functional reach: Predictive validity in a sample of elderly male veterans. J Gerontol. 1992; 47:M93.

3. Weiner, DK, et al: Does functional reach improve with rehabilitation. Arch Phys Med Rehab. 1993; 74:796.

4. Katz-Leurer, M, et al. Reliability and validity of the modified functional reach test at the sub-acute stage post-stroke. 2009; 31:243-248.

5. Smith, PS, & Hembree, JA. Berg Balance Scale and Functional Reach: determining the best clinical tool for individuals post acute stroke. Clinical Rehab. 2004;18:811-818.

Practice Setting	4	3	2	1	Comments
Acute	X				
Inpatient Rehab	X				
Home Health	X				
Skilled Nursing	X				
Outpatient	x				
Overall Comments: Currently ceiling and floor effect in stroke population unknown					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)	x				
Sub- Acute (2-6 months)	x				
Chronic (>6 months)	x				
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?	x	x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	X		

Goal Attainment Scaling (GAS)	
Reviewer: Rie	
ICF Domain (check all that apply): could be for all domains depending on category of goal set by participants[1] ___x__body function/structure ___x__ activity ___x_participation	
Type of measure: ___x_ performance-based _____self-report	
Instrument properties: Measures goal achievement in people with disability. Subject and treating team identify several personal goals at baseline (this makes GAS individualized). These goals are weighed by importance and difficulty, and then expected outcomes are assigned in 5 point scale. After a period of time, goal attainment is reviewed and scores given to each personal goals.	
Reliability (test-retest, intra-rater, inter-rater)	No reliability study done in participants with stroke. <u>Inter-rater reliability</u>: • in participants with TBI-high (r=0.92 at admission and r=0.94 at discharge)[2] • in participants with LE amputation-adequate/good (ICC=0.67) [3] • in infants with motor delays-good (kappa coefficient=0.89)[4,5] • in children with CP-good to excellent (kappa coefficient=0.82 for children's therapists and 0.64 for independent raters)[6]
Validity (concurrent, criterion-related, predictive)	Only concurrent validity was studied in participants with stroke. <u>Concurrent validity</u>: • in participants with stroke-GAS found to be a valid measure o f community reintegration with moderate correlation with London Handicap Scale (rho between -0.45 and -0.51, $p < 0.005$). However, no significant correlation between GAS and FIM[7] • in participants with MS-high correlation with CGI (rho=-0.86, $p < 0.001$), but not with BI and FIM[8] • in infants with motor delay- low correlation (r=0.44 for gross and r=0.18 for fine) with Peabody gross and fine motor scale age-equivalent change score[5,9]

	Content validity: • in participants with TBI-good-goals set represented 17 of 18 problem areas for brain injury rehabilitation[2] • in infants with motor delays- between 77 and 88% of the therapists' ratings met the criterion for content validity[4,5] Convergent validity: • in participants with TBI-high correlation (r=0.84) with CGI but not with IADL, Milwaukee evaluation of daily living skills, Spitzer quality of life index, Rappaport disability rating, and Kohlman evaluation of daily living skills[2] Construct validity: • in participants with LE amputation-moderate correlation with BI (r=0.44) and Locomotor Capabilities Index (LCI) of the Prosthetic Profile of the Amputee (r=0.35)[3]
Ceiling/ floor effects	GAS is specific to each individual and avoids problems such as floor and ceiling effects[10]
Sensitivity to change (responsiveness, MCID, MDC)	Responsiveness: • in participants with stroke-more responsive than Assessment of Quality of Life and Hospital Anxiety and Depression Scale[1] • in participants with TBI-more responsive than BI, FIM, and Functional Assessment Measure (FIM+FAM)[11] • in participants with MS-more responsive than BI and FIM[8] • in participants with LE amputation-more responsive than BI and LCI[3] • in infants with motor delays-more responsive measure of motor change when compared with behavioral objective[4,9] MCID: -one study found change of 10 points[10] and another 17 points[8] associated with clinically significant change

Instrument use	
Equipment required	Nothing standardized, depends on individual needs for each specific goals.
Time to complete	-15-20 minutes to set an average of 4 goals per patient[2] but need time to test the performance of such goals at time of goal setting and at selected completion time.
How is the instrument scored? (e.g. total score, are there subscales, etc.)	5 point scale: -2=much less than expected -1=somewhat less than expected 0=expected level of attainment if the patient receives the intended treatment program +1=somewhat better than expected +2=much better than expected The measure of change over time is computed as T-score with a mean equal to 50 and a standard deviation of 10 [10].
Level of client participation required (is proxy participation available?)	Clients should be included in deciding what goals are important to pursue and determine how meaningful those goals are to them.

Limitations: time consuming (above the usual goal-setting process)[8] so not very practical in clinical setting[10]. Studies used abbreviated version to shorten the time needed to 3-5 minutes over and above the process of goal-setting itself[1,10]. Limited amount of studies done in stroke population. Not a standardized measure[10]. Initial goal setting portion cannot be done by therapist who is not working extensively with the client as therapist must be able to predict expected outcome and set realistic goals[1].
Comments: I think having the basic knowledge of how to set goals (following SMART, or specific, measurable, achievable, realistic, and timed) should be sufficient to prepare for using GAS.

References:

1. Turner-Stokes L, Baguley IJ, De Graaff S, et al. Goal attainment scaling in the evaluation of treatment of upper limb spasticity with botulinum toxin: a secondary analysis from a double-blind placebo-controlled randomized clinical trial. *J Rehabil Med*. 2010;42:81-89.

2. Joyce BM, Rockwood KJ, Mate-Kole C. Use of goal attainment scaling in brain injury in a rehabilitation hospital. *Am J Phys Med Rehabil*. 1994;73:10-14.

3. Rushton PW, Miller WC. Goal attainment scaling in the rehabilitation of patients with lower-extremity amputations: a pilot study. *Arch Phys Med Rehabil*. 2002;83:771-775.

4. Palisano RJ. Validity of goal attainment scaling in infants with motor delays. *Phys Ther*. 1993;73:651-658.

5. Steenbeek D, Ketelaar M, Galama K, et al. Goal attainment scaling in paediatric rehabilitation: a critical review of the literature. *Dev Med Child Neurol*. 2007;49:550-556.

6. Steenbeek D, Ketelaar M, Lindeman E, et al. Interrater reliability of goal attainment scaling in rehabilitation of children with cerebral palsy. *Arch Phys Med Rehabil*. 2010;91:429-435.

7. Brock K, Black S, Cotton S, et al. Goal achievement in the six months after inpatient rehabilitation for stroke. *Disabil Rehabil*. 2009;31:880-886.

8. Khan F, Pallant JF, Turner-Stokes L. Use of goal attainment scaling in inpatient rehabilitation for persons with multiple sclerosis. *Arch Phys Med Rehabil*. 2008;89:652-659.

9. Palisano RJ, Haley SM, Brown DA. Goal attainment scaling as a measure of change in infants with motor delays. *Phys Ther*. 1992;72:432-437.

10. Turner-Stokes L. Goal attainment scaling (GAS) in rehabilitation: a practical guide. *Clin Rehabil*. 2009;23:362-370.

11. Turner-Stokes L, Williams H, Johnson J. Goal attainment scaling: does it provide added value as a person-centered measure for evaluation of outcome in neurorehabilitation following acquired brain injury? *J Rehabil Med*. 2009;41:528-535.

Practice Setting	4	3	2	1	Comments
Acute				x	
Inpatient Rehab			x		May be the most appropriate in IR setting
Home Health				x	
Skilled Nursing				x	
Outpatient				x	
Overall Comments: very time consuming, limited psychometric studies in stroke population, not standardized.					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				x	
Sub- Acute (2-6 months)				x	
Chronic (>6 months)				x	
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?			x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?		x	GAS is not a standardized measure, very time consuming.

HI MAT	
Reviewer: PINTO ZIPP	
ICF Domain (check all that apply): _____body function/structure ____X_ activity _____participation	
Type of measure: __X___ performance-based _____self-report	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	• Interrater reliability ICC=.99 (Williams et al, 2006)[1] • Retest reliability ICC=.99 (Williams et al, 2006)[1] • Internal consistency, Cronbach alpha= .97 (Williams et al, 2006)[1]
Validity (concurrent, criterion-related, predictive)	• Not available
Ceiling/ floor effects	• Not available
Sensitivity to change (responsiveness, MCID, MDC)	• MDC (1+-2.66 points) representing less than 5% of the total scale. When adjusted to consider systematic improvements a 4 point improvement or 2 point deterioration is needed for 95% confidence that a true change has occurred
Instrument use	
Equipment required	• Stairs, tape measure, stop watch
Time to complete	• Less than 20 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	• Pass/fail rating criterion for many of the 14 items test of high level activities including running, stairs, hopping, skipping, jumping, and balance items • Performance on 11 tasks was recorded with stopwatch • Performance on 2 tasks was measured with a tape measure • The raw scores of times and distances were converted from 0-4 with a scoring table. 0 representing inability to perform and 1-4 representing increasing levels of ability • Max score of 54 (13 items with a max score of 4, with 1 point additional for each stair item)

Level of client participation required (is proxy participation available?)	• Proxy not available

Limitations

- Currently only tested in people with TBI
- Limited psychometric testing

References

1. Williams G, Greenwood K, Robertson V, et al. High-Level Mobility Assessment Tool (HiMAT): Interrater Reliability, Retest Reliability, and Internal Consistency. *Physical Therapy* . 2006;86,395-400.

Practice Setting	4	3	2	1	Comments
Acute			**X**		
Inpatient Rehab			**X**		
Home Health			**X**		
Skilled Nursing			**X**		
Outpatient			**X**		
Overall Comments: Currently only tested in TBI					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)			X		
Sub- Acute (2-6 months)			X		
Chronic (>6 months)			X		
Overall Comments: Currently only tested in TBI					

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Comments**
Should this tool be required for entry level curricula?			At this time this tool should not be recommended for entry level education for stroke

Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	X		TBI

Jebsen Taylor Hand Function Test	
Reviewer: Dorian Rose	
ICF Domain (check all that apply): _____body function/structure ___x__ activity _____participation	
Type of measure: ___x__ performance-based _____self-report Description: assessment of seven functional hand motor skills: writing a sentence, simulated page turning, picking up small objects, simulated feeding, stacking checkers, picking up large light objects and picking up large heavy objects. Means for these subtests have been published (Jebsen,Hackel)	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Test-retest: r = 0.92[1] Inter-rater: ICC = 0.82-1.00[2] healthy elderly population Intra-rater: r =0.85[2]
Validity (concurrent, criterion-related, predictive)	Poor discriminate validity with the Michigan Hand Outcomes Questionnaire (MHQ) in the post-surgical population[3]
Ceiling/ floor effects	Not reported
Sensitivity to change (responsiveness, MCID, MDC)	Responsiveness: between 1-3 mo post-stroke=0.69 (moderate); between 1-6 mo post-stroke = 0.73(moderate)[4]
Instrument use	
Equipment required	Paper, pencil, Index (3"x5") cards, pennies, paper clips, bottle caps, kidney beans, spoon, checkers, large empty can, large weighted (1lb) can
Time to complete	15 minutes, depending on ability level [2]

How is the instrument scored? (e.g. total score, are there subscales, etc.)	It is scored by the summed times to complete 7 functional tasks. Maximal time allotted for each subtest is 120 seconds [4,5]
Level of client participation required (is proxy participation available?)	Client participation required

References

1.Jebsen RH, Taylor N, Trieschmann RB et al. An objective and standardized test of hand function. Arch Phys Med Rehabil. 1969;50:311-319.

2.Hackel ME, Wolfe GA, Bang SM, et al. Changes in hand function in the aging adult as determined by the Jebsen Test of Hand Function. Phys Ther. 1992;72:373-377.

3.Davis-Sears E, Chung KC. Validity and Responsiveness of the Jebsen Taylor Hand Function Test. J Hand Surg Am 2010;35(1): 30-37.

4.Beebe JA, Lange CE. Relationships and Responsiveness of Six Upper Extremity Function Tests During the First Six Months of Recovery After Stroke. JNPT.2009;33:96-103.

5.Duncan P, Richards L, Wallace D, et al. A randomized, controlled pilot study of a home-based exercise program for individuals with mild and moderate stroke. Stroke. 1998;29:2055-2060.

Practice Setting	4	3	2	1	Comments
Acute					
Inpatient Rehab			x		
Home Health			x		
Skilled Nursing			x		
Outpatient			x		
Overall Comments:					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)					
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		
Overall Comments: Work in post-stroke population is limited. Given the extensive work with the ARAT/WMFT, would not recommend the JTHFT for clinical practice.					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?		x		

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		

Motor Activity Log (MAL)	
Reviewer: Sullivan	
ICF Domain (check all that apply): _____body function/structure ___x_ activity __x_participation	
Type of measure: _____ performance-based _x_self-report	
Instrument properties: Semi-structured interview to assess arm function. 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)[1] or 14 tasks (MAL 14).[2] 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).	
Reliability (test-retest, intra-rater, inter-rater)	Test-retest reliability→ MAL AOU - 0.70 to 0.85[3] MAL QOM - 0.61 to 0.71[3] MAL 14 QOM r>0.91. The participant AOU and caregiver QOM and AOU scales were not reliable.[2]
Validity (concurrent, criterion-related, predictive)	Internal consistency →is high (AOU: alpha=0.88; QOM: alpha=0.91). The limits of agreement were -0.70 to 0.85 and -0.61 to 0.71 for AOU and QOM respectively.[3] Internal consistency of the MAL 14 was >0.81[2] Concurrent Validity→ *For the MAL 28*:[1] Correlation between QOM and Stroke Impact Scale Hand Function scores was 0.72. Correlation for QOM and accelerometry was 0.52.[1] Correlation with Action Research Arm Test was 0.63[3] *For the MAL 14*:[2] Correlation between participant QOM scale and caregiver QOM scale was 0.70 Correlation between participant QOM scale and caregiver MAL amount of use (AOU) scale was 0.73 Correlation between participant QOM scale and accelerometer

	recordings was 0.91
Ceiling/ floor effects	Not reported
Sensitivity to change (responsiveness, MCID, MDC)	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 was between 0.16 and 0.22. The responsiveness ratio was 1.9 (AOU) and 2.0 (QOM).[3] For the MAL 14, the responsiveness ratio >3 of the participant QOM scale was supported.[2]
Equipment required	Survey instrument
Time to complete	Approximately 20 minutes, shorter for the MAL 14
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Items are scored on a 6-point ordinal scale. <u>Scoring on Amount of Use Scale</u>: 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) <u>Scoring on Quality of Movement Scale</u>: 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 that 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)
Level of client participation required (is proxy participation available?)	Semi-structures interview - requires active participation. The MAL may be given to caregivers to complete. [1, 2]

Recommendations:

Comments: Recommended for patients who have complaints related to reduced hemiparetic arm function. This tool captures the important element of the patient's perception of arm function. Its inclusion would compliment data gathered in a clinically administered, performance-based test.

Not appropriate to administer to a client who has not been in the community since stroke.

1. Uswatte G, Taub E, Morris D, Light K, Thompson PA. The Motor Activity Log-28: assessing daily use of the hemiparetic arm after stroke. *Neurology.* Oct 10 2006;67(7):1189-1194.

2. Uswatte G, Taub E, Morris D, Vignolo M, McCulloch K. Reliability and validity of the upper-extremity Motor Activity Log-14 for measuring real-world arm use. *Stroke.* 2005;36(11):2493-2496.

3. van der Lee JH, Beckerman H, Knol DL, de Vet HC, Bouter LM. Clinimetric properties of the motor activity log for the assessment of arm use in hemiparetic patients. *Stroke.* 2004;35(6):1410-1414.

Practice Setting	4	3	2	1	Comments
Acute				**x**	**Not appropriate until the patient has had the opportunity to experience the effect of stroke on arm function in real-world settings. Responsiveness data only in chronic stroke.**
Inpatient Rehab	**x**				
Home Health	**x**				
Skilled Nursing	**x**				
Outpatient	**x**				

Overall Comments: Clinical Utility is excellent (shorter administration time for the MAL14). Care-giver proxy version is available. Good - excellent psychometric data but responsiveness data only for chronic stroke.

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				x	
Sub- Acute (2-6 months)	x				
Chronic (>6 months)	x				

Overall Comments: As above

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?		x	Students should be aware of this as an example of self-report arm function measure. This measure is often used in studies of arm intervention so students should be familiar with tool.

Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	x		

Modified Fatigue Impact Scale	
Reviewer: Dorian Rose	
ICF Domain (check all that apply): __x_body function/structure _x_ activity __x__participation	
Type of measure: _____ performance-based __x__self-report Description: 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.[1]	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Test-retest: ICC =0.85[1] (Rietberg, 2010) MS population
Validity (concurrent, criterion-related, predictive)	Concurrent validity: MFIS vs. Fatigue Severity Scale (FSS): r = 0.66; MFIS vs. the Checklist Individual Strength (CIS20R): r = 0.54[1]
Ceiling/ floor effects	Total MFIS scores did not show any floor or ceiling effects[2]
Sensitivity to change (responsiveness, MCID, MDC)	Smallest Detectable Change (SDC) = 16.2[1] Minimal Detectable Change (MDC) % = 19.3%[1]
Instrument use	
Equipment required	Questionnaire
Time to complete	15 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Participants rate on a 5-point Likert scale, with 0 = 'Never' to 4 = 'Almost always' their agreement with 21 statements. 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). A single overall score should not be generated by simply summing the 21 items.[3]

Level of client participation required (is proxy participation available?)	Client participation required

Limitations
The MFIS is a shortened modification of the Fatigue Impact Scale, designed as a self-report measure to rate fatigue in Multiple Sclerosis. Psychometric testing has not been conducted in the stroke population.

References

1. Rietberg MB, Van Wegen EH, Kwakkel G. Measuring fatigue in patients with multiple sclerosis: reproducibility, responsiveness and concurrent validity of three Dutch self-report questionnaires. Disability and Rehabilitation. 2010 March 26 (Epub ahead of print).

2. Kos D, Kerckhofs E, Carrea I, Verza R, Ramos M, Jansa J. Evaluation of the Modified Fatigue Impact Scale in four different European countries. Mult Sclerosis. 2005; 11: 76-80.

3. Mills RS, Young CA, Pallant JF, et al. Rash analysis of the Modified Fatigue Impact Scale (MFIS) in Multiple Sclerosis. J Neurol Neurosurg, Psychiatry. Published online June 14, 2010.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute				**x**	
Inpatient Rehab				**x**	
Home Health			**x**		
Skilled Nursing			**x**		
Outpatient			**x**		
Overall Comments:					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				x	
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		

Overall Comments:

Post-stroke fatigue is an impairment that we do not currently measure/quantify. The FIS was established for the MS population. We do not have psychometrics in stroke so cannot recommend at this time. There is a need for this type of measure for stroke.

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?			x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		Research needs to be done in the post-stroke population to determine/establish validity/reliability.

MODIFIED RANKIN	
Reviewer: PINTO ZIPP	
ICF Domain (check all that apply): _____body function/structure ____ activity ___x__participation	
Type of measure: __x___ performance-based _____self-report	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	• **Test-retest reliability** using the weighted kappa statistic was found to be (kappa w = 0.95) in 50 patients with **strokes** of varying severity (Wolfe, Taub, Woodrow, and Burney, 1991).[1] • Wilson et al. (2005) at 6 months post-stroke found agreement between the first and second assessments in 85% of cases for rater 1 **(kappa = 0.81; kappa w = 0.94**), and in 96% for rater 2 (**kappa = 0.95; kappa w = 0.99**).[2] • Wolfe et al. (1991) noted **intra-rater reliability** of the MRS in a sample of 14 patients who were least 3 months **post-stroke** to be excellent (kappa w = 0.95).[1] • van Swieten et al. (1988) examined the **inter-rater reliablity** of the MRS in 100 patients. The kappa for all pairwise observations was (kappa = 0.56; kappa w = 0.91). For the outpatient group, (kappa = 0.82). For the inpatient group, (kappa = 0.51).[3] • Wolfe et al (1991) noted the **inter-rater reliability** of the MRS in 50 patients with **stroke** of varying severity. The kappa coefficients ranged from kappa = 0.75 to kappa = 0.96.[1] • Wilson et al. (2002)[4] noted **inter-rater reliability** in acute stroke patients using the kappa statistic as kappa w = 0.78, and kappa = 0.25, when examining patients at least 6 months post-**stroke** kappa w = 0.71 (Wilson et al., 2005).[2] • Shinohara, Minematsu, Amano, and Ohashi (2006)[5] examined the inter-rater reliability in twenty raters (neurologists and nurses) who watched videotapes of 30 patient interviews (ICC = 0.95 for neurologists and ICC = 0.96 for nurses). • Zhao H, Collier JM, Quah DM, Purvis T, Bernhardt J (2010) found that the modified Rankin Scale has good inter-rater reliability but questionable validity in **acute stroke** patients. [7]

Validity (concurrent, criterion-related, predictive)	• Cup, Scholte op Reimer, Thijssen, and van Kuyk-Minis (2003) examined **concurrent validity** using Spearman's rho correlation coefficients and found r=-0.81 for Barthel Index (BI), -0.80 for the Frenchay Activities Index (FAI) and 0.68 Euroqol 5D (EQ-56). A correlation was also found between the MRS and the Stroke-Adapted Sickness Impact Profile-30 (SA-SIP30) (r = 0.47).[6] • Wolfe et al. (1991)[1] found excellent correlation **(kappa = 0.72; weighted kappa = 0.91)** between the MRS and the Barthel Index on 50 patients post-**stroke**. • Tilley et al. (1996)[8] found MRS to be closely related to the Glasgow Outcome Scale (94% agreement; Φ = 0.88) and the NIH Stroke Scale (86% agreement; phi coefficient = 0.67) and the Barthel Index (87% agreement; Φ = 0.76).
Ceiling/ floor effects	• **Floor effect** of 18% was noted in 95 **stroke** rehabilitation inpatients on admission (Dromerick, Edwards, and Diringer, 2003).[9]
Sensitivity to change (responsiveness, MCID, MDC)	• Dromerick et al. (2003) administered the MRS, BI and FIM to 95 stroke rehabilitation inpatients at admission and at discharge. The MRS was found to be poor at **detecting change** when compared to the FIM and BI. MRS detected change in 55 subjects, BI 71 patients and the FIM 91 patients.[9]

Equipment required	• Paper pencil
Time to complete	• Less than 5 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	• 0-6 rank based upon criteria stated
Level of client participation required (is proxy participation available?)	• Proxy participation not assessed

Limitations

- Not as sensitive to change as other measure such as the FIM and BI.

Reference

1. Wolfe CD, Taub NA, Woodrow EJ, and Burney PG. Assessment of scales of disability and handicap for stroke patients**.** Stroke 1991;22:1242-1244
2. Lindsay Wilson, J. T., Hareendran, A., Hendry, A., Potter, J., Bone, I., and Muir KW. Reliability of the Modified Rankin Scale Across Multiple Raters: Benefits of a Structured Interview. *Stroke* 2005;36:777-78.
3. Van Swieten JC, Koudstaal PJ, Visser MC, Schouten HJ, van Gijn J. "Interobserver agreement for the assessment of handicap in stroke patients." *Stroke* 1988;19(5):604-7
4. Wilson M. 2002. Six views of embodied cognition. *Psychon. Bull. Rev*. 9:625–36
5. Shinohara, Y., Minematsu, K., Amano, T., Ohashi, Y. (2006). Modified Rankin Scale with expanded guidance scheme and interview questionnaire: interrater Agreement and Reproducibility of Assessment. *Cerebrovasc Dis*, 21, 271-278.
6. Cup, E. H. C., Scholte op Reimer, W. J. M., Thijssen, M. C. E., van Kuyk-Minis, M. A. H. (2003). Reliability and validity of the Canadian Occupational Performance Measure in stroke patients. *Clin Rehabil*, 17, 402-409. 7. Kwon, Harzema, Duncan and Min-Lai 2004
7. Zhao H, Collier JM, Quah DM, Purvis T, Bernhardt J (2010) The modified Rankin Scale in acute stroke has good inter-rater reliability but questionable validity. Cerebrovasc Dis 29(2), 188-93.
8. Tilley, B. C., Marler, J., Geller, N. L., Lu, M., Legler, J., Brott, T., et al (1996). Use of a global test for multiple outcomes in stroke trails with application to the National Institute of Neurological Disorders and Stroke t-PA stroke trial. *Stroke*, 27, 2136-2142.
9. Dromerick, A. W., Edwards, D. F., Diringer, M. N. (2003). Sensitivity to changes in disability after stroke: A comparison of four scales useful in clinical trials. *Journal of Rehabilitation Research and Development*, 40(1), 1-8.

References

Rankin J. "Cerebral vascular accidents in patients over the age of 60."*Scott Med J* 1957;2:200-15

Bonita R, Beaglehole R. "Modification of Rankin Scale: Recovery of motor function after stroke."

***Stroke* 1988 Dec;19(12):1497-1500** Van Swieten JC, Koudstaal PJ, Visser MC, Schouten HJ, van Gijn J. "Interobserver agreement for the assessment of handicap in stroke patients."

Practice Setting	4	3	2	1	Comments
Acute		X			
Inpatient Rehab		X			
Home Health		X			
Skilled Nursing		X			
Outpatient		X			

Overall Comments:

Not as sensitive to change as FIM and BI

Practice Setting	4	3	2	1	Comments
Acute (<2 months)		X			
Sub- Acute (2-6 months)		X			
Chronic (>6 months)		X			

Overall Comments:

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?	x	x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?		X	

Motricity Index	
General Information:	
Target Client Population	Stroke, developed for acute stroke
Topic / Content area / Domain :	Body Structure / Function- motor function, strength
Instrument components (including scoring, type of measure [e.g. performance-based, self-report])	The Motricity Index (MI) is a measure of limb impairment, developed by Demeurisse et al (1979)[1]. In that study, numerous arm and leg movements were analyzed in the first six months after stroke, at four different time points. One movement, at the proximal, middle and distal joints in the arm and leg, was selected to represent strength at each joint. A weighted score was developed based on the difficulty of progressing from one muscle grade to the next over that 6 month period. Maximum total arm score is 99 + 1=100. Same applies for leg score. Guidelines for administering the MI were developed by Collin and Wade (1990)[2].

Motricity Index

UE tests: shoulder abduction, elbow flexion, pinch grip

LE tests: hip flexion, knee extension, dorsiflexion

Scoring for all movement except grip:

0 no movement
9 Palpable contraction in muscle, but no movement

14 Visible movement, but not full range and not against gravity

19 Full range of movement against gravity , but not resistance

25 Full movement against gravity but weaker than the other side

33 Normal power

Grip scoring:

0 no movement
11 Beginnings of prehension

<table>
<tr><td colspan="2">19 Able to grip cube, but not hold it against gravity (examiner may hold the wrist)
22 Able to grip and hold the cube against gravity
26 Able to grip and hold the cube against a weak pull, but weaker than the other side
33 Normal power</td></tr>
<tr><td colspan="2">Instrument properties</td></tr>
<tr><td>Reliability (test-retest, intra-rater, inter-rater)</td><td>Inter-rater:
Spearman rho (p< 0.001)
MI arm 0.88
MI leg 0.87
MI total 0.88
Intra-rater: unknown
Test-retest: unknown</td></tr>
<tr><td>Validity (concurrent, criterion-related, predictive)</td><td>Concurrent:
Sunderland (1989)[3] found that when comparing grip strength to the 9-Hole Peg Test, Motor Club Impairment, Frenchay Arm Test and Motricity Index-arm scores, the Motricity Index-arm test was the most sensitive measure in detecting early change with acute stroke subjects.
Bohannon (1999)[4] found high correlation between dynamometry of UE (criterion for strength) and Motricity Index arm scores, r= 0.89 (p<.001).
Cameron and Bohannon (2000)[5], found high correlation between dynamometry and Motricity –leg scores as well, r> .77 (p<.001).
In Collin and Wade's study[2], the Rivermead Motor Assessment was selected as the criterion measure for the Motricity Index. Assessments were done at 6, 12, and 18 weeks post-stroke within 5 days of each other. Good correlation was found between RMA and MI.</td></tr>
</table>

	RMA/ MI-arm RMA/MI-leg 6 wks 0.76 * 0.81* 12 wks 0.73 * 0.81* 18 wk 0.74 ** 0.75** Spearman rho ,*(p<0.001), **(p<0.010) Predictive: • In the study by Sunderland (1989)[3], acute stroke patients were measured at admission, 1, 3, and 6 months post-stroke with grip strength, the 9-Hole Peg Test, Motricity Index-arm and Motor Club Impairment and Frenchay Arm Test to determine which tests could best predict outcomes at 6 months as measured by the Frenchay Arm Test. The Motricity Index was able to best predict outcomes. • Collin and Wade found that lower scores on the MI combined with the trunk control test at 6 weeks predicted failure to walk by 18 weeks. Construct: • Bohannon found good construct validity with Cronbach α=.968
Responsiveness to change (e.g., MCD, MCID)	• Collin and Wade[2] looked at responsiveness by looking at the scores for the MI for arm and leg 6 weeks apart , and noted an increase. No statistical measure done. • Vos-Vroman (2005)[4] compared the responsiveness of the 10M Walk, Berg Balance Scale and the Motricity Index with 19 acute hemiparetic subjects. 10M ES= 1.17 SRM= 1.68 BBS ES= 0.59 SRM= 0.99 MI ES= 0.27 SRM=0.96
Ceiling/ floor effects	In the Sunderland study[3], comparing grip strength to four established UE measures, the Frenchay and 9-hole peg test showed floor effects on admission however the Motricity Index showed that 57% of patients had measureable pinch grip within the first 3 weeks of a stroke, only 2% had normal pinch grip.
Potential sources of bias	

Availability of normative data	unknown
Extent of use in target and other populations	Used in clinic and stroke research studies , particularly in Europe.
Instrument use	
Equipment required	2.5 x 2.5 cm cube
Time to complete	<5 minutes
Effect of tester experience (expertise/training)	easy to learn,
Level of client participation required	performance-based
Benefits	fast, easy to learn and administer,
Limitations	As with other measures that attempt 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 without the ability to coordinate and grade movement, full function does not occur.
Comments:	• fast • easy to learn and administer • reliable and valid • predictive ability with regard to UE function and walking ability
References (including websites):	1. Demeurisse, G., Demol, O., & Robaye, E. (1980). Motor evaluation in vascular hemiplegia. European Neurology, 19(6), 382-389. 2. Collin C, Wade D. Assessing motor impairment after stroke: a pilot reliability study. J Neurol Neurosurg, Psych 1990; 53:576-579. 3. Sunderland, A., Trinson, D., Bradley, L., Hewer, R. (1989). Arm function after stroke: an evaluation of grip strength as a measure of recovery and a prognostic indicator. Journal of Neurology, Neurosurgery & Psychiatry, 52, 1267-1272. 4. Vos-Vromans et al. Responsiveness of the ten meter walking test and other measures in patients with hemiparesis in the acute phase. Phys Ther Prac 2005; 21;173 (abstract only) 5. Bohannon R. Motricity Index scores are valid indicators of paretic upper extremity strength following stroke. J Phys Ther Sci 1999; 11;59-61. 6. Cameron D, Bohannon R. Criterion validity of lower extremity Motricity Index scores. Clin Rehabil 2000; 14:208.

Practice Setting	4	3	2	1	Comments
Acute		x			
Inpatient Rehab		x			
Home Health		x			
Skilled Nursing		x			
Outpatient		x			

Overall Comments:

Without strong psychometrics- biggest selling points are speed, ease of use, correlates to dynamometry, has ability to detect small UE movement in early acute stroke and better at predicting 6 month UE outcomes as measured by the Frenchay than grip strength, the Frenchay and the 9 hole peg test on admission.

Would use early on after stroke onset for its use in predicting UE function and when combined with the trunk control test to predict walking ability

quick, easy to learn and administer, only equipment is 1 inch cube

tests one representative movement at the proximal, middle and distal joint of arm and leg

good inter-rater reliability, otherwise unknown

good construct validity

good concurrent validity with dynamometry, UE and LE

good concurrent validity with grip strength and Rivermead Motor Assessment

good predictive validity for MI-arm and UE function, able to detect a pinch in first 3 weeks of stroke when 9 hole peg test and Frenchay could not.

low MI-leg and Trunk Control Test scores at 6 weeks could predict walking ability at 18 weeks

Practice Setting	4	3	2	1	Comments
Acute (<2 months)		x			
Sub- Acute (2-6 months)		x			
Chronic (>6 months)					
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?			x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	UE	LE	**- would consider use in UE research** **- when comparing the responsiveness of the 10M walk, BBS, MI-leg scores, MI showed poor responsiveness to change**

National Institutes of Health Stroke Scale (NIHSS)	
Reviewer: Beth Crowner	
ICF Domain (check all that apply): __X[1]__body function/structure _____ activity _____participation	
Type of measure: __X___ performance-based _____self-report Description: Measures severity of symptoms associated with cerebral accidents and is used as a quantitative measure of neurological deficit post stroke. 15 items used to assess severity in LOC, ability to respond to questions and obey simple commands, papillary response, deviation of gaze, hemianopsia, facial palsy, resistance to gravity in hemi limb, plantar reflexes, limb ataxia, sensory loss, visual neglect, dysarthria, and aphasia.	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Test-Retest: adequate to excellent (kappa 0.66-0.77)[1] Intra-Rater: excellent (ICC=0.93) for non-neurologists[2] Inter-Rater (11 studies): 6 excellent[2-7]; 1 adequate[8]; 3 adequate to excellent[9-11]; 1 poor to excellent[12] (kappa 0.29-0.97) Good reliability for use in current patients, retrospectively, and via tele-medicine; Good reliability dependent on use of trained raters and standardized use of rating scale. Recommended that raters be trained prior to use of the instrument[6]
Validity (concurrent, criterion-related, predictive)	Concurrent: Poor correlations between NIHSS and Modified Rankin (correl. coeff=0.219) and Barthel (coeff. -0.165) [5], but study patients were all mild.; adequate to excellent correlations with infarct volumes using CT (r=0.54-0.74) [1, 13] and MRI(r=0.61-0.71) [14, 15] Predictive: Predicts Barthel, Rankin and Glascow Outcome Scale at 3 months[16]; if administered in 24 hrs, retrospectively predicts next level of care after acute hosp.[17]; predicts clinical outcome[18, 19], recovery[20], discharge destination[21], 3 month mortality[22], presence and location of vessel occlusion[23] Does not correlate well with SS-QOL.[24]

Ceiling/ floor effects	Poor regarding strong ceiling effect[19, 24, 25]
Sensitivity to change (responsiveness, MCID, MDC)	Responsiveness: in comparing scale scores to infarction size, agreement of score change was achieved in 40/63 patients, demonstrating responsiveness to change.[1] No MCID/MDC info. is available

Instrument use

Equipment required	Questionnaire with attached images
Time to complete	6.6 minutes[1]
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Items graded on 3-4 point scale, 0=no improvement. Points are totaled and an increased score denotes increased severity. >25 (very severe), 15-24 (severe), 5-14 (mild to moderate), 1-5 (mild impairment)[1]
Level of client participation required (is proxy participation available?)	Can be based on evaluation performed and reported by Neurologist[1], Reliable when used remotely via the REACH system (telestroke).[8]

Limitations

- Good reliability depended on trained rater and standardized application of rating scale.
- Videotape training is effective in producing mod → excellent reliability.[10]
- 'Limb Ataxia' did not correlate well with identified scale factors and has been recommended for elimination.[3, 6, 9]
- Limited items for severe stroke may favor assessment of left hemisphere strokes. [5, 26] Fink et all[9] found only a significant difference between the hemispheres for NIHSS after adjustment for lesion volume when chronic T2 (MRI) lesions were studied, but patients with right-sided stroke may have a low NIHSS score despite substantial diffusion-weighted MRI lesion volume.
- Scoring differs if used for retrospective evaluation. If using this approach, ratings should be based on evaluation reports from a neurologist[8, 27]
- Certification in use is required for participation in many clinical trials and is recommended to maintain reliable assessment practices. DVD training is available and has been demonstrated to be valid and reliable for individuals, groups or website users.[16]

Recommendations:

Comments: Note: the SIS may be a better measure but the above practice settings are what would be appropriate IF the NIHSS was chosen

(1) Brott T, Adams HP, Jr., Olinger CP et al. Measurements of acute cerebral infarction: a clinical examination scale. *Stroke* 1989 July;20(7):864-70.
(2) Goldstein LB, Samsa GP. Reliability of the National Institutes of Health Stroke Scale. Extension to non-neurologists in the context of a clinical trial. *Stroke* 1997 February;28(2):307-10.
(3) Dewey HM, Donnan GA, Freeman EJ et al. Interrater reliability of the National Institutes of Health Stroke Scale: rating by neurologists and nurses in a community-based stroke incidence study. *Cerebrovasc Dis* 1999 November;9(6):323-7.
(4) Kasner SE, Chalela JA, Luciano JM et al. Reliability and validity of estimating the NIH stroke scale score from medical records. *Stroke* 1999 August;30(8):1534-7.
(5) Meyer BC, Hemmen TM, Jackson CM, Lyden PD. Modified National Institutes of Health Stroke Scale for use in stroke clinical trials: prospective reliability and validity. *Stroke* 2002 May;33(5):1261-6.
(6) Schmulling S, Grond M, Rudolf J, Kiencke P. Training as a prerequisite for reliable use of NIH Stroke Scale. *Stroke* 1998 June;29(6):1258-9.
(7) Williams LS, Yilmaz EY, Lopez-Yunez AM. Retrospective assessment of initial stroke severity with the NIH Stroke Scale. *Stroke* 2000 April;31(4):858-62.
(8) Bushnell CD, Johnston DC, Goldstein LB. Retrospective assessment of initial stroke severity: comparison of the NIH Stroke Scale and the Canadian Neurological Scale. *Stroke* 2001 March;32(3):656-60.
(9) Goldstein LB, Bertels C, Davis JN. Interrater reliability of the NIH stroke scale. *Arch Neurol* 1989 June;46(6):660-2.
(10) Lyden P, Brott T, Tilley B et al. Improved reliability of the NIH Stroke Scale using video training. NINDS TPA Stroke Study Group. *Stroke* 1994 November;25(11):2220-6.
(11) Shafqat S, Kvedar JC, Guanci MM, Chang Y, Schwamm LH. Role for telemedicine in acute stroke. Feasibility and reliability of remote administration of the NIH stroke scale. *Stroke* 1999 October;30(10):2141-5.
(12) Meyer BC, Lyden PD, Al-Khoury L et al. Prospective reliability of the STRokE DOC wireless/site independent telemedicine system. *Neurology* 2005 March 22;64(6):1058-60.
(13) Saver JL, Johnston KC, Homer D et al. Infarct volume as a surrogate or auxiliary outcome measure in ischemic stroke clinical trials. The RANTTAS Investigators. *Stroke* 1999 February;30(2):293-8.
(14) Derex L, Nighoghossian N, Hermier M et al. Influence of pretreatment MRI parameters on clinical outcome, recanalization and infarct size in 49 stroke patients treated by intravenous tissue plasminogen activator. *J Neurol Sci* 2004 October 15;225(1-2):3-9.
(15) Schiemanck SK, Post MW, Witkamp TD, Kappelle LJ, Prevo AJ. Relationship between ischemic lesion volume and functional status in the 2nd week after middle cerebral artery stroke. *Neurorehabil Neural Repair* 2005 June;19(2):133-8.
(16) Lyden P, Lu M, Jackson C et al. Underlying structure of the National Institutes of Health Stroke Scale: results of a factor analysis. NINDS tPA Stroke Trial Investigators. *Stroke* 1999 November;30(11):2347-54.
(17) Schlegel D, Kolb SJ, Luciano JM et al. Utility of the NIH Stroke Scale as a predictor of hospital disposition. *Stroke* 2003 January;34(1):134-7.
(18) Demchuk AM, Tanne D, Hill MD et al. Predictors of good outcome after intravenous tPA for acute ischemic stroke. *Neurology* 2001 August 14;57(3):474-80.
(19) Muir KW, Weir CJ, Murray GD, Povey C, Lees KR. Comparison of neurological scales and scoring systems for acute stroke prognosis. *Stroke* 1996 October;27(10):1817-20.

(20) Adams HP, Jr., Davis PH, Leira EC et al. Baseline NIH Stroke Scale score strongly predicts outcome after stroke: A report of the Trial of Org 10172 in Acute Stroke Treatment (TOAST). *Neurology* 1999 July 13;53(1):126-31.
(21) Rundek T, Mast H, Hartmann A et al. Predictors of resource use after acute hospitalization: the Northern Manhattan Stroke Study. *Neurology* 2000 October 24;55(8):1180-7.
(22) Chang KC, Tseng MC, Tan TY, Liou CW. Predicting 3-month mortality among patients hospitalized for first-ever acute ischemic stroke. *J Formos Med Assoc* 2006 April;105(4):310-7.
(23) Fischer U, Arnold M, Nedeltchev K et al. NIHSS score and arteriographic findings in acute ischemic stroke. *Stroke* 2005 October;36(10):2121-5.
(24) Williams LS, Weinberger M, Harris LE, Clark DO, Biller J. Development of a stroke-specific quality of life scale. *Stroke* 1999 July;30(7):1362-9.
(25) Pickard AS, Johnson JA, Feeny DH. Responsiveness of generic health-related quality of life measures in stroke. *Qual Life Res* 2005 February;14(1):207-19.
(26) Woo D, Broderick JP, Kothari RU et al. Does the National Institutes of Health Stroke Scale favor left hemisphere strokes? NINDS t-PA Stroke Study Group. *Stroke* 1999 November;30(11):2355-9.
(27) Anemaet WK. Using standardized measures to meet the challenge of stroke assessment. *Topics in Geriatric Rehabilitation* 2002 December;18(2):47-62.

Practice Setting	4	3	2	1	Comments
Acute		x			The tool is largely used as a predictive measure in acute stroke; may be less useful in sub-acute settings although it can be used retrospectively
Inpatient Rehab		x			
Home Health		X			
Skilled Nursing		X			
Outpatient		X			
Overall Comments:	While the test can be administered by non-MD's, PT's seldom administer the scale. NIHSS scale items are not testable in patients that have sustained severe stroke Test takes > 20 minutes to administer.				

Patient Acuity	4	3	2	1	Comments
Acute (< 2 mos)		x			
Subacute (2-6 mos)		x			
Chronic (> 6 mos)		X			
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?	No	Yes	Widely used tool but is most frequently administered by non PT's
Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	X		

Nottingham Assessment of Somatosensation (NSA)	
Reviewer: Sullivan	
ICF Domain (check all that apply): __x__body function/structure ____ activity ___participation	
Type of measure: __x___ performance-based _ self-report	
Instrument properties: Multi-modal sensory examination includes tests of: 1. Tactile sensation (light touch, touch localization, temperature discrimination, pinprick sensation, bilateral simultaneous stimulation), 2. Kinesthesia and 3. Stereognosis.	
Reliability (test-retest, intra-rater, inter-rater)	Inter-rater reliability – data not published but one article reports that, "Kappa coefficients showed acceptable agreement on 12 out of 86 items. Light touch and pressure scales were most reliable and pin-prick and temperature scales were least reliable".[1] Inter-rater reliability of the stereognosis subtest reported to kappa coefficients 0.38 – 1.0. Coefficients were higher on the unaffected side and for certain items (scossors, sponge, cup).[2] Intra-rater and inter-rater reliability of the Erasmus MC modifications to the Nottingham Sensory Assessment (EmNSA) - kappa coefficients 0.58 - 1.00. Two point discrimination was less reliable 0.11 - 0.63.[3] Inter-rater reliability of EmNSA - kappa coefficients 0.46 1.00. Two point discrimination was less reliable 0.10 - 0.66.[3]
Validity (concurrent, criterion-related, predictive)	Not reported
Ceiling/ floor effects	Not reported
Sensitivity to change (responsiveness, MCID, MDC)	Not reported

Instrument use	
Equipment required	For tactile sensation → blindfold, cotton ball, Neurotip, 2 test tubes for hot and cold water, talcum powder For stereognosis assessment →Blindfold, 2 different coins, pen, pencil, comb, scissors, sponge, piece of flannel cloth, cup, glass
Time to complete	Entire test can take up to 60 minutes, depending on the client's sensory impairment. Kinesthesia and Stereognosis tests take approximately 15 minutes each. A revised assessment[4] was shortened with "decision rules" (e.g. if the patient has intact sensation distally, proximal sensation is assumed to be normal and not tested; the "intact "side is not tested; 2-point discrimination was eliminated as not thought to be clinically relevant)
How is the instrument scored? (e.g. total score, are there subscales, etc.)	<u>For tactile sensation</u>→ 0 - *Absent* -fails to identify the test sensation on 3 trials 1 - *Impaired* - identifies the test sensation, but not on all 3 trials in each region of the body or feels duller 2 - *Normal* - correctly identifies the test sensation on 3 trials <u>For stereognosis</u> → 2 - *Normal* - item is correctly named or matched. 1 -*Impaired* - some features of object identified or attempts descriptions of objects. 0 -*Absent* - unable to identify the object in any manner. <u>For kinesthesia</u>→ 0 - *Absent* - no appreciation of movement taking place 1 - *Appreciation of movement taking place* - indicates on each movement that a movement takes place but the of movement direction is incorrect 2 – *Direction of movement sense* - able to appreciate and mirror the direction of the test movement, but is inaccurate in its new position. 3 - *Joint Position Sense* - accurately mirrors the test movement to within 10°of the new test position

Level of client participation required (is proxy participation available?)	Client must actively participate in test. Proxy version not available.

Limitations: Time to administer
Comments: 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 &/or if sensory loss is hypothesized to underlie the patient's movement dysfunction.
Comments: 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.
Comments: This tool has been used in clinical trials following stoke to test interventions such as electrical stimulation and task specific training. The inclusion of a sensory outcome measure in clinical trials could advance knowledge by identifying those interventions 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.

Practice Setting	4	3	2	1	Comments
Acute				**x**	
Inpatient Rehab			**x**		
Home Health			**x**		
Skilled Nursing			**x**		
Outpatient			**x**		

Overall Comments:

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 & time). Those two 2 tests may be more appropriate for use in the clinic in that they use standardized equipment and procedures and have some acceptable psychometric data available.

Practice Setting	4	3	2	1	Comments
Acute (<2 months)			x		
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		

Overall Comments: See comments above

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?		x	This tool has been used in clinical trials following stoke to test interventions such as electrical stimulation and task specific training. The inclusion of a sensory outcome measure in clinical trials could advance

			knowledge by identifying those interventions 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

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		This tool has been used in clinical trials following stoke to test interventions such as electrical stimulation and task specific training. The inclusion of a sensory outcome measure in clinical trials could advance knowledge by identifying those interventions 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.

1. Lincoln NB, Jackson JM, Adams SA. Reliability and revision of the Nottingham Sensory Assessment for stroke patients. *Physiotherapy.* 1998;84(8):358-365.Gaubert C, Mockett S. Inter-rater reliability of the Nottingham method of stereognosis assessment. *Clinical Rehabilitation.* 2000;14(2):153-159.

2. Stolk-Hornsveld F, Crow J, Hendriks E, van der Baan R, Harmeling-van der Wel B. The Erasmus MC modifications to the (revised) Nottingham Sensory Assessment: a reliable somatosensory assessment measure for patients with intracranial disorders. *Clinical Rehabilitation.* 2006;20(2):160-172.

3. Lincoln N, JM J, SA A. Reliability and Revision of the Nottingham Sensory Assessment for Stroke Patients. *Physiotherapy.* 1998;84(8):358-365.

Orpington Prognostic Scale	
Reviewer: Dorian Rose	
ICF Domain (check all that apply): __x___body function/structure _____ activity _____participation	
Type of measure: ___xx__ performance-based _____self-report	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Test-retest: ICC = 0.95[1]; Inter-rater: ICC = 0.99 [1]
Validity (concurrent, criterion-related, predictive)	Predictive: OPS at 2 wks post-onset predicted discharge disposition in patients over 75 yrs. Patients with OPS < 3.2 were d/c home within 3 wks of stroke, and scores > 5.2 required long term care. 3.2-5.2: benefit from intensive rehabilitation. [2] Predictive: OPS at 48 hrs post-onset predicted length of hospital stay, place of discharge, and outcome at 6 months and 2 years [3] Predictive OPS score at 2 weeks post-stroke correlated with improvement in FIM score (*r* =-0 .74) and discharge FIM score (*r* =-0 .81) [4]
Ceiling/ floor effects	Not provided
Sensitivity to change (responsiveness, MCID, MDC)	N/A

Instrument use	
Equipment required	Score sheet/list of cognition questions
Time to complete	15 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Total score; there are 4 domains (motor, proprioception, balance, cognition) that are summed to provide a total score with a lower score reflective of less impairment.
Level of client participation required (is proxy participation available?)	Client participation required

Comments: Should be presented as a tool to suggest discharge destination after acute hospital stay. **I think students should be exposed to this tool, but not necessarily required to administer it.**
Excellent predictive validity underscores the importance of this test in acute care.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute	**x**				
Inpatient Rehab	**x**				x (if transferred to IP Rehab within 2 weeks post-onset)
Home Health					
Skilled Nursing					
Outpatient					
Overall Comments: This assessment is very easy to administer (3/4 domains are probably already part of an acute eval) and provides predictive validity as to outcome. Experienced therapists may feel they "do not need" such an assessment as through their clinical experience "can subjectively tell" an individual's prognosis. The OPS provides an objective measurement for those not highly experienced in acute stroke care.					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)	x				Specifically, less than 2 weeks post-stroke
Sub- Acute (2-6 months)					
Chronic (>6 months)					
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?	x			Provides an objective measure to predict stroke outcome. 3/4 domains are ones that PT's would already assess. There are an additional 10 cognitive questions that we typically would not ask.

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		

References

1. Rieck M, Moreland J. The Orpington Prognostic Scale for patients with stroke: Reliability and pilot predictive data for discharge destination and therapeutic services. Disability and Rehabilitation. 2005;27:1425-1433.
2. Kalra L, Crome P. The role of prognostic scores in targeting stroke rehabilitation in elderly patients. J Am Geriat Soc. 1993;41:396-400.
3. Pittock SJ, Meldrum D, Ni Dhuill C, Hardiman O, Moroney JT. The Orpington Prognostic Scale within the first 48 hours of admission as a predictor of outcome in ischemic stroke. J Stroke Cerebrovasc Dis 2003;12:175-181.
4. Shoemaker MJ, Mullins-MacRitchie M, Bennett J, Vryhof K, Boettcher I.
Predicting Response to Rehabilitation in Elderly Patients with Stroke Using the Orpington Prognostic Scale and Selected Clinical Variables. J Geriatr Phys Ther. 2006; 29(2):69-73.

Instrument Name: Postural Assessment Scale for Stroke Patients (PASS)	
General Information:	
Target Client Population	Stroke
Topic / Content area / Domain:	Activity Measure- Trunk
Instrument components (including scoring, type of measure [e.g. performance-based, self-report])	Because sitting balance has been correlated to attaining greater independence with functional activity with stroke patients[1,2], many clinicians feel that early assessment of postural control is an important part of a clinical exam. The Postural Assessment Scale for Stroke Patients (PASS) is a 12 item performance-based assessment designed specifically for stroke patients. Benaim et al (1999)[3] developed the tool with the intent that it: (1) be used with patients of all levels of impairment, (2) contain items of increasing difficulty and (3) assess the ability to maintain or change a given lying, sitting or standing as well as move between these postures.[3] The items on the PASS are adapted from the Fugl-Meyer Assessment (FMA)[11]. Unlike the FMA, which uses a 3-point grading scale, the PASS utilizes 4 levels of grading to make it a more sensitive scale in an attempt to capture change that is often not reflected in the middle score on the FMA. PASS Items and Criteria for Scoring Maintaining a Posture 1. Sitting without support (sitting on the edge of an 50-cm-high examination with the feet touching the floor) 0=cannot sit 1=can sit with slight support, for example, by 1 hand 2=can sit for more than 10 seconds without support 3=can sit for 5 minutes without support

	2. Standing with support (feet position free, no other constraints) 0=cannot stand, even with support 1=can stand with strong support of 2 people 2=can stand with moderate support of 1 person 3=can stand with support of only 1 hand 3. Standing without support (feet position free, no other constraints) 0=cannot stand without support 1=can stand without support for 10 seconds or leans heavily on 1 leg 2=can stand without support for 1 minute or stands slightly asymmetrically 3=can stand without support for more than 1 minute and at the same time perform arm movements above the shoulder level 4. Standing on nonparetic leg (no other constraints) 0=cannot stand on nonparetic leg 1=can stand on nonparetic leg for a few seconds 2=can stand on nonparetic leg for more than 5 seconds 3=can stand on nonparetic leg for more than 10 seconds 5. Standing on paretic leg (no other constraints) Same scoring as item 4 Changing Posture Scoring of items 6 to 12 is as follows (items 6 to 11 are to be performed with a 50-cm-high examination table, like a Bobath plane; items 10 to 12 are to be performed without any support; no other constraints):

	0=cannot perform the activity 1=can perform the activity with much help 2=can perform the activity with little help 3=can perform the activity without help 6. Supine to affected side lateral 7. Supine to nonaffected side lateral 8. Supine to sitting up on the edge of the table 9. Sitting on the edge of the table to supine 10. Sitting to standing up 11. Standing up to sitting down 12. Standing, picking up a pencil from the floor
Reliability (test-retest, intra-rater, inter-rater)	In the Benaim study (1999)[3], a separate group of 12 subjects was used to test reliability. Two raters (1 physical therapist and I physiatrist) assessed each subject on the same day. Three days later, the physiatrist re-examined each subject. The PASS was shown to have high inter-rater agreement (average κ-coefficient =0.88) and intra-rater agreement (average κ-coefficient = 0.72). The Pearson correlation between global scores reflected high inter-rater and intra-rater reliability, 0.99 ($P<10^{-6}$) and 0.98 ($P<10^{-6}$), respectively. In 2002, Mao et al[4] compared the psychometric properties of the PASS, FM-balance subscale[11], and Berg Balance Scale (BBS)[12] with 123 patients at 14, 30, 90 and 180 days after stroke. The inter-rater

	agreement on individual items on all three measures using the median weighted κ scores were > .75, indicating good item agreement. The ICC 's for total scores were >0.92 for all scales, indicating excellent total score agreement. Internal consistency: (Cronbach -coefficient=0.95, indicating that the PASS is homogenous and likely to produce consistent responses. [3,4]
Validity (concurrent, criterion-related, predictive)	• Construct: • Benaim reports strong correlation on Day 30 assessment between the PASS and total FIM (0.73; $P<10^{-6}$), transfer FIM (0.82; P<10) and locomotor FIM (0.73; $P<10^{-6}$), as well as with motricity, sensation and spatial neglect. The more severe the impairment, the lower the PASS score. • Mao found that pair-wise correlations between the PASS, FM-Balance and BBS scores, were high (>0.90) across all 4 time periods that patients were assessed. Predictive: • Benaim[3] showed strong correlation between Day 30 PASS scores and Day 90 total FIM (r=.75; $P<10^{-6}$), transfer FIM (r=0.74;$P<10^{-6}$) and locomotion FIM(r=0.71, $P<10^{-6}$) scores. • DiMonaco[2], et al found that the scores for the PASS and the Trunk Impairment Scale both were significantly associated with Discharge FIM numbers. While both measures predicted functional ability as well as destination at discharge, the PASS had a slightly better prognostic value.[2]
Responsiveness to change (e.g., MCD, MCID)	Mao[4] showed that the PASS was responsive to change before Day 90 Effect Size ≥0.8 at 14-30 days post stroke and ≥0.63 at 30-90 days post stroke

Ceiling/ floor effects	The scale demonstrates a ceiling effect, limiting a discriminative ability between individuals. This was noted across four points in time in the original study done by Benaim et al. Because nearly 40% of patients score 36/36 on D90, Benaim et al recommended after that date that a more difficult tool be used to measure balance, e.g., the step test. Mao noted that the PASS does not have a floor effect in the first 14 days after stroke as do the Berg and FM-balance.
Potential sources of bias	
Availability of normative data	In the Benaim study, normative data was collected on 30 age-matched controls. Maximal scores were obtained with all but 3 subjects. The item for single limb stance > 10 seconds posed the only difficulty. The mean PASS score was 35.7 out of 36, with scores ranging from 32-36.
Extent of use in target and other populations	
Instrument use	
Equipment required	• Examination table, ~ 50 cm high, • watch with second hand
Time to complete	10 minutes
Effect of tester experience (expertise/training)	Does not require extensive training or expertise. Items are tasks that are routinely observed and assessed in a therapy session.
Level of client participation required	performance-based
Benefits	• quick • easy to learn and administer, • good predictive ability to help plan treatment, • can be used with all levels of patients, • able to detect change, particularly 14-30 days after stroke, less responsive up to 90 days post-stroke
Limitations	see above ceiling effects
Comments:	A modified version of the PASS, the PASS-TC is a five item test, similar to the Trunk Control Test[10], (sitting unsupported, rolling to sound side, rolling to weaker side, moving from supine to sitting over edge of bed) except the PASS-TC has an additional item in moving from sitting to supine.

10

	Reliability: The PASS-TC showed excellent inter-rater reliability with ICC of total score 0.97 (95% CI, 0.95 to 0.98) and high internal consistency with Cronbach values of 0.94 and 0.97 for each rater.[5] Convergent validity: The PASS-TC scores correlated highly to the Barthel Index and Fugl-Myer-balance scores (Pearson r=0.89 and r=0.73, respectively; P<0.0001).[5] Predictive validity: In a study by Hsieh et al (2002)[5], the PASS-TC, age, FM-motor, and Barthel Index were the best predictors of comprehensive ADL function (combined scores of Barthel Index[8] and Frenchay Activities Index[9]) at 6 months post-stroke, with the PASS-TC accounting for 45% of the variance and having slightly more power than the other variables. [5,] Wang et al (2005)[6] found that the PASS-TC at 14, 30, 90, and 180 days post stroke, correlated with comprehensive ADL's at one year. (Spearman p≥.5, P <.001). These results are similar to study by Franchgioni[7] et al looking at the Trunk Control Test[10] as a predictor of ADL function as measured by the total discharge FIM. Responsiveness: The PASS-TC was moderately responsive in the acute phase of 14-30 days post-stroke. (SRM=.65, Wilcoxian z=9.12, P<.001) By days 30-90 post-stroke, responsiveness was small and very poor after 90 days. [6] Limitations: The PASS-TC shows ceiling effects at all time points. More than 75% of patients achieved the maximal score by day 90. The PASS-TC could not detect change beyond 90 days.
References (including websites):	1. The measure of balance in sitting in stroke rehabilitation prognosis. Sandin and Smith Stroke.1990; 21:82-86. 2. The relationship between initial trunk control or postural balance and inpatient rehabilitation

outcome after stroke: a prospective comparative study.

Di Monaco et al. Clin Rehabil.2010; 24: 543-554

3. Validation of a Standardized Assessment of Postural Control in Stroke Patients. Benaim, c., et al. Stroke 1999; 30:1862-1868

4. Analysis and Comparison of the Psychometric Properties of Three Balance Measures for Stroke Patients. Mao, et al. Stroke. 2002; 33:1022- 1027.

5. Trunk Control as an Early Predictor of Comprehensive Activities of Daily Living Function in Stroke Patients. Hsieh, et al. Stroke. 2002; 33:2626.

6. Discriminative, predictive and evaluative properties of a trunk control measure in patients with stroke. Wang, et al. Physical Therapy 2005; 85(9): 887-894.

7. Franchignoni FP, Tesio L, Ricupero C, Martino MT. Trunk control test as an early predictor of stroke rehabilitation outcome. Stroke. 1997; 28: 1382–1385.

8. Mahoney FI, Barthel D. "Functional evaluation: the Barthel Index." Maryland State Medical Journal 1965; 14:56-61.

9. Holbrook M, Skilbeck CE. An activities index for use with stroke patients. Age Ageing. 1983; 12: 166–170.

10. Collin C, Wade D. Assessing motor impairment after stroke: a pilot reliability study. J Neurol Neurosurg Psychiatry. 1990; 53:576-579.

11. Fugl-Meyer AR, Jaasko L, Leyman I, Olsson S, Steglind S. The post-stroke hemiplegic patient, I: a method for evaluation of physical performance. Scand J Rehabil Med. 1975; 7: 13–31

12. Berg, K., Wood-Dauphinee, S. L., Williams, J. I. (1995). The Balance Scale: reliability assessment with elderly residents and patients with an acute stroke. Sc and J Rehabil Med, 27(1), 27-36.

StrokEngine: http://www.medicine.mcgill.ca/strokengine

Practice Setting	4	3	2	1	Comments
Acute	**x**				**Admission PASS scores, were able to predict functional ability as measured by discharge FIM scores, as well as discharge location. PASS slightly better than Trunk Impairment Scale at predicting.**
Inpatient Rehab	**x**				**- Strong correlation between PASS ,total FIM, transfer FIM, locomotor FIM, motricity, sensation and spatial neglect on Day 30 post stroke;** **-Some redundancy with FiM as noted by 2nd reviewer, but gives more info on those individuals that cannot walk or stand**
Home Health	**x**				
Skilled Nursing	**x**				
Outpatient	**x**				**Day 30 PASS scores correlated with Day 90 total FIM (predictive)**

- **Overall Comments: Most responsive day 14-30 post –stroke, therefore its use seems to be more dependent on timing than practice setting. May have less utility in the OP setting in those individuals with mild impairment both from a predictive standpoint and may have a ceiling effect. (But pts with Medicaid often end up in hospital OP settings early after stroke) The PASS contains routine functional movements assessed in the clinic and thus gives an objective score .**

- **reliable and valid tool,**
- **can be used with all levels of stroke,**
- **does not have a floor effect with lower functioning patients in the first 14 days post stroke as do the BERG and Fugl-Myer Balance subscale,**
- **does have ceiling effect after 90 days**
- takes <10 minutes to administer,
- need only stopwatch,
- no special training

with acute subjects <90 days, suggested by Benaim to use another tool to measure/ capture balance difficulties at later time points

Practice Setting	4	3	2	1	Comments
Acute (<2 months)	x				
Sub- Acute (2-6 months)		x		x	responsive to change before day 90 post-stroke
Chronic (>6 months)				x	
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments see above overall comments
Should this tool be required for entry level curricula?	x			

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		**Acute stroke only**

Borg's Rate of Perceived Exertion (RPE)	
Reviewer: Kluding	
ICF Domain (check all that apply): __X___body function/structure ____ activity ____participation	
Type of measure: _____ performance-based __X_self-report	
Instrument properties	
Reliability (test-retest, intra-rater, inter-rater)	**Test-retest reliability**: Not reported in stroke. However, one study 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.[1] Test-retest reliability is variable in studies of healthy subjects, with ICC values of 0.75-0.82.[2]
Validity (concurrent, criterion-related, predictive)	**<u>Concurrent</u>** RPE poorly correlated with 6 MWT and 12 MWT distance in people with stroke.[1] Strong correlation between RPE and ratings of exertion fatigue on a visual analog scale following exercise (r=0.8, p=0.00) in people with stroke.[3] **<u>Criterion-related</u>** 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):[4] Range of mean validity coefficients with RPE:

<table>
<tr><td></td><td>
<table>
<tr><td>Heart rate</td><td>Blood lactate</td><td>VO_{2max} or VO_2</td><td>Ventilation</td><td>Resp rate</td></tr>
<tr><td>0.47-0.61</td><td>0.42-0.69</td><td>0.31-0.76</td><td>0.53</td><td>0.67</td></tr>
</table>

Strongest relationships were noted in highly fit male participants at high (maximal) exertion.[4]

<u>Predictive</u>

The RPE scale (with rating of 6 to 20) was developed so heart rate could be predicted by multiplying the RPE by 10.[5]

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.[1]
</td></tr>
<tr><td>Ceiling/ floor effects</td><td>Not reported in stroke</td></tr>
<tr><td>Sensitivity to change (responsiveness, MCID, MDC)</td><td>Not reported in stroke</td></tr>
<tr><td colspan="2">Instrument use</td></tr>
<tr><td>Equipment required</td><td>A copy of the scale to explain the categories</td></tr>
<tr><td>Time to complete</td><td>A few seconds</td></tr>
<tr><td>How is the instrument scored? (e.g. total score, are there subscales, etc.)</td><td>Multiple versions of the scale exist, most commonly used are the scale with a range of scores 6-20, or 1-10.</td></tr>
<tr><td>Level of client participation required (is proxy participation available?)</td><td>No proxy participation available.</td></tr>
</table>

Limitations: 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

1. Eng JJ, Chu KS, Dawson AS, Kim CM, Hepburn KE. Functional walk tests in individuals with stroke: Relation to perceived exertion and myocardial exertion. *Stroke.* 2002;33:756-761.

2. Lamb K, Eston R, Corns D. Reliability of ratings of perceived exertion during progressive treadmill exercise. *Br J Sports Med.* 1999;33(5):336-339.

3. Tseng BY, Gajewski BJ, Kluding P. Reliability, responsiveness, and validity of the Visual Analog Fatigue Scale to measure exertion fatigue in people with chronic stroke: A preliminary study. *Stroke Res Treat.* 2010;2010:7 pages.

4. Chen M, Fan X, Moe S. Criterion-related validity of the Borg rateings of perceived exertion scale in healthy individuals: a meta-analysis. *J Sports Sci.* 2002;20:873-899.

5. Borg G. Pyschophysical bases of perceived exertion. *Med Sci Sports Exerc.* 1982;14(5):377-381.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute				**X**	
Inpatient Rehab				**X**	
Home Health				**X**	
Skilled Nursing				**X**	
Outpatient				**X**	
Overall Comments: 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.					

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute (<2 months)				X	
Sub- Acute (2-6 months)				X	
Chronic (>6 months)				X	
Overall Comments: See above**.**					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?			X	

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?		X	

Rivermead Assessment of Somatosensory Performance (RASP)	
Reviewer: Sullivan	
ICF Domain (check all that apply): __x__body function/structure _____ activity ___participation	
Type of measure: __x___ performance-based _ self-report	
Instrument properties: The RASP is a multi-modal sensory tool that tests 5 sensations (sharp/dull discrimination, surface pressure, tactile localization, temperature discrimination, joint movement and movement discrimination), and 2 secondary sensations (bilateral touch discrimination and two-point discrimination). Sensation is tested on the face, hand and foot.	
Reliability (test-retest, intra-rater, inter-rater)	Test-retest overall (r=0.92) varies among subtests from 0.96 (surface localization) to 0.50 (proprioception direction)[1] Inter-rater reliability (r=0.92)[1]
Validity (concurrent, criterion-related, predictive)	Low correlations with the Rivermead Mobility Index (r=0.08 – 0.36 depending on subtest); Rivermead Motor Assessment (r=0.05-0.32); and Barthel Index (r=0.09-0.31)[1]
Ceiling/ floor effects	Not reported
Sensitivity to change (responsiveness, MCID, MDC)	Not reported
Instrument use	
Equipment required	In an effort to improve reliability of sensory testing, custom equipment were developed for the test, including the 1. "neurometer" – a pen shaped device that allows consistent amount of pressure to be applied to an area, 2. "neurotemp" which has temperature displays standardization of temperature stimuli, and the 3. "two-point neurodiscriminator" - a 4-pointed fixed distance discriminator used to test 2-point discrimination on the finger pads Although customized of equipment may improve reliability, the tools are

<table>
<tr><td></td><td>only available commercially.</td></tr>
<tr><td>Time to complete</td><td>20-45 minutes depending on the client's level on sensory deficit</td></tr>
<tr><td>How is the instrument scored? (e.g. total score, are there subscales, etc.)</td><td>"Sham" tests (no stimuli applied) are first done using 2 subtests. If the client responds that they feel stimuli during the "sham" tests, it is concluded that the client is not reliable and testing does not proceed.

For each stimulus correctly identified, a score of 1 is assigned. Within each test area, a client can score a maximum of 6.

Normative performance and suggestive cut-off scores for each sub-test are below.[2]

Table 2b: Sharp/dull discrimination – normative performance and impairment cutoff
<table><tr><td>Subtest 1
Sharp/dull discrimination</td><td>Control performance
Left side (n = 50)</td><td>Right side (n = 46)</td></tr><tr><td>Max score (30)</td><td></td><td></td></tr><tr><td>Mean</td><td>26.6</td><td>26.5</td></tr><tr><td>s.d.</td><td>2.6</td><td>2.5</td></tr><tr><td>Range</td><td>18–30</td><td>21–30</td></tr><tr><td>Suggested Impairment cutoff</td><td>less than 22</td><td></td></tr></table>
Table 3b: Surface touch – normative performance and impairment cutoff
<table><tr><td>Subtest 2
Surface pressure touch</td><td>Control performance
left side (n = 50)</td><td>right side (n = 50)</td></tr><tr><td>Max score (30)</td><td></td><td></td></tr><tr><td>Mean</td><td>29.9</td><td>29.9</td></tr><tr><td>s.d.</td><td>0.3</td><td>0.7</td></tr><tr><td>Range</td><td>28–30</td><td>25–30</td></tr><tr><td>Suggested Impairment cutoff</td><td>less than 29</td><td></td></tr></table>
Table 4b: Surface localization – normative performance and impairment cutoff
<table><tr><td>Subtest 3
Surface localization</td><td>Control performance
Left side (n = 50)</td><td>Right side (n = 50)</td></tr><tr><td>Max score (30)</td><td></td><td></td></tr><tr><td>Mean</td><td>29.9</td><td>29.8</td></tr><tr><td>s.d.</td><td>0.4</td><td>1.1</td></tr><tr><td>Range</td><td>27–30</td><td>22–30</td></tr><tr><td>Suggested Impairment cutoff</td><td>less than 29</td><td>less than 28</td></tr></table></td></tr>
</table>

<table>
<tr>
<td></td>
<td>
Table 6a: Two-point discrimination – index finger performance controls
<table>
<tr><td>Subtest 5 Reliable Two-point discrimination</td><td colspan="3">Right hand controls (n = 48)</td><td colspan="3">Left hand-controls (n = 49)</td></tr>
<tr><td></td><td>3mm</td><td>4mm</td><td>5mm</td><td>3 mm</td><td>4 mm</td><td>5 mm</td></tr>
<tr><td></td><td>16</td><td>18</td><td>14</td><td>18</td><td>15</td><td>16</td></tr>
</table>
Table 7b: Temperature discrimination–normative performance and impairment cutoff
<table>
<tr><td>Subtest 6 Temperature discrimination</td><td>Controls Left side(n = 48)</td><td>Right side(n = 48)</td></tr>
<tr><td>Max score (30)</td><td></td><td></td></tr>
<tr><td>Mean</td><td>28.4</td><td>28.6</td></tr>
<tr><td>s.d.</td><td>1.7</td><td>1.8</td></tr>
<tr><td>Range</td><td>24–30</td><td>23–30</td></tr>
<tr><td>Suggested Impairment cutoff</td><td>less than 25</td><td></td></tr>
</table>
Table 8b: Proprioceptive movement discrimination – normative performance and impairment cutoff
<table>
<tr><td>Subtest 7a Proprioception movement discrimination</td><td colspan="2">Controls</td></tr>
<tr><td></td><td>RBD Left side affected (n = 50)</td><td>LBD Right side affected (n = 50)</td></tr>
<tr><td>Max score (30)</td><td></td><td></td></tr>
<tr><td>Mean</td><td>29.9</td><td>30</td></tr>
<tr><td>s.d.</td><td>0.8</td><td>0.1</td></tr>
<tr><td>Range</td><td>24–30</td><td>29–30</td></tr>
<tr><td>Impairment cutoff</td><td>less than 28</td><td>less than 30</td></tr>
</table>
Table 9b: Proprioceptive direction discrimination – normative performance and impairment cutoff
<table>
<tr><td>Subtest 7b Proprioception direction discrimination</td><td colspan="2">Controls</td></tr>
<tr><td></td><td>Left side (n = 50)</td><td>Right side (n = 50)</td></tr>
<tr><td>Max score (30)</td><td></td><td></td></tr>
<tr><td>Mean</td><td>29.8</td><td>29.8</td></tr>
<tr><td>s.d.</td><td>0.9</td><td>0.9</td></tr>
<tr><td>Range</td><td>24–30</td><td>24–30</td></tr>
<tr><td>Impairment cutoff</td><td>less than 28</td><td></td></tr>
</table>
</td>
</tr>
<tr>
<td>Level of client participation required (is proxy participation available?)</td>
<td>Client participation is required.</td>
</tr>
</table>

Limitations: This test requires specialized equipment.
Comments: While this tool is appropriate regardless of setting, the need for customized equipment limits the clinical utility of this test.
Comments: Given that standardized equipment enhance the reliability of results, this tool may be appropriate to examine sensation in clinical trials. The inclusion of a sensory outcome measure in clinical trials could advance knowledge by identifying those interventions 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.

1. Winward CE, Halligan PW, Wade DT. The Rivermead Assessment of Somatosensory Performance (RASP): standardization and reliability data. *Clinical rehabilitation.* 2002;16(5):523-533.

2. Winward CE, Halligan PW, Wade DT. Rivermead Assessment of Somatosensory Performance. Suffolk, England: Thames Valley Test Company Limited; 2000.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute				**x**	
Inpatient Rehab				**x**	
Home Health				**x**	
Skilled Nursing				**x**	
Outpatient				**x**	
Overall Comments: Clinical Utility is poor due to the time to complete, the use of customized equipment, and the need to buy the test					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				x	
Sub- Acute (2-6 months)				x	
Chronic (>6 months)				x	

Overall Comments:

Clinical Utility is poor due to the time to complete, the use of customized equipment, and the need to buy the test

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?		x	Students should be aware of this and other standardized sensory outcome measures.

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		

Reintegration to Normal Living

Reviewer: Dorian Rose

ICF Domain (check all that apply):

_____body function/structure _____ activity __x__participation

Type of measure:

_____ performance-based __x__self-report

Description: The RNL Index[1] is a self-report measure consisting of 11 declarative statements encompassing 8 domains (mobility, self-care, daily activity, recreational and social activities, coping skills, family roles, personal relationships, and presentation of self to others).

RNLI-Postal[2]: This postal version was developed specifically for use with stroke patients. An agree/disagree (1/0) response format is used in contrast to the VAS.

Instrument properties (please use footnotes)

Reliability (test-retest, intra-rater, inter-rater)	Inter-rater: Significant other to patient correlations: *r* = 0.62 (for hospital inpts.); *r* = 0.69 (for discharged pts. with CA or MI); Health-professional to patient correlations: *r* = 0.39 (for hospital inpts.); *r* = 0.43(for discharged pts. with CA or MI). Concluded that health professional should not complete instrument as proxy [1] At admission to a treatment program, patients' and proxies' scores did not differ significantly: at discharge and follow-up, they differed significantly [3] Test-retest: for community dwelling elderly: *r* = 0.83 (Steiner, 1996); for adults with TBI: *r* = 0.12; for their significant others: *r* = 0.79. [3] **RNLI-Postal (modified for use w/stroke patients)**[2]: Test-retest: Kappa statistic: 0.38-0.92 Internal consistency: Cronbach's alpha = 0.84

Validity (concurrent, criterion-related, predictive)	Criterion validity: no gold standard found. RNL is marginally related to work status and disease status and not related to family status and living arrangements, or the presence of problems in living. Construct validity: the RNL index is related to the Quality of Life index: *r* = 0.68 and the Affect Balance Scale (psychologic well-being) in the predicted directions; *r* = 0.41 [1] **RNLI-Postal (modified for use w/stroke patients)** [2]: Construct validity: Barthel Index: r = 0.42; Frenchay Activities Index: r=0.69; SF-3:;r=.74
Ceiling/ floor effects	Not reported
Sensitivity to change (responsiveness, MCID, MDC)	Responsiveness Not assessed in stroke population. In clients with MI or CA who were newly diagnosed, hospitalized, treated and discharged from the hospital, and followed up at 3 months, a preliminary evaluation of responsiveness by considering change scores in items showed that most patients changed at this level [1]. A preliminary evaluation of changes in group scores on subscales for these same patients showed some evidence of change in the overall index and in the Daily Functioning subscale but not in the Perception of Self subscale.
Instrument use	
Equipment required	Questionnaire, placard with visual analogue scale.
Time to complete	10 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Each of the 8 domains is accompanied by a visual analogue scale (VAS 0-10) or a 3 or 4 point categorical scale. The analogue scale is anchored by the statements “does not describe my situation” and “fully describes my situation.” The categorical scales have interim response descriptors “partially describes my situation” (3 points) or “somewhat describes my situation” and “mostly describes my situation” (4 points). The items add up to a total score. When scored on the VAS, the sum is algebraically converted to be out of 100; otherwise, scores range from 11 too 33 (3 points) or 11 to 44 (4 points). There are two subscales: Daily Activity (mobility, participation in work, social and recreational activities) and Perception of Self (comfort with relationships and coping skills)

Level of client participation required (is proxy participation available?)	At admission to a treatment program, patients' and proxies' scores did not differ significantly: at discharge and follow-up, they differed significantly. [3] Recommend to be completed by client.

Limitations
The RNLI was not developed specifically for patients post-stroke. The RNLI-Postal was developed on 76 patients post-stroke and developed specifically for postal use.
Comments-*patients with acute stroke may not have had experience with "normal living reintegration" (especially if still in the hospital. If they have been in the community, I think this may be an appropriate tool

References

1. Wood-Dauphinee SL, Opzoomer MA, William JI, Marchand B, Spitzer WO. Assessment of global function: the Reintegration to Normal Living Index. Arch Phys Med Rehabil. 1988; 69:583-590.
2. Daneski K, Coshall C, Tilling K, Wolfe CDA. Reliability and validity of a postal version of the Reintegration to Normal Living Index, modified for use with stroke patients. Clinical Rehabil. 2003;17:835-839.
3. Trombly CA, Radomsky MV, Davis ES. Achievement of self identified goals by adults with traumatic brain injury: phase I. Am J Occup Ther 1998; 52:810-8.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute					
Inpatient Rehab					
Home Health			**x**		
Skilled Nursing					
Outpatient			**x**		
Overall Comments:					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)					
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		
Overall Comments: This tool has not be extensively studied/used in the post-stroke population.					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?			x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?		x	

Rivermead Motor Assessment	
General Information:	
Target Client Population	Stroke- acute, sub-acute and chronic
Topic / Content area / Domain :	Body structure/function- measure of motor performance
Instrument components (including scoring, type of measure [e.g. performance-based, self-report])	Rivermead Motor Assessment is a performance-based measure developed specifically for the stroke population with the intent to be used for both the clinic and research purposes. It consists of 3 sections: gross function (RMA-gf), leg and trunk (RMA-lt), and the arm (RMA-a). 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.

Rivermead Motor Assessment

General instructions: Go through the items in order of difficulty. Score '1' if patient can perform activity, ' 0' if he cannot. Three tries are allowed for each item. You may stop the 'Gross function' section and 'Arm' section after 3 consecutive '0' scores for 3 consecutive items.
In the 'Leg and Trunk' section all items should be tested, even if there are three consecutive '0' scores. Give no feed-back of whether correct or incorrect, just give general encouragement.
Repeat instructions and demonstrate them to the patient if necessary. All exercises to be carried out independently unless otherwise stated. All arm tests refer to the affected side unless otherwise stated.
'Gross function' section can be assessed simply by asking, which makes it a rapid measure.[15]

A. Gross function
Can the patient:
1. Sit unsupported (without holding edge of bed, feet unsupported)
2. Transfer from lying to sitting on side of bed (using any method)
3 Transfer from sitting to standing
4. Transfer from wheelchair to chair towards unaffected side (may use hands)
5. Transfer from wheelchair to chair towards affected side (may use hands)
6. Walk 10 meters indoors with an aid (any walking aid, no standby help)
7. Climb flight of stairs independently (any method, may use banister and aid)
8. Walk 10 meters indoors without an aid (no standby help or walking aid)
9. Walk 10 meters, pick up beanbag from floor, turn and carry back (may use aid to walk)
10. Walk outside 40 meters (may use walking aid, no standby help)
11. Walk up and down 4 steps (may use any aid but may not hold on to railing)
12. Run 10 meters (must be symmetrical)

13. Hop on affected leg 5 times on the spot (must hop on ball of foot without stopping to regain balance, no help with arms)

B. Leg and Trunk

1. Roll to affected side
Starting position should be lying, not crook lying.
2. Roll to unaffected side
Starting position should be lying, not crook lying.
3. Half-bridging
Starting position- half-crook lying. Patient must put some weight through the affected leg to lift hip on affected side. Therapist may position leg, but patient must maintain position even after movement is completed.
4. Sitting to standing
May not use arms-- feet must be flat on floor--must put weight through both feet.
5. Half-crook lying: lift affected leg over side of bed and return it to the same position.
Affected leg in half-crook position. Lift leg off bed on to support; for example, box, stool, floor, so that hip is in neutral and knee at 90 degrees while resting on support.
Must keep affected knee flexed throughout movement. Do not allow external rotation at hip. This tests control of hip and knee.
6. Standing, step unaffected leg on and off block
Without retraction of pelvis or hyperextension of knee. This tests knee and hip control while weight bearing through the affected leg.
7. Standing, tap ground lightly five times with unaffected foot
Without retraction of pelvis or hyperextension of knee. Weight must stay on leg. This again tests knee and hip control while weight bearing through the affected leg but is more difficult than in 6.
8. Lying, dorsiflex affected ankle with leg flexed
Physiotherapist may hold affected leg in position, knee at 90 degrees. Do not allow inversion. Must have half range of movement of unaffected foot.
9. Lying, dorsiflex affected ankle with leg extended
Same conditions as in 8, with leg extended. Do not allow inversion or knee flexion. Foot must reach plantigrade (90°).
10. Stand with affected hip in neutral position, flex affected knee
Therapist may not position leg. This is extremely difficult for most hemiplegic patients, but is included to assess minimal dysfunction.

C. Arm

1. Lying, protract schoulder girdle with arm in elevation
Arm may be supported.
2. Lying, hold extended arm in elevation (some external rotation) for at least 2 sec
Therapist should place arm in position and patient must maintain position with some external rotation. Do not allow pronation. Elbow must be held within 30 degrees of full extension.
3. Flexion and extension of elbow, with arm as in 2 above
Elbow must extend to at least 20 degrees full extension. Palm should not face out during any part of movement.

4. Sitting, elbow into side, pronation and supination
Three-quarters range is acceptable, with elbow unsupported and at right angles.
5. Reach forward, pick up large ball with both hands and place down again
Ball should be on table so far in front of patient that he has to extend arms fully to reach it. Shoulders must be protracted, elbows extended, wrist neutral or extended, and fingers extended throughout movement. Palms should be kept in contact with the ball.
6. Stretch arm forward, pick up tennis ball from table, release on affected side, return to table, then release again on table. Repeat five times
Shoulder must be protracted, elbow extended and wrist neutral or extended during each phase.
7. Same exercise as in 6 above with pencil
Patients must use thumb and fingers to grip.
8. Pick up a piece of paper from table in front and release five times
Patient must use thumb and fingers to pick up paper and not to pull it to edge of table. Arm position as in 6 above.
9. Cut putty with a knife and fork on plate with non-slip mat and put pieces into container at side of plate
Bite-size pieces.
10. Stand on spot, maintain upright position, pat large ball on floor with palm of hand for 5 continuous bounces
11. Continuous opposition of thumb and each finger more than 14 times in 10 sec
Must do movement in consistent sequence. Do not allow thumb to slide from one finger to the other.
12. Supination and pronation on to palm of unaffected hand 20 times in 10 sec
Arm must be away from body, the palm and dorsum of hand must touch palm of good hand. Each tap counts as one. This is similar to 4 above, but introduces speed.
13. Standing, with affected arm abducted to 90 degrees with palm flat against wall. Maintain arm in position. Turn body towards wall and as far as possible towards arm, i.e. rotate body beyond 90 degrees
Do not allow flexion at elbow, and wrist must be extended with palm of hand fully in contact with wall.
14. Place string around head and tie bow at back
Do not allow neck to flex. Affected hand must be used for more than just supporting string. This tests function of hand without help of sight.
15. 'Pat- a-cake' seven times in 15 sec
Mark crosses on wall at shoulder level. Clap both hands together (both hands touch crosses.) Each sentence counts as one. Give patients three tries. This is a complex pattern which involves co-ordination, speed, and memory, as well as good arm function.

Instrument properties

Reliability (test-retest, intra-rater, inter-rater)	• Lincoln and Leadbitter 1979[7]: (*from StrokEngine, abstract and original article unavailable)* Test-retest- RMA-gf r=0.66

	RMA-lt r=0.93 RMA-a r=o.88 Inter-rater- no significant differences for scoring across raters. • The Kurtais study (2009)[3] : Internal consistency present in each section: RMA-gf - Cronbach's α= 0.93, ICC=0.88 RMA-lt - Cronbach's α= 0.88, ICC=0.84 RMA-a - Cronbach α= 0.95, ICC=0.93
Validity (concurrent, criterion-related, predictive)	**Scalability and Construct** • Lincoln and Leadbetter (1979)[7] found Guttman scaling of items to be valid and unidimentional. • In studies by Adams et al (1997) [4.5], the RMA-lt section did not meet scaling criteria with acute stroke patients and the only the gross motor function test met scaling criteria with non-acute stroke patients. • Van de Winckel (2007)[2] investigated the construct validity and unidimentionality of the RMA-arm with chronic stroke subjects (mean 8 months post stroke). 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.[2] • Using Mokken scale analysis, Kurtais (2009)[3] generally found satisfactory Guttman scaling on the RMA. However, a different hierarchical ordering of test items was revealed on all 3 subscales. • Kurtais [3]also found, like Adams, that to fit the Rasch model expectations, it was necessary to remove items from all 3 subscales (items deemed too extreme or a misfit with the original scale). • Soyuer and Soyuer (2005)[14] also found convergent validity between scores of the total RMA when compared to total FIM (r=0.87), motor FIM (r=0.90) at 7-10 days post stroke, and to total FIM (r= 0.88) and motor FIM (0.89) at 3 months post –stroke. **Concurrent:** In study by Endres, et al (1990)[16], RMA has excellent correlation with BI across each assessment period initial (r=0.84), one month (0.78), and one year (0.63).

	Predictive: Collin and Wade showed that low RMA scores at 6 weeks post stroke predicted poor prognosis to ambulate.[8]
Responsiveness to change (e.g., MCD, MCID)	All 3 sections sections are sensitive to change, the arm section the least responsive when compared to the FIM (ES=0.61, SRM=1.20) [3] RMA-gf: ES=0.51 SRM=0.83 RMA-lt: ES=-.45 SRM=0.86 RMA-a ES=0.38 SRM=0.60 Collen (1990) found that a 3 point change in the total RMA score represented a clinically meaningful change.[17]
Ceiling/ floor effects	• A large ceiling effect was noted on the Gross Motor Function Subscale of the RMA when compared to HIMAT with *TBI population*[6] • Floor effects in earlier phases of stroke noted.[3]
Potential sources of bias	Kurtais[3] reports a low sample size, and due to the number of extreme scores (high and low) at assessment, more numbers were excluded from Rasch analysis.
Availability of normative data	not known
Extent of use in target and other populations	• 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.
Instrument use	
Equipment required	• Block of 20 cm height • Pencil • Volleyball • Tennis ball • Piece of paper • Fork and knife • Plate and container (use box of putty as container) • Beanbag • Cord • Putty • Watch with chronometer Non-slip mat
Time to complete	45 minutes, less with more involved patients
Effect of tester experience	does not require formal training

(expertise/training)	
Level of client participation required	performance-based, although validity has been shown between verbal report and performance on the gross function subset.[15]
Benefits	simple, valid, reliable
Limitations	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. Two studies have offered revised hierarchical scales [2,3] that meet Rasch analysis, and another has suggested using the RMI as a summated index rather than a hierarchical ranked scale. [11]
Comments:	The Rivermead Mobility Index (RMI)[9] was developed from the RMA-GF subscale. • Per Tyson and DeSouza[10], it has the most "relevant and robustly developed" measure for general mobility. • An Italian study[11] found the RMI to be internally consistent, valid and responsive, but expressed minor concerns regarding floor effects with sub-acute population and items not being on a hierarchy as originally designed. • Hsueh et al[12] found that the psychometric properties of the STREAM to be "slightly more superior" than the RMI as a general mobility test. • Recommended by US Health Care Policy Research[12], but is not as widely used in the US[13].
References (including websites):	1. www.medicine.mcgill.ca/strokengine 2. Van de Winckel Ann; Feys Hilde; Lincoln Nadina; De Weerdt Willy. Assessment of arm function in stroke patients: Rivermead Motor Assessment arm section revised with Rasch analysis. Clin Rehabil 2007; 21: 471-9. 3. Kurtaiş et al. The psychometric properties of the Rivermead Motor Assessment: its utility in stroke. J Rehabil Med 2009; 41:1055-1061. 4. . Adams SA, Ashburn A, Pickering RM, Taylor D. The scalability of the Rivermead Motor Assessment in acute stroke patients. Clin Rehabil 1997; 11: 42–51. (abstract only) 5. Adams SA, Pickering RM, Ashburn A, Lincoln NB. The scalability of the Rivermead Motor Assessment in nonacute stroke patients . Clin Rehabil 1997; 11: 52–59. (abstract only) 6. 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. 7. Lincoln N, Leadbitter D. Assessment of motor function in stroke patients. Physiotherapy 1979; 65: 48-51 8. Collin, C., Wade, D. (1990). Assessing motor impairment after stroke: A pilot reliability study. Journal of Neurology, Neurosurgery, and Psychiatry, 53, 576-579. 9. Collen FM, Wade DT, Robb GF, Bradshaw CM. The Rivermead Mobility Index: a further development of the Rivermead Motor Assessment. Int Disal Stud. 1991;13;50-4. (abstract only) 10. Tyson SF, DeSouza LH. Reliability and validity of functional balance tests post-stroke. Clinical Rehabil 2004; 18:916. 11. Franchignoni F. Psychometric properties of the Rivermead Mobility Index in Italian stroke rehabilitation inpatients. Clin Rehabil 2003; 17: 273-282. 12. Hsueh et al. Comparison of psychometric properties of three mobility measures for patients with stroke. Stroke 2003; 34: 1741. 13. Forlander DA, Bohannon RW. Rivermead Mobility Index: a brief review of research to date. Clin Rehabil. 1999; 13:97-100. 14. Soyuer F,Souyuer A. Ischemic stroke: Motor impairment and disability with relation to age and lesion location (Turkish). Journal of Neurological Sciences, 22(1), 43-49. (source: StrokEngine) 15. Sackley, C., Lincoln, N. (1990). The verbal administration of the gross function section of the Rivermead Motor Assessment. Clin Rehabil, 4, 301-303. (abstract only) 16.Endres, M., Nyary, I., Banhidi, M., Deak, G. (1990). Stroke rehabilitation: A method and evaluation. International Journal of Rehabilitation Research, 13, 225-236. 17. Collen FM, Wade DT, Bradshaw CM. Mobility after stroke: reliability of measures of impairment and disability. Int Disabil Stud. 1990; 12:6-9. (abstract only)
Completed by **Diane Nichols PT, NCS**	

Practice Setting	4	3	2	1	Comments
Acute		**x**			
Inpatient Rehab		**x**			
Home Health		**x**			
Skilled Nursing		**x**			
Outpatient		**x**			

Overall Comments:

- used extensively in Europe

- very good psychometrics

- comprehensive motor assessment

- 45 minutes to administer if pt is able to complete the test

- equipment necessary to administer the test

- Modified version of the Gross Mobility section exists = Rivermead Mobility Index, also has very good psychometrics

Test is copyrighted

Practice Setting	4	3	2	1	Comments
Acute (<2 months)		x			
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			

Overall Comments:

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Do not recommend**	**Comments**
Should this tool be required for entry level curricula?		x		

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?	x		

2nd Reviewer comments:

This tool is a very comprehensive tool for assessment of motor performance with good reliability, validity in sub-acute stroke, and responsiveness. However, it is widely used in research and in Europe. Due to the time required to perform the measure, it may be more useful for research (vs. clinical) purposes. (? STREAM is quicker with similar or better psychometric properties)

Stroke Adapted Sickness Impact Profile 30 (SA-SIP30)

Reviewer: Sullivan

ICF Domain (check all that apply):

_____body function/structure ___x_ activity __x__participation

Type of measure:

_____ performance-based __x_self-report

Instrument properties The SA-SIP30 contains 30 items. Each item has statement describes some aspect of daily life. Patients are asked to mark items most descriptive of themselves *on a given day*. Responses are "yes" or "no". The number of "no" responses are totaled. The SA-SIP30 was derived from the Sickness Impact Profile – 136 (SIP-136).

There are 8 subscales:

- Body Care and Movement (5 items)
- Social Interaction (5 items)
- Mobility (3 items)
- Communication (3 items)
- Emotional Behavior (4 items)
- Household Management (4 items)
- Alertness Behavior (3 items)
- Ambulation (3 items)

Subscales can be combined to form 2 dimensions:

- Physical: includes the subscales Body care and movement, Ambulation, Household management and Mobility (15 items)
- Psychosocial: includes the subscales Alertness behavior, Communication, Social interaction and Emotional behavior (15 items)

Reliability (test-retest, intra-rater, inter-rater)	Internal consistency → excellent for the total scale(alpha = 0.85,[1] 0.82[2]) and psychosocial (alpha = 0.78) and moderate to excellent for the physical dimensions (alpha = 0.76,[2] 0.82)[1]. Internal consistency of the emotional behavior (alpha = 0.57), and ambulation (alpha = 0.54) subscales were poor.[1] The psychosocial dimension was reported to be poor (alpha = 0.68)[2] to excellent (alpha = 0.78)[1] Inter-rater→Not reported. Test-retest→Not reported.
Validity (concurrent, criterion-related, predictive)	Criterion→ Not reported Content→The scale has been modified to eliminate the least relevant and redundant items.[1]Twenty percent of the score variance could be attributed to the Physical dimension and 11% to the Psychosocial dimension.[1] Convergent→was examined by comparing the scores of the SA-SIP30 with the SIP 136. The SA-SIP30 total score explained 91% of the variance in SIP-136 scores;[1] 87% of the original physical dimension scores and 88% of the psychosocial dimension scores could be explained by the SA-SIP30. Spearman rank correlation coefficient between the SA-SIP30 and the SIP-136 total scores was excellent (r = 0.96). Subscale correlations were excellent, ranging from r = 0.75 (emotional behavior) to r = 0.90 (body care and movement).[1] The SA-SIP30 was correlated with the Barthel Index and the Rankin Scale;[1] moderately correlated with the disability score on the Barthel Index (r = 0.50,[1] 0.517[3]), EuroQol (r = -0.483),[3] and the Frenchay Activities Index (r = -0.426).[3] and had an moderate to excellent correlation with the global functional health score on the Rankin Scale (r = 0.68,[1]0.468[3]) Discriminant→ The correlation between the Canadian Occupational Performance Measure and the SA-SIP30 was poor (r = 0.102), likely because COPM examines issues specific to the individual, whereas the SA-SIP30 focuses on a societal perspective of independence.[3] Known groups→The SA-SIP30 was unable to distinguish between clients with supratentorial and infratentorial strokes, but was able to distinguish clients with lacunar infarctions from those with cortical or subcortical lesions. Further, clients

	with lacunar infarcts reported better functional health than those with cortical or subcortial lesions on the psychosocial dimension of the scale and on the total SA-SIP30 score.[1] Cutoff scores[4] →were reported at: • > 28 – poor health outcomes • >40 for the physical dimension - dependent in their activities of daily living • > 25 - unable to live independently • > 33- poor health-related quality of life
Ceiling/ floor effects	Not reported
Sensitivity to change (responsiveness, MCID, MDC)	Moderate responsiveness with effect sizes from .5 - 1 year post-stroke were 0.60 for the total SA-SIP30, and 0.56 and 0.65 for the physical and psychosocial dimensions.[5]
Instrument use	
Equipment required	Scale, pen & paper
Time to complete	The average scale completion time has not been reported, however, the SA-SIP30 is a shorter scale than the original SIP, which takes 30 minutes complete.
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Each subscale and expressed as a percentage of items completed from 0 to 100%. Higher scores indicate less desirable health outcomes.
Level of client participation required (is proxy participation available?)	• The original SIP was tested for use with proxy respondents, however the SA-SIP30 has not yet been tested for use by proxy respondent. • The SA-SIP30 might be less effective for patients with severe stroke because in developing the SA-SIP30, higher item weights were mostly associated with items that were removed.[1] Agreement between scores obtained with the original SIP-136 and the SA-SIP30 were lower among those with severe stroke. [1]

Limitations: Required client's participation, proxy version not validated (but has been validated for original version (SIP136). A minor limitation is that this scale is not as well known in the USA as the Stroke Impact Scale which measures the same constructs.
Comments: Would be appropriate in these settings provided that 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.
Is this tool appropriate for research purposes? Yes __x__ No _____ Comments: The SA-SIP30[1] was developed from the original 136-item Sickness Impact Profile (SIP-136), to examine quality of life post stroke. The scale was developed specifically for use in stroke outcome research in order to overcome the problem of the excessive length of the SIP-136.

1. van Straten A, de Haan RJ, Limburg M, Schuling J, Bossuyt PM, van den Bos GAM. A Stroke-Adapted 30-Item Version of the Sickness Impact Profile to Assess Quality of Life (SA-SIP30). *Stroke.* 11/1 1997;28(11):2155-2161.

2. Van de Port IGL, Ketelaar M, M. SVP, Van Den Bos GAM, poE. Lvd. Monitoring the functional health status of stroke patients: the value of the Stroke-Adapted Sickness Impact Profile-30. *Disability and Rehabilitation.* 2004;26(11):635-640.

3. Cup EHC, Scholte op Reimer WJM, Thijssen MCE, van Kuyk-Minis MAH. Reliability and validity of the Canadian Occupational Performance Measure in stroke patients. *Clinical Rehabilitation.* 2003;17(4):402-409.

4. van Straten A, de Haan RJ, Limburg M, van den Bos GAM. Clinical Meaning of the Stroke-Adapted Sickness Impact Profile-30 and the Sickness Impact Profile-136. *Stroke.* 2000;31:2610-2615.

5. Van de Port IGL, Ketelaar M, Schepers VPM, Van den Bos GAM, Lindeman E. Monitoring the functional health status of stroke patients: the value of the Stroke-Adapted Sickness Impact Profile-30. *Disability and Rehabilitation.* 2004;26(11):635-640.

Practice Setting	4	3	2	1	Comments
Acute				**x**	**Not appropriate if the patient has not been in the community since stroke**
Inpatient Rehab				**x**	
Home Health		**x**			
Skilled Nursing		**x**			
Outpatient		**x**			

Overall Comments: Good clinical utility, however this scale takes longer to complete (30 minutes for full scale) versus 15-20 minutes for a full scale SIS (a comparable measure). Shortened version (SASIP 30) has been developed, but less psychometric data is available.

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				x	**Not appropriate if the patient has not been in the community since stroke**
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			

Overall Comments: As above

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?		x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		A stroke specific quality of life scale is very appropriate to use in studies. This is one of several scales that may be appropriate for his use, however it seems that American studies more frequently use the SIS.

Satisfaction with Life Scale	
General Information:	
Target Client Population	generic
Topic / Content area / Domain :	participation Level
Instrument components (including scoring, type of measure [e.g. performance-based, self-report])	Satisfaction With Life Scale (SWLS) is a self-reported scale used for the general population to assess one's satisfaction with life (Diener 1985)[1]. According to Shin and Johnson[2], life satisfaction refers to "a global assessment of a person's quality of life according to his chosen criteria." Life satisfaction is considered one component of subjective well-being, along with positive and negative affect. However, life satisfaction measures a cognitive-judgmental construct rather than an emotional construct in psychological research. The scale has been used to question, for example, students, caregivers, prisoners, patients, and various professionals. The minimal score is 5 and maximal score is 35. A higher score indicates greater satisfaction.

Satisfaction with Life Scale (**SWLS**) Below are five statements that you may agree or disagree with. Using the 1 – 7 scale below indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

7 – Strongly agree 6 – Agree 5 – Slightly agree 4 – Neither agree nor disagree 3 – Slightly disagree
2 – Disagree 1 – Strongly disagree

____ In most ways my life is close to my ideal.

____ The conditions of my life are excellent.

____ I am satisfied with my life.

____ So far I have gotten the important things I want in life.

____ If I could live my life over, I would change almost nothing.

Add the numbers you wrote beside each of the five questions to get a total. See below.

31 – 35 Extremely satisfied
26 – 30 Satisfied

21 – 25 Slightly satisfied
20 Neutral
15 – 19 Slightly dissatisfied
10 – 14 Dissatisfied
5 – 9 Extremely dissatisfied

SWLS is in the public domain. Permission is not needed to use it.

Instrument properties

Reliability (test-retest, intra-rater, inter-rater)	**Test-retest:** correlation coefficient range from various studies (Pavot 1991)[5] .83[6] at 2 weeks .84[7] at 1 month .64[8] at 2 month .82[1] at 2 months .50[9] at 10 weeks .54[10] at 4 years Test-retest changes over time in response to mood, situational context and life events.[5]
Validity (concurrent, criterion-related, predictive)	**Construct:** Validation studies with other satisfaction with life scales have modest to moderate correlation, r>.35 - .82[1,5,7] In general, those who score higher on SWLS are well-adjusted have good self-esteem and are free of psychopathology. **Concurrent:** Deiner (1985)[1] had two trained interviewers rate 53 elderly subjects on the SWLS based upon a one-hour long interview. Questions focused on self-directed learning and how active they remained. Each subject also completed the SWLS and the Life Satisfaction Index (LSI)[3,4], a scale developed specifically for the geriatric population. The LSI also includes affective content. The interviewers/raters rated subjects on a 7 point scale for global life satisfaction. • SWLS vs LSI : r=.46 • Inter-rater : r=.73 • Raters vs SWLS: r=.43 • Raters vs LSI: r=.68

	Discriminative: Vitaliano et al[11] reported that SWLS scores of caregivers attending to spouses with dementia declined in response to increased caregiver burden. Yet, other affective signs such as depression, anger and anxiety did not change significantly. Appears that caregivers were adapting to life changes but they recognized the change in their quality of life.
Responsiveness to change (e.g., MCD, MCID)	Scores on SWLS have been shown to increase in response to clinical intervention.[5] Scores change in response to life events, both good and bad, over time.[5]
Ceiling/ floor effects	N/A
Potential sources of bias	As a self -report test, responder may not provide reliable responses
Availability of normative data	Table of normative data in Pavot (1993)[5]
Extent of use in target and other populations	Used with the elderly, ill and debilitated patients, individuals with chronic and complex needs, a validated version for use with children is also available
Instrument use	
Equipment required	None
Time to complete	<5 minutes
Effect of tester experience (expertise/training)	N/A
Level of client participation required	Self-administered; studies showing interviewer or informant ratings, appears to have a moderate correlation to respondent ratings[5]
Benefits	Brief, easy to complete, discriminative ability, sensitive to change
Limitations	• SWLS only measures the cognitive aspect of subjective well-being therefore should be used with other measures for a full picture of the individual's well-being[5] • Respondents can distort a response, therefore informant or interviewer rating often suggested as well[5] • As the scale is sensitive to change, may also reflect mood or situational context rather than a real change is satisfaction • Lower correlations with construct validity may point to measurement error [5]

Comments:	Available in several languages: French, Dutch, Russian, Korean, Hebrew, Mandarin[5]
References (including websites):	1. DIENER E et al. The Satisfaction With Life Scale. Journal of Personality Assessment, 1985,49, 1 2. Shin, D. C., & Johnson, D. M. (1978). Avowed happiness as an overall assessment of the quality of life. Social Indicators Research, 5, 475-492. 3. Neugarten, B. L., Havighurst, R. J., &Tobin, S. S. (19161). The measurement of life $atisfaction. Journal of Gerontology, 16, 134-143. 4. Adams, D. L. (1969). Analysis of a life satisfaction index. Journal of Gerontology, 24, 470-474. 5. Pavot W; Diener. E. Review of the Satisfaction With Life Scale Psychological Assessment]; 1993; 5, pg. 164-172. Referenced in Pavot (1993) - abstracts only available: 6. Alfonso VC and Allison.DB. The extended Satisfaction With Life Scale. The Behavior Therapist. 1992, 5:15-16. 7. Pavot et al. Further validation of the Satisfaction with Life Scale.1991 8. Blais et al. French-Canadian validation of the Satisfaction With Life Scale Canadian Journal of Behavioral Science. 1989; 21:210-223. 9. Yardley JK and Rice R. The relationship between mood and subjective well-being. Social Indicators Research. 1991;24, 101-111. 10. Magnus, Diener, Fujita and Pavot. Personality and events: a longitudinal analysis. Journal of Personality and Social Psych. 1992; 11. Vitaliano et al. The screen for caregiver burden. The Gerontologist. 1991; 31: 76-83. 12. Arindell et al. The Satisfaction With Life Scale: psychometric properties in a non-psychiatric medical outpatient sample. Personality and Individual differences 1991; 12:117-123. Pavot W, Diener E. The Satisfaction With Life Scale and the emerging construct of life satisfaction. Journal of Positive Psycholgy. 2008; 3:137-152.

Practice Setting	4	3	2	1	Comments
Acute			**x**		
Inpatient Rehab			**x**		
Home Health			**x**		
Skilled Nursing			**x**		
Outpatient			**x**		

Overall Comments:

- **general scale w/o specific stroke reliability or validity.**
- **Does show responsiveness to change , but this can be mood or situational response, Higher scores tend to reflects psychological well-being.**
- **While one's psychological well-being is pertinent information for clinicians, do not feel this particular tool is necessary for us to administer. While a quick snapshot of how one might feel at the moment, it does not reflect how one's impairments may impact on an individuals life. Does not reflect level of disability or participation. More beneficial to the psychology staff.**

Practice Setting	4	3	2	1	Comments
Acute (<2 months)			x		
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		

Overall Comments:

2nd reviewer comments:
The scale is only five questions long (making it quick to administer), and primarily asks about satisfaction with life, which may differ from actual participation. Responses are affected by life circumstances/happiness, which again, may not reflect someone's ability to participate but someone's mood or other circumstances affecting their satisfaction. It has not been used or validated in the stroke population. It may be more beneficial to use a measure of participation that is more stroke specific.

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Do not recommend**	**Comments**
Should this tool be required for entry level curricula?			x	

Research Use	YES	NO	**Comments:** **Perhaps if used with other measures for a more complete picture of satisfaction with life. This is a very quick test that reflects how one feels at the moment . We cannot interpret why someone might be feeling dissatisfied at that moment. It might be unrelated to the stroke and this test does not give us that information.**
Is this tool appropriate for research purposes?		x	

Semmes-Weinstein Sensory Assessment	
Reviewer: Dorian Rose	
ICF Domain (check all that apply): __x___body function/structure _____ activity _____participation	
Type of measure: ___x__ performance-based _____self-report	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Inter-rater reliability: ICC = 0.97 in 30 subjects including peripheral nerve injury, Braille readers and healthy controls[1]
Validity (concurrent, criterion-related, predictive)	Construct validity: not empirically tested; Weinstein[2] reports a low correlation (r=0.17) between pressure sensitivity and spatial threshold (divergent validity) Concurrent validity: r = 0.55 w/object identification[3] Concurrent validity: r = 0.696 w/object recognition time[4] Concurrent validity: r=0.59 w/patient's estimated impact on activities of daily living [5]
Ceiling/ floor effects	Not reported
Sensitivity to change (responsiveness, MCID, MDC)	Responsiveness: assessed in 19 patients with median and ulnar nerve injury at 3-48 months. Effect Size = 1.5 (large)[6]

Instrument use	
Equipment required	Semmes-Weinstein monofilament kit
Time to complete	15 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Each filament size is assigned an ordinal score. Patient is scored according to the size of monofilament they can detect.[7] Normal = 0 (patient can feel filament 2.83) Diminished light touch (patient can feel filament 3.61) = 1 Diminished protective sensation (patient can feel filament 4.31) = 2 Loss of protective sensation (patient can feel filament 6.65)=3 Unable to feel the largest filament (6.65) = 4 This score is then averaged across the number of sites that sensation is tested.
Level of client participation required (is proxy participation available?)	Client participation required

Limitations
The psychometric properties have been tested on individuals with peripheral nerve injuries; they have not been tested on those with stroke. The Semmes-Weinstein monofilaments, however, have been used in research studies with stroke.[7-9]
Comments: I think entry-level students should be EXPOSED to Semmes-Weinstein Monofilaments as they are often reported in the literature and used clinically with other populations (e.g. diabetes) but I wouldn't recommend that entry-level students be expected to be competent administering this test to a stroke population.

1. Novak C, Mackinnon S, Kelly L. Correlation of two-point discrimination and hand function following median nerve injury. Annals Plastic Surgery. 1993;31:495-498.
2. Weinstein S. Fifty years of somatosensory research: from the Semmes-Weinstein monofilaments to the Weinstein enhanced sensory test. J Hand Therapy. 1993;6:11-22.
3. Novak C, Kelly L, Mackinnon S. Sensory recovery after median nerve grafting. J Hand Surgery. 1992;17A:59-68.
4. Dellon A, Kallman C. Evaluation of functional sensation in the hand. J Hand Surgery. 1983;8:865-870.
5. Rosen B, Dahlin L, Lundborg G. Assessment of functional outcome after nerve repair in a longitudinal cohort. Scandinavian J Plastic Reconstructive Hand Surgery. 2000;34:71-78.
6. Rosen B, Lundborg G. A model instrument for the documentation of outcome after nerve repair. J Hand Surgery. 2000;25A:535-543.
7. Zackowski KM, Dromerick AW, Sahrmann SA, Thach WT, Bastian AJ. How do strength, sensation, spasticity and joint individuation relate to the reaching deficits of people with chronic hemiparesis? Brain. 2004;127:1035-46.
8. Lang CE, Wagner JM, Dromerick AW, Edwards DF. Measurement of Upper-Extremtiy Function Early After Stroke: Properties of the Action Research Arm Test. Arch Phys Med Rehabil. 2006; 87:1605-1610.
9. Wagner JM, Lang CE, Sahrmann SA et al., Relationships between sensorimotor impairments and reaching deficits in acute hemiparesis. Neurorehabil Neural Repair. 2006;20:406-16.

Practice Setting	4	3	2	1	Comments
Acute			**x**		
Inpatient Rehab			**x**		
Home Health			**x**		
Skilled Nursing			**x**		
Outpatient			**x**		
Overall Comments:					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)			x		
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		
Overall Comments: Provides an objective measure of sensation. Has not been validated in the post-stroke population. Would not be appropriate for all stroke patients, but may have utility when intervention is specifically targeted to improve sensation.					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?		x		

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		Research needs to be done to establish/determine validity/reliability in the post-stroke population.

SF-36	
Reviewer: PINTO ZIPP	
ICF Domain (check all that apply): _____body function/structure _____ activity ____X_ participation	
Type of measure: _____ performance-based ___X__self-report	
Instrument properties	
Reliability (test-retest, intra-rater, inter-rater)	• Hagen, Bugge, and Alexander (2003) examined the SF-36 at week 1 and 3 and 6 months **post stroke** and noted that **internal consistency** of the eight subscales at all three time-points was good except for at 1 month Vitality (alpha = 0.68) and at 3 month General Health (alpha = 0.67).[1] • Dorman et al. (1998) assessed the **test-retest reliability and the internal consistency** of the SF-36 in 2,253 patients with **stroke**. ICC's ranged from 0.28 for Mental Health to 0.80 for Social Functioning. Internal consistency ranged from 0.81 for Social Functioning to 0.96 for Emotional Role Functioning.[2] • Anderson, Laubscheret and Burns (1996) using the Australian version of the SF-36 in 90 individuals **one year post-stroke** found excellent internal consistency for Bodily Pain and Role Limitations-Emotional and poor internal consistency for Vitality (0.60) and Physical Functioning (0.90).[3]
Validity (concurrent, criterion-related, predictive)	• Mayo et al. (2002) found that SF-36 scores discriminated between those with **stroke** and age gender-matched controls.[4]

Ceiling/ floor effects	• Lai, Perera, Duncan, and Bode (2003) observed **floor effects** in 278 patients 90 days **post stroke** and **ceiling effects** in functioning subscale.[5] • Hobart et al. (2002) noted **floor effects** in 177 people after **stroke** in the Role Limitations-Physical (59.1%), Role Limitations-Emotional (63.1%), Social Functioning (29.9%), and Bodily Pain (25.6%) subscales in addition to **ceiling effects** on Role Limitations-Emotional (63.1%), Social Functioning (29.9%) and Bodily Pain (25.6%) subscales.[6]
Sensitivity to change (responsiveness, MCID, MDC)	• Muller-Nordhorn et al. (2004) found that the standardized response means **(SRMs)** to be small for the physical component summary scale of the SF-12 (SRM 0.49) and moderate for the mental component summary scale of the SF-12 (SRM 0.52) in stroke patients.[7]
Instrument use	
Equipment required	• Pencil, survey
Time to complete	• 30 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	• On a nominal (yes/no) or ordinal scale. With each response being assigned a number of points. Total all the point, transform to percentage score. 100% optimal health
Level of client participation required (is proxy participation available?)	• May use proxy. However test-retest reliability was negatively affected by the use of proxy Dorman et al, 1998.[8] Thus the subjective nature of the SF-36 may make proxy use difficult and not advisable.
Limitations • The psychometric properties of the SF-36 soon after stroke are not well known • No studies on the responsiveness of the SF-36 in patients with stroke we noted • Test is copyrighted • Scoring system may be difficult to navigate	

Reference

1. Hagen, S., Bugge, C., Alexander, H. (2003). Psychometric properties of the SF-36 in the early post-stroke phase. *Journal of Advanced Nursing*, 44(5), 461-468.
2. Dorman, P. J., Dennis, M., Sandercock, P. (1999). How do scores on the EuroQol relate to scores on the SF-36 after stroke? Stroke, 30(10), 2146-2151.
3. Anderson, C., Laubscher, S., Burns, R. (1996). Validation of the Short Form 36 (SF-36) Health Survey Questionnaire among stroke patients. *Stroke*, 27(10), 1812-1816.4. Mayo et al 2002
4. Mayo, N. E., Wood-Dauphinee, S., Cote, R., Durcan, L., Carlton, J. (2002). Activity, Participation, and Quality of Life 6 Months Poststroke. *Arch Phys Med Rehabil*, 83, 1035-1042.
5. Lai, S-M., Perera, S., Duncan, P. W., Bode, R. (2003). Physical and social functioning after stroke: Comparison of the Stroke Impact Scale and Short Form-36. *Stroke*, 34, 488-493.
6. Hobart, JC, et al: Quality of life measurement after stroke: uses and abuses of SF-36.Stroke 33:1348,2002.
7. Muller-Nordhorn, J., Nolte, C. H., Rossnagel, K., Jungehulsing, G. J., Reich, A., Roll, S., Villringer, A., Wllich, S. N. (2004). Responsiveness to change of the SF-12 in patients with cerebrovascular disease. *Biometrical Journal*, 46(S1), 50.
8. Dorman, P., Slattery, J., Farrell, B., Dennis, M., Sandercock, P. (1998). Qualitative comparison of the reliability of health status assessments with the EuroQol and SF-36 Questionnaires After Stroke. *Stroke*, 29, 63-68.

Practice Setting	4	3	2	1	Comments
Acute				x	
Inpatient Rehab		x			
Home Health		x			
Skilled Nursing		x			
Outpatient		x			

Overall Comments:

- The psychometric properties of the SF-36 soon after stroke are not well known
- No studies on the responsiveness of the SF-36 in patients with stroke we noted
- Concerns about a floor and ceiling effects

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				x	
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			

Overall Comments:

Some reports of psychometric properties in stroke but not extensive for all subscales.

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?		x	Students should be aware this tool as it is often used in the medical community.

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		Can be dependent upon the research question

(Stroke Impact Scale (SIS)

Reviewer: Sullivan

ICF Domain (check all that apply):

_____body function/structure ___x_ activity __x__participation

Type of measure:

_____ performance-based ___x_self-report

Instrument properties The SIS version 3.0 includes 59 items. Each item is scores on a 5-point ordinal scale. The scale assesses 8 domains:

- Strength - 4 items
- Hand function - 5 items
- ADL/IADL - 10 items
- Mobility - 9 items
- Communication - 7 items
- Emotion - 9 items
- Memory and thinking - 7 items
- Participation/Role function - 8 items

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.

SIS 16 → 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).[1]

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:

1 = could not do at all
2 = very difficult
3 = somewhat difficult
4 = a little difficult
5 = not difficult at all

<table>
<tr><td>Reliability (test-retest, intra-rater, inter-rater)</td><td>Internal consistency →of the SIS version 2.0 was reported to be > 0.83.[1, 2]

Test-rest reliability →of the SIS version 2.0 was adequate to excellent test-retest in all domains except for the Emotion domain, which had poor test-retest.[1]</td></tr>
<tr><td>Validity (concurrent, criterion-related, predictive)</td><td><u>Concurrent</u> → SIS version 2.0 has been examined with results below[1]
<table>
<tr><th>SIS Domain</th><th>Comparative measure</th><th>Correlation</th><th>Rating</th></tr>
<tr><td>Hand function</td><td>FMA-Upper Extremity Motor</td><td>r = 0.81</td><td>Excellent</td></tr>
<tr><td>Mobility</td><td>FIM Motor</td><td>r = 0.83</td><td>Excellent</td></tr>
<tr><td></td><td>Barthel Index</td><td>r = 0.82</td><td>Excellent</td></tr>
<tr><td></td><td>Duke Mobility Scale</td><td>r = 0.83</td><td>Excellent</td></tr>
<tr><td></td><td>SF-36 Physical Functioning</td><td>r = 0.84</td><td>Excellent</td></tr>
<tr><td>Strength</td><td>NIHSS Motor</td><td>r = -0.59</td><td>Adequate</td></tr>
<tr><td></td><td>FMA Total</td><td>r = 0.72</td><td>Excellent</td></tr>
<tr><td>ADL/IADL</td><td>Barthel Index</td><td>r = 0.84</td><td><u>Excellent</u></td></tr>
<tr><td></td><td>FIM Motor</td><td>r = 0.84</td><td>Excellent</td></tr>
<tr><td></td><td>Lawton IADL</td><td>r = 0.82</td><td>Excellent</td></tr>
<tr><td>Memory</td><td>MMSE</td><td>r = 0.58</td><td>Adequate</td></tr>
<tr><td>Communication</td><td>FIM Social/Cognition</td><td>r = 0.53</td><td>Adequate</td></tr>
<tr><td></td><td>NIHSS Language</td><td>r = -0.44</td><td>Adequate</td></tr>
<tr><td>Emotion</td><td>Geriatric Depression Scale</td><td>r = -0.77</td><td>Excellent</td></tr>
<tr><td></td><td>SF-36 Mental Health</td><td>r = 0.74</td><td>Excellent</td></tr>
<tr><td>Participation</td><td>SF-36 Emotional Role</td><td>r = 0.28</td><td>Poor</td></tr>
<tr><td></td><td>SF-36 Physical Role</td><td>r = 0.45</td><td>Adequate</td></tr>
</table></td></tr>
</table>

<table>
<tr>
<td></td>
<td>
<table>
<tr><td></td><td>SF-36 Social Functioning</td><td>r = 0.70</td><td>Excellent</td></tr>
<tr><td>Physical</td><td>Barthel Index</td><td>r = 0.76</td><td>Excellent</td></tr>
<tr><td></td><td>FIM Motor</td><td>r = 0.79</td><td>Excellent</td></tr>
<tr><td></td><td>SF-36 Physical Functioning</td><td>r = 0.75</td><td>Excellent</td></tr>
<tr><td></td><td>Lawton IADL</td><td>r = 0.73</td><td>Excellent</td></tr>
</table>
<u>Construct</u>→ Most domains of the SIS can differentiate between patients with varying degrees of stroke severity.[1, 3]

<u>Criterion</u>→ validity of the SIS hand function was good (rho = .51-.68; P < .01)[4]

<u>Predictive</u>→

• The SIS version 2.0 domains of Physical function, Emotion, and Participation were found to be statistically significant predictors of the patient's own assessment of recovery. [1]
• For individuals with chronic stroke who underwent constraint therapy, the initial Functional Independence Measure score predicted the overall and ADL, IADL SIS scores.[5]
</td>
</tr>
<tr>
<td>Ceiling/ floor effects</td>
<td>A floor effect has been reported in the hand function, memory and emotion scales.[1, 6]

A ceiling effect has been reported in the Communication scale. [1, 6]</td>
</tr>
<tr>
<td>Sensitivity to change (responsiveness, MCID, MDC)</td>
<td>Significant change was observed in client's' recovery in the at 1 and 3 months, and at 1 and 6 months post-stroke, however sensitivity to change was affected by stroke severity and time of assessment.[1]

The <u>Minimal Detectable Change</u> (MDC) of the strength, activities of daily living/instrumental activities of daily living, mobility, and hand function subscales were 24.0, 17.3, 15.1, and 25.9, respectively. The <u>Minimal Clinically Important Differences</u> (MCID) for these 4 subscales were 9.2, 5.9, 4.5, and 17.8 points respectively.[7]

The hand function subscale showed medium responsiveness (SRM = .52, Wilcoxon Z = 4.24, P < .05).[4]

Responsiveness of the SIS total score was significantly larger than that of the Stroke Specific Quality of Life Scale total (SRM difference, .36; 95% confidence interval, .02-.71).[4]</td>
</tr>
</table>

Instrument use	
Equipment required	Score sheet
Time to complete	15-20 minutes for full SIS
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Instructions for administration of the SIS 3.0 is available online at http://www2.kumc.edu/coa/SIS/Stroke-Impact-Scale.htm The SIS uses the scoring algorithm of the SF-36.[8] Each domain is scored as follows: Transformed Scale=[(Actual raw score-lowest *possible* raw score)]x100 *Possible* raw score range There are 3 items that change polarity in the emotion domain: 3f, 3h, and 3i. Scores must be reversed for scoring, i.e. 1 becomes 5, 2 becomes 4, 3 remains the same, 4 becomes 2, and 5 becomes 1, prior to manual calculation. You can download a file that will create a SIS or SIS – 16 database for you to input your own data at: http://www2.kumc.edu/coa/SIS/SIS_instructions.htm
Level of client participation required (is proxy participation available?)	The SIS can be mail administered, completed by proxy, completed by proxy by mailed administration or be administered by telephone.

Limitations: 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 the 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..

Comments:

I think a generic and disease specific quality of life should be taught in entry-level curricula. For example the SF-36 might be used as an example of a generic tool and the SIS would be an excellent example of how a disease-specific tool includes items that capture both generic constructs and issues specific to a particular diagnosis…using the SF-36 and the SIS would accomplish this nicely.

1. Duncan PW, Wallace D, Lai SM, Johnson D, Embretson S, Laster LJ. The Stroke Impact Scale version 2.0 : evaluation of reliability, validity, and sensitivity to change. *Stroke.* 1999;30(10):2131k-2140.

2. Edwards B, O'Connell B. Internal consistency and validity of the Stroke Impact Scale 2.0 (SIS 2.0) and SIS-16 in an Australian sample. *Quality of Life Research.* 2003;12(8):1127-1135.

3. Lai SM, Perera S, Duncan PW, Bode R. Physical and social functioning after stroke: comparison of the Stroke Impact Scale and Short Form-36. *Stroke.* Feb 2003;34(2):488-493.

4. Lin KC, Fu T, Wu CY, Hsieh YW, Chen CL, Lee PC. Psychometric comparisons of the Stroke Impact Scale 3.0 and Stroke-Specific Quality of Life Scale. *Quality of Life Research.* 2010;19(3):435-443.

5. Huang Y, Wu C, Hsieh Y, Lin K. Predictors of Change in Quality of Life After Distributed Constraint-Induced Therapy in Patients with Chronic Stroke. *Neurorehabilitation and Neural REpair.* 2010;24(6):559-566.

6. Duncan PW, Bode RK, Min Lai S, Perera S. Rasch analysis of a new stroke-specific outcome scale: the stroke impact scale. *Archives of Physical Medicine and Rehabilitation.* 2003;84(7):950-963.

7. Lin KC, Fu T, Wu CY, et al. Minimal detectable change and clinically important difference of the Stroke Impact Scale in stroke patients. *Neurorehabilitation & Neural Repair.* 2010;24(5):486-492.

8. Stuart AL, Ware JE. Measuring functioning and well-being: the Medical Outcomes Study approach. *Duke University Press.* Vol Durham, North Carolina1992:375-376.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute				**x**	**Not appropriate is the patient has not been in the community since stroke since the items tap community-based activities**
Inpatient Rehab			**x**		**May be appropriate if the patient has been in the community since stroke**
Home Health	**x**				
Skilled Nursing	**4**				**May be appropriate if the patient has been in the community since stroke**
Outpatient	**x**				
Overall Comments: Excellent psychometrics and clinical utility					

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute (<2 months)				x	**Not appropriate is the patient has not been in the community since stroke since the items tap community-based activities**
Sub- Acute (2-6 months)	x				
Chronic (>6 months)	x				
Overall Comments: Excellent psychometrics and clinical utility					

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Comments**
Should this tool be required for entry level curricula?	x		A generic and disease specific quality of life should be taught in entry-level curricula. For example the SF-36 might be used as an example of a generic tool and the SIS would be an excellent example of how a disease-specific tool includes items that capture both generic constructs and issues specific to a particular diagnosis…using the SF-36 and the SIS would accomplish this nicely. .

Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	x		

Stroke Specific Quality of Life Scale (SSQOL)	
Reviewer: Beth Crowner	
ICF Domain (check all that apply): ___body function/structure ____ activity _X[1,2] participation	
Type of measure: _____ performance-based __X[2]__self-report Description: Patient derived measure designed for use in clinical trials to assess quality of life in patients who have suffered a stroke.[3] Has been developed into SA(aphasia)-QOL[4] and translated into both Danish and German versions.	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	• Internal Consistency: strong [3] to excellent[2] Cronbach's alpha ranging from = .75 (work/productivity) to .89 (self-care)[3] • Test-retest: excellent r=.92[5] • Inter-rater: r=.92[5]

Validity (concurrent, criterion-related, predictive)	• Adequate[2]
	• Construct:
	  • with Barthel Index (.45), Beck Depression Inventory, and subscales of SF-36 (.65) [3]
	  • UE function poorly associated with NIHSS (.18)[3]
	  • Scores in language and thinking domains not associated with selected items from NIHSS (.00 and .10)[3]
	  • Social roles domain not linearly associated with SF-36 social functioning subscale score (.01)[3]
	  • Vision not correlated with NIHSS (.11)[3]
	• Predictive: for HRQOL (OR = 2.97)[3]
	• Validated: for ischemic stroke, but not hemorrhagic stroke.[6]
	• Validity of Phone Interview: r = .93[5]

Ceiling/ floor effects	• Ceiling effects exceed 20% in 10 of 12 domains[7] • Ceiling effect of 63% of max score in Vision domain[3] • Floor effect of 24% in Energy domain [7]
Sensitivity to change (responsiveness, MCID, MDC)	• Adequate [2] • Responsiveness: most domains moderate (Standard Effect Size > .4)[3]; less responsive to change (in UE function subscale) than SIS hand function and overall SIS was more responsive to change across multiple sub-scales and domains than SSQOL[10] • Effect size: for domains between 1 and 3 months post-stroke ranged from .2 (personality) to .83 (social roles), mood and personality less responsive across all instruments tested (incl. Beck Depression Inv. & SF-36).[3]

Instrument use	
Equipment required	Patient Self-report Questionnaire; No training required for administration
Time to complete	~12 minutes[8]
How is the instrument scored? (e.g. total score, are there subscales, etc.)	49 items, each scored on 5 point Likert Scale. Increased score equates to increase in function. Yields both domain (12) and overall scores.[1,2,6]
Level of client participation required (is proxy participation available?)	Interview, self-report and proxy used. In proxy vs. self-report, physical domains kept high correlation (r=.72-.82) but psychological and social domains were less well correlated (r=.11-.49). Proxies systematically scored patient below what patient scored themselves in both personality and family roles.[2]

Limitations:

- No standard or normative values available for comparison.[1]
- New scale and not well studied. Not tested among severe stroke populations.[2]
- Marked sex difference in ADL independence and QOL as measured by SSQOL, women less than half as likely to be independent with ADLs. Possible gender bias.[9]
- Not as responsive as SIS
- Not suitable for use by a proxy[5,11]

References:

1. Salter K, Jutai J, Zettler L, Moses M, Foley N, Teasell R. 21. Outcomes measures in stroke rehabilitation. The Evidence-Based Review of Stroke Rehabilitation (EBRSR). http://www.ebrsr.com. Accessed March 15, 2010.
2. Salter K, Jutai JW, Teasell R, Foley NC, Bitensky J, Bayley M. Issues for selection of outcome measures in stroke rehabilitation: ICF participation. *Disability and Rehabilitation*. 2005;27:507-528.
3. Williams LS, Weinberger M, Harris LE, Clark DO, Biller J. Development of a stroke-specific quality of life scale. *Stroke.* 1999;30:1362-1369.
4. Hilari K, Byng S. Measuring quality of life in people with aphasia: The stroke specific quality of life scale. *Int J Lang Commun Disord.* 2001;36:86-91.
5. Williams LS, Redmon G, Saul DC, Weinberger M. Reliability and telephone validity of the Stroke-specific Quality of Life (SS-QOL) scale. *Stroke.* 2000;32:339-b. (abstract)
6. Ewert T, Stucki G. Validity of the SS-QOL in Germany and in survivors of hemorrhagic or ischemic stroke. *Neurorehabil Neural Repair.* 2007;21:161-168.
7. Czechowsky D, Hill MD. Neurological outcome and quality of life after stroke due to vertebral artery dissection. *Cerebrovascular Diseases*. 2002;13:192-197.
8. Geyh S, Cieza A, Kollerits B, Grimby G, Stucki G. Content comparison of health-related quality of life measures used in stroke based on the international classification of functioning, disability and health (ICF): a systematic review. *Qual Life Res.* 2007;16:833-851.

9. Gargano JW, Reevew MJ. Sex differences in stroke recovery and stroke-specific quality of life: Results from a statewide stroke registry. *Stroke*. 2007;38:2541-2548.
10. Lin KC, Fu T, Wu CY, Hsieh YW, Chen CL, Lee PC. Psychometric comparisons of the Stroke Impact Scale 3.0 and the Stroke-Specific Quality of Life Scale. *Qual Life Res.* 2010; 19(3): 435-43.
11. Williams LS, Bakas T, Brizendine E, Plue L, Tu W, Hendire H, Kroenke K. How valid are family proxy assessments of stroke patients' health-related quality of life? *Stroke*. 2006; 37(8):2081-5.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute				X	
Inpatient Rehab				**X**	
Home Health			**X**		
Skilled Nursing				**X**	
Outpatient			**X**		
Overall Comments:	Many items ask about functioning in the home/living environment. Thus, it is more suitable to OP/home health. It's a fairly new measure with limited data on psychometrics although reliability is better than validity. Ceiling effects are notable; Note as responsive as the Stroke Impact Scale.				

Patient Acuity	**4**	**3**	**2**	**1**	**Comments**
Acute (< 2 mos)			**X**		
Subacute (2-6 mos)			**X**		
Chronic (> 6 mos)			**X**		
Overall Comments:	Has not been tested in severe stroke populations;				

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?	No	No	Not a priority to teach students; Other measures (eg. SIS may be more appropriate)
Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	X		It has been used in some clinical trials but may be more useful if the tool is revised to improve its psychometric properties

Stroke Rehabilitation Assessment of Movement (STREAM) Limb Subscales	
Reviewer: Sullivan	
ICF Domain (check all that apply): __x___body function/structure _____ activity ___participation	
Type of measure: _x_____ performance-based _ _self-report	
Instrument properties: 10 upper extremity and 10 lower extremity items compare quality and excursion of movement between involved and uninvolved sides.	
Reliability (test-retest, intra-rater, inter-rater)	Inter-rater reliability: Moderate to excellent for individual items[1,2] and excellent for subscales and for total score [3 1] Test-retest reliability was excellent for the motor sections of the STREAM.[2]
Validity (concurrent, criterion-related, predictive)	Total STREAM is moderately to highly correlated with the FMA, [3] Box and Block Test, Berg Balance Scale, Timed Up and Go (TUG), and Gait Speed, Barthel Index,[4] and the Rivermead Mobility Index.[5] Predictive Validity: STREAM scores are predictive of discharge destination after acute care hospitalization:[4] • Total STREAM < 63: probability of D/C to home = 0 • Total STREAM = 61 – 95: 55% home D/C • Total STREAM = 95 – 100: 86% home D/C • STREAM scores are predictive of gait speed and functional ability.[4] STREAM (total and subscale scores) are reported to correlate with stroke severity.[4]
Ceiling/ floor effects	• No ceiling or floor effects from stroke onset to 180 days.[5] • Compared to the Barthel Index and the FMA, the STREAM had lowest ceiling effect in acute stroke; a ceiling effect was more significant at 3-months post-stroke.[4] • At admission, floor effects were reported on the UE/LE subscales and ceiling effects were reported on the UE subscale.[2] At discharge, a ceiling effect was reported for the STREAM motor subscales.[2],[4]

Sensitivity to change (responsiveness, MCID, MDC)	In patients with acute stroke, total STREAM score as well as subscale scores were responsive to change.[4] In patients with severe stroke, the STREAM was responsive to change in gait speed, but less responsive to change than gait speed or the BBS. [6] There was a small effect size for the total STREAM (and a moderate effect size for the shortened version)s between admission to discharge from a rehabilitation program.[2]
Instrument use	
Equipment required	• Support surface (e.g., mat or bed)
Time to complete	15 – 20 minutes for entire STREAM (both limb subscales plus gross mobility scale)
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Each item is scored on a 3 point ordinal scale. The quality of motor function examined although not reflected in total score. The maximum score for the total STREAM = 70 points (UE motor function = 20; LE motor function = 20; basic mobility = 30) Scoring allows for omission of items if pain or limited passive range of motion.
Level of client participation required (is proxy participation available?)	Client must actively participate. No proxy version is available.

Limitations: In scoring, all 1's are scored as 1 so quality and excursion of movement is not factored into the scoring system.
Should this tool be required for entry level curricula? Yes _x__ No _____ Comments:
Is this tool appropriate for research purposes? Yes __x__ No _____ Comments:

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute	**x**				
Inpatient Rehab	**x**				
Home Health	**x**				
Skilled Nursing	**x**				
Outpatient	**x**				
Overall Comments:	Good reliability and validity with other established measures, including Fugl-Meyer. Predictive validity for D/C placement and function.				

Patient Acuity	**4**	**3**	**2**	**1**	**Comments**
Acute (< 2 mos)	x				
Subacute (2-6 mos)	x				
Chronic (> 6 mos)		**X**			
Overall Comments:					

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Do not recommend**	**Comments:** **Quick, reliable method to quantify the quality and excursion of limb movement following stroke**
Should this tool be required for entry level curricula?	X			

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?	X		

1. Daley K, Mayo N, Wood-Dauphinee S. Reliability of scores on the Stroke Rehabilitation Assessment of Movement (STREAM) measure. *Physical Therapy.* 1999;79(1):8-19; quiz 20-13.

2. Hsueh I-P, Hsu M-J, Sheu C-F, Lee S, Hsieh C-L, Lin J-H. Psychometric Comparisons of 2 Versions of the Fugl-Meyer Motor Scale and 2 Versions of the Stroke Rehabilitation Assessment of Movement. *Neurorehabil Neural Repair.* November 1, 2008 2008;22(6):737-744.

3. Wang CH, Hsieh CL, Dai MH, Chen CH, Lai YF. Inter-rater reliability and validity of the stroke rehabilitation assessment of movement (stream) instrument. *J Rehabil Med.* Jan 2002;34(1):20-24.

4. Ahmed S, Mayo NE, Higgins J, Salbach NM, Finch L, Wood-Dauphinee SL. The Stroke Rehabilitation Assessment of Movement (STREAM): a comparison with other measures used to evaluate effects of stroke and rehabilitation. *Physical Therapy.* 2003;83(7):617-630.

5. Hsueh IP, Wang CH, Sheu CF, Hsieh CL. Comparison of Psychometric Properties of Three Mobility Measures for Patients With Stroke. *Stroke.* 2003;**34**:**1741-1745**.

6. Salbach NM, Mayo NE, Higgins J, Ahmed S, Finch LE, Richards CL. Responsiveness and predictability of gait speed and other disability measures in acute stroke. *Arch Phys Med Rehabil.* Sep 2001;82(9):1204-1212.

Stroke Rehabilitation Assessment of Movement (STREAM) – Mobility Subscale	
Reviewer: Beth Crowner	
ICF Domain (check all that apply): ____body function/structure __X___ activity _____participation	
Type of measure: __X__ performance-based _____self-report Description: Measures voluntary movements and basic mobility in patients with stroke.[1] Also in simplified form (S-STREAM)[2]	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Inter-rater: Moderate to excellent (ICC=.96)[3-5] ; fair for S-STREAM (ICC-.88)[6] Intra-rater: Excellent (GCC=.982-.999)[3] Internal consistency: Excellent (Cronbach α >.98) on all subscales[3] Test-retest: moderate to excellent for S-STREAM (ICC=0.95)[6] ; UE subscale=(0.99)[5]
Validity (concurrent, criterion-related, predictive)	Concurrent: STREAM subscale scores closely related to Fugl-Meyer UE (.87), Fugl-Meyer LE (.78), and Rivermead Mobility Index (.83); Total STREAM score was moderately to highly associated with Barthel Index (.95) and Fugl Meyer (.95)[4] Convergent and Discriminant: Pearson Correlations with other measures: Box and Block (affected UE; .73-.78); Barthel Index (.71-.78); Berg Balance Scale (.65-.75); TUG (.57-.80), Gait speed (.62-.74); Showed usefulness comparable to that of the BI for predicting discharge destination from an acute care hospital. For individuals who are unable to perform high-level functional tests, the STREAM can be used within the first few days post-stroke to predict the probability of discharge from an acute care hospital and functional potential 3 months post-stroke.[7]

Ceiling/ floor effect	The STREAM had a lower ceiling effect compared with the Barthel Index and the TUG; after 3 months, less than 40% of individuals had reached the max score on the total STREAM, less than 60% had reached the maximum score on the UE and LE subscales.[7] UE-STREAM has significant floor and ceiling effects (>21% of subjects) at various stages of recovery.[8]
Sensitivity to change (responsiveness, MCID, MDC)	Responsiveness: Standardized response mean of .89, ranked 6/10 of outcome measures studied.[9] MDC: for UE-STREAM is varied 3 points[5] to 18.5 points[6]; MDC on S-STREAM for LE subscale=18 points and for Mobility subscale=16.6 points.[6] MCID: UE subscale=2.2 points, LE subscale-=1.9 points, mobility subscale=4.8 points[10]
Instrument use	
Equipment required	Questionnaire with option of mobility aids, stool, a support surface (eg, bed) and stairs with railings.
Time to complete	15 min (original STREAM)[7]; <10 min for S-STREAM[2]
How is the instrument scored? (e.g. total score, are there subscales, etc.)	30 test items with a total score and 3 subscale scores: UE movements(3 pts each), LE movements (3 pts each), basic mobility (4 points each)[3]; because the calculation of the final score on the STREAM requires several steps, it may be difficult to arrive at the total score in the presence of the patient.[7]; S-STREAM=15 items (5 items from each subscale)

Level of client participation required (is proxy participation available)	Clients would need to be able to follow commands for resistance/motor testing

Reference List

Comments:

Fairly quick to administer with little equipment or training required. Captures information about basic UE/LE motor function and mobility.

STREAM (and BERG and Barthel) may be more useful in capturing change in severely affected individuals compared to gait speed. STREAM captures components required for walking and, potentially, changes that must occur in these components before improvements in walking speed are observed. It may be more discriminative than gait speed of the amount of physical assistance that slow walkers require to ambulate.[9]

(1) Daley K, Mayo N, Wood-Dauphinee S, Danys I, Cabot R. Verification of the Stroke Rehabilitation Assessment of Movement (STREAM). *Physiother Can* 1997;49:269-78.

(2) Hsueh IP, Wang WC, Wang CH et al. A simplified stroke rehabilitation assessment of movement instrument. *Phys Ther* 2006 July;86(7):936-43.

(3) Daley K, Mayo N, Wood-Dauphinee S. Reliability of scores on the Stroke Rehabilitation Assessment of Movement (STREAM) measure. *Phys Ther* 1999 January;79(1):8-19.

(4) Wang CH, Hsieh CL, Dai MH, Chen CH, Lai YF. Inter-rater reliability and validity of the stroke rehabilitation assessment of movement (stream) instrument. *J Rehabil Med* 2002 January;34(1):20-4.

(5) Lin JH, Hsu MJ, Sheu CF et al. Psychometric comparisons of 4 measures for assessing upper-extremity function in people with stroke. *Phys Ther* 2009 August;89(8):840-50.

(6) Lu WS, Wang CH, Lin JH, Sheu CF, Hsieh CL. The minimal detectable change of the simplified stroke rehabilitation assessment of movement measure. *J Rehabil Med* 2008 August;40(8):615-9.

(7) Ahmed S, Mayo NE, Higgins J, Salbach NM, Finch L, Wood-Dauphinee SL. The Stroke Rehabilitation Assessment of Movement (STREAM): a comparison with other measures used to evaluate effects of stroke and rehabilitation. *Phys Ther* 2003 July;83(7):617-30.

(8) Lin JH, Hsu MJ, Sheu CF et al. Psychometric comparisons of 4 measures for assessing upper-extremity function in people with stroke. *Phys Ther* 2009 August;89(8):840-50.

(9) Salbach NM, Mayo NE, Higgins J, Ahmed S, Finch LE, Richards CL. Responsiveness and predictability of gait speed and other disability measures in acute stroke. *Arch Phys Med Rehabil* 2001 September;82(9):1204-12.

(10) Hsieh YW, Wang CH, Sheu CF, Hsueh IP, Hsieh CL. Estimating the minimal clinically important difference of the Stroke Rehabilitation Assessment of Movement measure. *Neurorehabil Neural Repair* 2008 November;22(6):723-7.

Practice Setting	4	3	2	1	Comments
Acute		X			
Inpatient Rehab		X			
Home Health		X			
Skilled Nursing		X			
Outpatient		X			
Overall Comments:					

Patient Acuity	4	3	2	1	Comments
Acute (< 2 mos)		X			
Subacute (2-6 mos)		X			
Chronic (> 6 mos)				X	**Limited responsiveness; the tool assesses measures of basic mobility and motor function. This tool may not be sensitive enough to demonstrate change in chronic stroke**
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?	No	Yes	
Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	Yes		

Tardieu[1]/Modified Tardieu Scale[2] (MTS)

Reviewer: Beth Crowner

ICF Domain (check all that apply):

__X___body function/structure _____ activity _____participation

Type of measure:

__X___ performance-based _____self-report

Description: The MTS uses standardized procedures to measure quality of muscle reaction at specified velocities (i.e. fast stretch, speed of the limb segment falling under gravity, and slow controlled motion). During the fast stretch maneuver the particular angle at which 'catch' occurs from hyperactive stretch reflex is called R1, also known as angle of muscle reaction. During the slow controlled maneuver, passive range of motion (PROM) is assessed and is called R2 and represents the muscle length at rest and is recorded as an angle. The difference between the two measures is R2–R1 or the dynamic component of spasticity and is more important than

the single measures of R1 and R2[2, 3]. A large and small difference between R1 and R2 is

suggestive of spasticity and muscle contracture, respectively.[2] Three velocities can be applied to the muscle: V1(as slow as possible; used to determine R2), V2 (speed of the limb falling under gravity; can be used to determine R1), or V3 (as fast as possible; can be used to determine R1)[2]

Instrument properties (please use footnotes)

Reliability (test-retest, intra-rater, inter-rater)	<u>Inter-rater</u> .74, .56. .72 (R1, R2 and R2-R1; **stroke** and BI; biceps)[4] .70[5],.58-.74[6] and .22-.71[7] (children with CP; LE muscles) .29-.53 poor to moderate (adults with TBI; UE and LE)[8] 66% (experienced/no training; 74-81% with training) CP; knee/elbow)[9] <u>Intra-rater</u> Poor in children with hemplegic CP[10] (biceps); V1=.2; V2=.8; V3=.3 77% (experienced/no training; 80-90% with training)CP knee/elbow)[9] <u>Test-retest</u>

	Variable in children with CP (.68-.90 HS; .38-.90 calf; .61-.93 AD) [6]; Repeated measures over time with different raters can vary 10-18° and with same rater by 4-19°.[6] Moderate to very good in adults with TBI (.52-.87)[8]
Validity (concurrent, criterion-related, predictive)	In patients with **stroke** MTS and Modified Ashworth (MAS) were compared to laboratory measures of spasticity (application of potentiometer and EMG); Agreement for predicting spasticity was better for MTS than MAS[11] To identify <u>presence</u> of spasticity: Elbow flexors: MTS=1.0; MAS kappa=.24 Ankle PF's: MTS=1.0; MAS kappa.25 To identify <u>severity</u> of spasticity: Elbow flexors: MTS/EMG (r=.86); MAS=.33 Ankle PF's: MTS/EMG (r=.62); MAS=.15 In subjects with CP (plantarflexors), compared to lab measure (potentiometer and EMG), MTS was able to identify presence of spasticity (kappa=.73), presence of contracture (kappa=.50), and severity of contracture (r=.49) but not severity of spasticity. [12] MAS over-estimated presence of spasticity 19% of time, while MTS under-estimated by 11%.
Ceiling/ floor effects	N/A
Sensitivity to change (responsiveness, MCID, MDC)	N/A
Instrument use	
Equipment required	Goniometer
Time to complete	Roughly 1 minute or less per muscle/joint being measured
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Measures are recorded in terms of ROM (degrees) calculated for both R1 and R2

Level of client participation required (is proxy participation available?)	The client must be present but does not need to have a high level of cognition other than to relax during the test.

Limitations

- Reliability is highly variable among studies. Training has been shown to improve reliability.[9]
- The speed at which to move the limb during V3 is not well defined.
- Because of wide error margins for both inter-rater and test-retest reliability, it is suggested that potentially large changes in these measures need to be found as a result of an intervention in order to be sure that any changes documented are attributable to the intervention and not measurement error.[6]
- Greater reliability than MAS[8, 11]
- May be better at measuring spasticity (due to the quick stretch) than other forms of hypertonicity that involve co-contraction (eg. dystonia). Because it grades according to the resistance to passive movement, findings could be confounded by changes in non-neurally mediated muscle stiffness.[12]
- Most studies primarily look at R1 compared to R2; Few studies address the "Y" component (Quality of Muscle Reaction), which is one aspect of the original instrument

Reference List

(1) Tardieu G, Shentoub S., Delaure R. [Research on a technic for measurement of spasticity.]. *Rev Neurol (Paris)* 1954;91(2):143-4.

(2) Boyd R, Graham K. Objective measurement of clinical findings in the use of botulinum toxin type A for the management of children with cerebral palsy. *Eur J Neurol* 1999;6(Suppl. 4):S23-S25.

(3) Boyd RD, Ada L. Physiotherapy management of spasticity. In: Barnes MP, Johnson GR, editors. *Upper motor neurone syndrome and spasticity. Clinical management and neurophysiology*.Cambridge: Cambridge University Press; 2001. p. 96-121.

(4) Ansari NN, Naghdi S, Hasson S, Azarsa MH, Azarnia S. The Modified Tardieu Scale for the measurement of elbow flexor spasticity in adult patients with hemiplegia. *Brain Inj* 2008 December;22(13-14):1007-12.

(5) Fosang A, Galea M, Reddihough D, McCoy A. Inter-rater and intra-rater reliability of three measures of spasticity in the lower limb. *Dev Med Child Neurol* 2001;Suppl 88:25-6.

(6) Fosang AL, Galea MP, McCoy AT, Reddihough DS, Story I. Measures of muscle and joint performance in the lower limb of children with cerebral palsy. *Dev Med Child Neurol* 2003 October;45(10):664-70.

(7) Yam WK, Leung MS. Interrater reliability of Modified Ashworth Scale and Modified Tardieu Scale in children with spastic cerebral palsy. *J Child Neurol* 2006 December;21(12):1031-5.

(8) Mehrholz J, Wagner K, Meissner D et al. Reliability of the Modified Tardieu Scale and the Modified Ashworth Scale in adult patients with severe brain injury: a comparison study. *Clin Rehabil* 2005 October;19(7):751-9.

(9) Gracies JM, Burke K, Clegg NJ et al. Reliability of the Tardieu Scale for assessing spasticity in children with cerebral palsy. *Arch Phys Med Rehabil* 2010 March;91(3):421-8.

(10) Mackey AH, Walt SE, Lobb G, Stott NS. Intraobserver reliability of the modified Tardieu scale in the upper limb of children with hemiplegia. *Dev Med Child Neurol* 2004 April;46(4):267-72.
(11) Patrick E, Ada L. The Tardieu Scale differentiates contracture from spasticity whereas the Ashworth Scale is confounded by it. *Clin Rehabil* 2006 February;20(2):173-82.
(12) Alhusaini AA, Dean CM, Crosbie J, Shepherd RB, Lewis J. Evaluation of Spasticity in Children With Cerebral Palsy Using Ashworth and Tardieu Scales Compared With Laboratory Measures. *J Child Neurol* 2010 March 10.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute		**X**			May not be as useful in the first few days post CVA when patients have not yet developed hypertonicity
Inpatient Rehab		**X**			
Home Health		**X**			
Skilled Nursing		**X**			
Outpatient		**X**			
Overall Comments:	The measure can be administered in any setting and is quick to administer. Reliability and validity are variable among muscle groups and between studies. The operational definitions for how to move the limb (speed) is poor which can lead to variation in reliability. While it is not the current "gold standard," it has been shown to be more reliable than the Modified Ashworth (current gold standard)				

Patient Acuity	**4**	**3**	**2**	**1**	**Comments**
Acute (< 2 mos)		**X**			
Subacute (2-6 mos)		**X**			
Chronic (> 6 mos)		**X**			
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Comments
Should this tool be required for entry level curricula?	X		Students should learn both the Modified Ashworth and the Modified Tardieu as they are two of the most commonly used clinical measures for hypertonicity.
Research Use	**YES**	**NO**	**Comments**
Is this tool appropriate for research purposes?	X		

Tinetti Mobility/Performance Oriented Mobility Assessment Test	
Reviewer: Rie	
ICF Domain (check all that apply): _____body function/structure __x__ activity _____participation	
Type of measure: __x__ performance-based _____self-report	
Instrument properties: originally created to measure balance and gait function in elderly, it consists of 9 balance and 7 gait maneuvers.	
Reliability (test-retest, intra-rater, inter-rater)	No intra-rater reliability information found in stroke population. <u>Test-retest reliability</u>: • in participants with stroke-high with ICC=0.91[1] (analysis done for gait portion of Tinetti test only) <u>Inter-rater reliability</u>: • in participants with stroke-high with ICC=0.85[1] (analysis done for gait portion of Tinetti test only) • in participants with PD-good to excellent (r≥0.80)[2] • in participants with ALS-excellent (r=0.95)[3] (analysis done for balance portion of Tinetti test only) • in elderly participants, done by both novice and experienced PT- fair to good (kappa coefficient=0.4-0.75), no significant difference between novice and experienced PT[4] (analysis done for balance portion of Tinetti test only) <u>Intra-rater reliability</u>: • in participants with PD-moderate to high (r=0.69-0.88)[2] • in participants with ALS-excellent (r=0.92-0.97)[3] (analysis done for balance portion of Tinetti test only)

Validity (concurrent, criterion-related, predictive)	Only concurrent validity tested in stroke population. <u>Concurrent validity</u>: • in participants post stroke and healthy age-matched older adults-significant negative correlation with COP-COM or distance between center of pressure and center of mass in terms of root mean square (r=-0.58 for AP direction, r=-0.57 for ML direction)[5] • in participants with PD-significant and fair negative correlation with United Parkinson's Disease Rating Scale motor scores (r_s=-0.45) and gait speed (r_s=0.53)[2] <u>Criterion-related validity</u>: • in participants with PD-ability of Tinetti Test to positively identify fall risk when history of falls was truly present was 76%. Ability to obtain a negative test when the condition history of falls was absent was 66%[2] <u>Discriminant validity</u>: • in community-dwelling older participants-excellent, where subject who were older, had experience a fall in the previous year, used a walking aid, and suffered more ADL disabilities obtained lower scores[6] (analysis done for balance portion of Tinetti test only) <u>Convergent validity</u>: • in community-dwelling older participants-moderately or strongly correlated with TUG (r=-0.55), Functional Reach (r=0.48), Tinetti gait (r=0.81), walking speed (r=-0.54), and ADL scale (r=0.60)[6] (analysis done for balance portion of Tinetti test only) <u>Predictive validity</u>: • in community-dwelling older participants-lower scores on the Tinetti balance test significantly predicted the occurrence of falling and ADL decline and improvement[6]

Ceiling/ floor effects	No study found
Sensitivity to change (responsiveness, MCID, MDC)	No sensitivity study done in stroke population. Sensitivity and specificity: • in elderly individuals living in residential care facilities- sensitivity and specificity for Tinetti test to be used as screening tests for referral to PT was 68% and 78%, respectively[7] (analysis done for balance portion of Tinetti test only)
Instrument use	
Equipment required	Hard, armless chair[2], stopwatch or wristwatch, 15 ft walkway
Time to complete	Less than 5 minutes[2], 15 minutes for both gait and balance subscales and 10 minutes for balance subscale[7], approximately 10 minutes to test balance portion[3], average of 20 minutes to complete entire test procedure with test administration lasting approximately 3 minutes[4], average time to complete Tinetti balance test was 160 seconds[6]
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Scoring done in 3 point ordinal scale, ranging from 0-2, where highest score indicates independence with each test item. The Tinetti test consists of balance and gait subscale (9 balance and 7 gait maneuvers) with total balance score of 16, gait score of 12 for total test score of 28.[8] Score of 19-24 out of 28 have "moderate" risk for falling, and those scoring <19 have a "high" risk for falling[2,8] Elderly individuals scoring <10 out of 16 on the Tinetti Balance Test have a high risk for falling[3]
Level of client participation required (is proxy participation available?)	Participant must complete the test physically

Limitations: Participants must be able to follow instructions and able to ambulate short distances with assistive device. Some of the studies looked at only 1 of the 2 subsections of Tinetti test, which makes it difficult to interpret the results fully. Also, there are multiple names for this test, which is confusing.

Recommendations:

Practice Setting (Comments: Most commonly, the Tinetti test is done to assess fall risk, so it could be done in any setting as long as the patient is appropriate to perform tasks from this test. The studies were done in home environment[6] and at skilled nursing facility[4,7].

Comments: the majority of studies were done for chronic patient population[1,5,8], but if patient is able to follow instruction and ambulate short distances with assistive device, it could be done at any acuity level.

References:

1. Daly JJ, Roenigk K, Holcomb J, et al. A randomized controlled trial of functional neuromuscular stimulation in chronic stroke subjects. *Stroke*. 2006;37:172-178.
2. Kegelmeyer DA, Kloos AD, Thomas KM, Kostyk SK. Reliablity and validity of the Tinetti Mobility Test for individuals with Parkinson disease. *Phys Ther*. 2007;87:1369-1378.
3. Kloos AD, Dal Bello-Haas V, Thome R, et al. Interrater and intrarater reliability of the Tinetti Balance Test for individuals with amyotrophic lateral sclerosis. *J Neurol Phys Ther*. 2004;28:12-19.
4. Cipriany-Dacko, LM, Innerst D, Johansen J, Rude V. Interrater reliability of Tinetti Balance Scores in novice and experienced physical therapy clinicians. *Arch Phys Med Rehabil*. 1997;78:1160-1164.
5. Corriveau H, Hebert R, Raiche M, Prince F. Evaluation of postural stability in the elderly with stroke. *Arch Phys Med Rehabil*. 2004;85:1095-1101.
6. Lin MR, Hwang HF, Hu MH, et al. Psychometric comparisons of the timed up and go, one-leg stand, functional reach, and Tinetti balance measures in community-dwelling older people. *J Am Geriatr Soc*. 2004;52:1343-1348.
7. Harada N, Chiu V, Damron-Rodrigues J, et al. Screening for balance and mobility impairment in elderly individuals living in residential care facilities. *Phys Ther*. 1995;75:462-469.
8. Soyuer F, Ozturk A. The effect of spasticity, sense and walking aids in falls of people after chronic stroke. *Disabil Rehabil*. 2007;29:679-687.

Practice Setting	4	3	2	1	Comments
Acute			**x**		
Inpatient Rehab			**x**		
Home Health			**x**		
Skilled Nursing			**x**		
Outpatient			**x**		
Overall Comments:					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)			x		
Sub- Acute (2-6 months)			x		
Chronic (>6 months)			x		
Overall Comments: all studies in stroke population done in those with chronic stroke but not all studies utilized both mobility and balance subscales.					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?			x	

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	x		

Trunk Control Test	
General Information:	
Target Client Population	Stroke
Topic / Content area / Domain :	Activity Measure- Trunk
Instrument components (including scoring, type of measure [e.g. performance-based, self-report])	The Trunk Control Test (TCT) is a performance-based test designed by Collin and Wade (1990) to provide a simple, valid motor assessment to monitor clinical progress, evaluate interventions and use in research and rehabilitation medicine.[1] The TCT consists of 4 items that require trunk movement. While supine on a bed, the patient is asked to: • roll to the weak side • roll to the strong side • sit up from lying down • sit on the edge of the bed with feet unsupported for a minimum for 30 seconds Scoring: 0 unable to perform without assistance 12 able to perform in an abnormal manner 25 able to complete movement normally The TCT score is the addition of the scores obtained on the four items, with a maximum of 100 points.
Instrument properties	
Reliability (test-retest, intra-rater, inter-rater)	Inter-rater: Collin found good inter-rater reliability (Spearman rho=0.76; p<0.001) Internal consistency: Individual items p were significantly intercorrelated with values of r
Validity (concurrent, criterion-related, predictive)	Criterion related Concurrent: Good correlation to the Rivermead Motor Assessment - gross function section[4] was found. (.70, .72 and .79, p< 0.01; at 6wks, 12 wks and 18 wks post stroke, respectively)[1].

	Predictive: Wade found that scoring 50 or more at 6 weeks on the TCT was predictive of walking 10 meters without assistance at 18 weeks. Franchignoni found that the TCT score at admission was a better predictor of motorFIM discharge scores better than the motorFIM admission scores. [2] Construct: High correlation between TCT and motorFIM and totalFIM[2]
Responsiveness to change (e.g., MCD, MCID)	unknown
Ceiling/ floor effects	***Has pronounced ceiling effects (Frangchignoni)[5] therefore cannot be used as an evaluative or discriminative measure***.
Potential sources of bias	
Availability of normative data	unknown
Extent of use in target and other populations	unknown
Instrument use	
Equipment required	Bed
Time to complete	5 minutes
Effect of tester experience (expertise/training)	In the Collin and Wade study[1], doctors learning the test received written guidelines and one demonstration. Good inter-rater reliability was established with this method.
Level of client participation required	Performance based
Benefits	• Quick • Reliable • Easy to train and administer • Predictive data regarding walking ability
Limitations	• See above ceiling effect • Per Collin and Wade: 1. does not give any information on the quality of movement, therefore not useful in planning treatment, 2. not sensitive to

	minor changes in motor function, 3. does not account for other impairments affecting movement such as spasticity, apraxia, or sensory loss.
Comments:	
References (including websites):	1. Assessing motor impairment after stroke: a pilot reliability study. Collin C, Wade D. J Neurology, Neurosurg Psychiatry 1990; 53:576-579 2. Trunk control test as an early predictor of stroke rehabilitation outcome. Franchigioni et al. Stroke 1997; 28:1382-1385. 3. Trunk control test as a functional predictor in stroke patients. Duarte et al. J Rehabil Med 2002; 34:267-272. 4. Assessment of motor function in stroke patients. Lincoln N, Leadbetter D. Physiotherapy 1979, 65:48-51. 5. Franchignoni F. Psychometric properties and practical attributes of the trunk control test in stroke patients [letter to the editor]. J Rehabil Med.2003 ;35:150.

Practice Setting	4	3	2	1	Comments
Acute				**x**	**pronounced ceiling effects**
Inpatient Rehab				**x**	
Home Health				**x**	
Skilled Nursing				**x**	
Outpatient				**x**	

Overall Comments:

- Developed for stroke population, reliable, easy to train, no special equipment, some predictive ability. However, one of its earlier proponents, later found it to have significant ceiling effects and felt it not to be of evaluative and discriminative use. *****CANNOT GET ACCESS TO FULL ARTICLE, so I am a bit concerned making this comment. DN*

- The PASS contains the Trunk Control Test's 4 items plus 8 more. The PASS has stronger psychometric properties, even though it too has a ceiling effect at 90 days.

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				x	
Sub- Acute (2-6 months)				x	
Chronic (>6 months)				x	

Overall Comments:

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?			x	

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?		x	

2nd Reviewer Comments:
The tool has marked ceiling effects and a lack of sensitivity (ie. patients who are dependent or require min assist would both score "0"). While the tool is quick and simple to use, a standard PT assessment that indicates level of assistance (or the FIM) would provide greater detail and information about a patient's status. I would not recommend this as a tool

Trunk Impairment Scale	
General Information:	
Target Client Population	Stroke
Topic / Content area / Domain :	Activity level-trunk control
Instrument components (including scoring, type of measure [e.g. performance-based, self-report])	The Trunk Impairment Scale (TIS) is a performance based clinical test designed to assess the motor function of the trunk after stroke. It contains 17 items with a minimum score = 0 and maximum = 23, with a higher score indicating better performance. Consists of 3 subscales with following items: • Static sitting balance** o ability to sit unsupported, o maintain sitting while therapist crosses unaffected leg over hemiplegic leg , o maintain sitting while patient crosses unaffected leg over hemiplegic leg • Dynamic sitting balance o patient touches hemiplegic elbow to bed by shortening hemiplegic side of trunk o patient touches unaffected elbow to bed by shortening the unaffected side of trunk o patient lifts hemiplegic pelvis off bed by shortening hemiplegic side of trunk o patient lifts unaffected pelvis off of bed by shortening unaffected side of trunk • Coordination o rotate upper trunk 6x - each side moves forward 3x o rotate lower trunk 6x - each side moves forward 3x **Verheyden (2010)[10] found that the static sitting components did not meet Rasch criteria and proposed a revised TIS 2.0. The dynamic and coordination subscales did fit Rasch analysis and were retained.

Reliability (test-retest, intra-rater, inter-rater)	Test –Retest agreement[1]: • kappa and weighted kappa (0.46-1.0) • ICC (90% lower confidence interval)=0.87-0 .96 Inter-rater agreement[1]: • kappa and weighted kappa (0.70-1.0) • ICC (90% lower confidence interval)= 0.85-0.99 Intra-rater agreement[1] : • kappa and weighted kappa (0.45-1.0) Internal Consistency: • Cronbach α= 0.89 for total score TIS[1]

Validity (concurrent, criterion-related, predictive)	• Revised TIS 2.0 proposed: the static sitting subscale was omitted as it did not meet Rasch analysis.[8] Construct: • Spearman rank correlation to Barthel=0.86[1] Concurrent: • Spearman rank correlation to Trunk Control Test is r=0.83.[1] Predictive: • Trunk control has been linked to improved functional mobility. In a study conducted to examine the predictive validity of the TIS and its subscales with acute stroke subjects, the TIS was performed on admission and at 6 months post-stroke. The TIS total score (partial R^2= .52, p< .0001 and the static sitting sub-score (partial R^2=.50, p< .0001) on admission were better predictors of the Barthel Index (BI) score at 6 months than the BI admission score. [3] • In another study by DiMonaco (2010), the predictive ability of admission IP rehab TIS and the PASS scores on Discharge FIM scores and Discharge placement (home or institution) was determined. Both TIS and PASS were able to predict discharge FIM scores (P=0.01, and P=0.04, respectively) and placement (P=0.040 and P=0.032, respectively).[7] Discriminant: • In a study by Verheyden (2005), the TIS was able to discriminate between healthy and stroke subjects.
Responsiveness to change (e.g., MCD, MCID)	Not known
Ceiling/ floor effects	No ceiling effect[6]
Potential sources of bias	
Availability of normative data	45% of age and sex matched healthy subjects obtained sub-maximal scores in a study on the discriminant ability of the TIS. A score of 20 out of 23 indicates normal trunk function.[6]
Extent of use in target and other populations	• TIS has been shown to be a reliable and valid tool with MS[4]. • It also shows construct validity with Parkinson's Disease.[5]
Instrument use	
Equipment required	Bed or mat

Time to complete	2-18 minutes
Effect of tester experience (expertise/training)	training indicated for consistency of rating.
Level of client participation required	Performance-based
Benefits	• no ceiling effect with sub-acute and chronic stroke patients • Use as a clinical and research tool • Provides more detailed assessment of the trunk that can be used to guide treatment • good psychometric properties[9]
Limitations	• Small number of subjects in studies • Validated with sub-acute and chronic stroke patients, but not acute
Comments:	
References (including websites):	1. The Trunk Impairment Scale: a new tool to measure motor impairment of the trunk after Stroke. G Verheyden, et al. Clin Rehabil 2004; 18:326-334. 2. Trunk performance after stroke and the relationship with balance, gait and functional ability. Verheyden, G. , et al. Clinical Rehabilitation 2006; 20(5):451-458.J Neurol Neurosurg Psychiatry 2007;78:694-698 doi:10.1136/jnnp.2006.101642 3. Trunk performance after stroke: an eye catching predictor of functional outcome. Geert Verheyden, et al. J Neurol Neurosurg Psychiatry 2007;78:694-698. 4. Reliability and Validity of Trunk Assessment for People With Multiple Sclerosis. Verheyden G et al. Phys Ther 2006; vol. 86, No. 1, pp.66-76. 5. Validity of the Trunk Impairment Scale as a Measure of Trunk Performance in People With Parkinson's Disease. Verheyden G et al. Arch Phys Med Rehabil 2007. Volume 88, Issue 10, Pages 1304-1308 6. Discriminant ability of the Trunk Impairment Scale: A comparison between stroke and healthy individuals. Verheyden G et al. Disabil Rehabil 2005; 27:1023-8. 7. DiMonoco et al. The relationship between initial trunk control or postural balance and inpatient rehabilitation outcome after stroke: a prospective comparative study. Clin Rehabil June 2010 vol. 24 no. 6 543-554 8. Verheyden G, Kersten P. Investigating the internal validity of the Trunk Impairment Scale (TIS) using Rasch analysis: the TIS 2.0. Disabil Rehabil. 2010 Jun 22.

	9. Tyson, S. How to measure balance in clinical practice. A systematic review of the psychometric properties and clinical utility of balance activity for neurological conditions. Clin Rehabil 2009; 23:824-840.

2nd Reviewer comments:
This measure is a reliable, comprehensive assessment of trunk control. There could be floor effects for lower functioning patients if they remove the three static sitting balance items. Items are broken into affected and unaffected sides, making it useful for patients with stroke. For higher functioning stroke patients, the test could take up to 18 minutes. It may take too long if a clinician is using another measure (eg standing balance) for these higher functioning individuals.
In sum, it is a useful tool for assessing trunk control (and would prefer inclusion of static sitting balance items

Practice Setting	4	3	2	1	Comments
Acute		**x**			
Inpatient Rehab		**x**			
Home Health		**x**			
Skilled Nursing		**x**			**pt needs to be able to follow instructions**
Outpatient		**x**			

Overall Comments:

Modification to TIS was made, G. Verheyden, to eliminate static sitting portion of the test: First item had ceiling effects and the other static sitting items did not meet Rasch analysis. Dynamic sitting balance and coordination subsections did fit Rasch model. She proposed the TIS 2.0 (Disabil Rehabil. 2010 Jun 22.)

- good psychometric properties - reliable and valid - no ceiling effect

- <18 minutes (<10 minutes per Tyson), no special equipment

- looks at how a person moves not just the task, therefore can give information for treatment needs

- since it is an impairment scale, functional movement tests still need to be done- adds time in the clinic

Practice Setting	4	3	2	1	Comments
Acute (<2 months)		x			
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			

Overall Comments: No ceiling effect, normative data available- TIS is able to differentiate those with stroke from those w/o neurological insult

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Do not recommend**	**Comments** **- good reliability in determining pt's ability to balance but difficult to establish agreement between raters on quality of movement, therefore,** **-training and experience warranted, and perhaps further development of the scale**
Should this tool be required for entry level curricula?		x		

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?	x		**- yes- need to establish quality of movement interpretation guidelines therefore, training and agreement between raters prior to use**

Timed Up and Go (TUG)	
Reviewer: Kluding	
ICF Domain (check all that apply): _____body function/structure __x__ activity ____participation	
Type of measure: __x___ performance-based ___self-report	
Instrument properties This is a test of mobility, balance, and locomotor performance.	
Reliability (test-retest, intra-rater, inter-rater)	**Test-retest reliability**: Excellent (ICC = 0.95 - 0.96) in people with stroke.[1, 2] Most studies of older adults have found excellent reliability (ICC 0.97-0.99) [2, 3] However, ICC of 0.56 reported in large survey of elderly people in Canada with and without cognitive impairment,[4] with TUG tests performed a mean of 112 days apart, in different environments, and with different testers.
Validity (concurrent, criterion-related, predictive)	**Concurrent** In people with stroke: • TUG significantly correlated with tests of gait speed (-0.86 to -0.92), stair climbing time (0.86 to 0.9), and 6 minute walk test (-0.89 to 0-.92)[1] • TUG significantly correlated with Chedoke-McMaster leg (-0.7) and foot (-0.69) scores, significantly correlated with strength in paretic (-0.71) and non-paretic (-0.44) limb.[5] • TUG significantly correlated with Falls Efficacy Scale (Swedish version) (ρ=-0.55 to -0.7) and Berg Balance Scale (ρ=-0.68 to -0.72).[6] **Criterion-related** n/a **Predictive**

	TUG $\geq$ 14s had 50% sensitivity and 78% specificity for fall prediction 6-12 months after discharge in people with stroke.[7]
Ceiling/ floor effects	Individuals may be unable to perform test without assistance, which indicates a floor effect. For example: • at discharge from inpatient rehab, 2/44 (4.5%) people with stroke unable to perform TUG[5] • 1 week after stroke 10/50 (20%) unable to perform TUG; 1 month after stroke 3/50 (6%) unable to perform TUG[8] A score of 8.5 seconds has been used as a "maximum score" for subjects with stroke,[5, 8] based on a mid-range value of scores reported for healthy elderly.[3] However, 4/50 (8%) of subjects 1 month post stroke reached this max score;[8] 10/44 (22.7%) reached this max score at discharge from inpatient rehab and 16/44 (36.4%) reached this max score 6 months later.[5] A range of 6.7 to 27. 7 seconds was reported in community-dwelling subjects with chronic stroke.[1] This seems to calls into question the validity of an arbitrary maximum score on a timed test.
Sensitivity to change (responsiveness, MCID, MDC)	**Responsiveness** SRM indicated a small effect size (0.34) in people with stroke between discharge from inpatient rehab and 6 months later.[5] SRM of 0.73 (95%CI 0.17-1.06) between 1 week and 1 month post stroke, in subjects able to perform test at baseline.[8] **MCID / MDC (not available in people with stroke)** Elderly African Americans MDC_{90}=4.0 s[9] Alzheimer's Disease MDC_{90}=4.09 s[10] Parkinson's Disease MDC_{95}=11 s[11]

Instrument use	
Equipment required	Standard chair with armrests, tape measure to mark 3 meters in an open area, colored tape or cone for turnaround point, stopwatch
Time to complete	1-2 minutes
How is the instrument scored? (e.g. total score, are there subscales, etc.)	The individual starts sitting in a chair that is not up against a wall. The testing procedure is as follows: individual stands up from chair, walks 3m, turns around a cone at the end of the 3m, walks back to the chair and sits down. Individual is asked to perform this task as quickly as possible but to remain safe at all times. Use of an assistive device (cane or walker) is allowed but physical assistance is not permitted. Time in seconds to complete the test is recorded. TUG was developed as a timed alternative to the "Get Up and Go" test,[3] which was scored on a 5 point scale from "normal" to "severely abnormal".[12] Chair seat height and turn direction (towards or away from affected side) are important variables to consider: turning towards affected side and a higher chair (115% of lower leg length) had significantly faster TUG scores in people with stroke.[13] No subscales reported. Modifications include dual task comparisons (TUGcognitive and TUGmanual) but not reported in stroke.[14]
Level of client participation required (is proxy participation available?)	No proxy participation available.

Limitations: Individual must be able to walk without assistance. Time score does not indicate difficulties with quality of movement, or where patient encountered difficulty (sit to stand, turn, or walking).
Patients in acute setting may be less likely to complete the test without assistance.

1. Flansbjer U, Holmback A, Downham D, Patten C, Lexell J. Reliability of gait performance tests in men and women with hemiparesis after stroke. *J Rehabil Med.* 2005;37:75-82.
2. Ng SS, Hui-Chan CW. The timed up & go test: its reliability and association with lower-limb impairments and locomotor capacities in people with chronic stroke. *Arch Phys Med Rehabil.* Aug 2005;86(8):1641-7.
3. Podsiadlo D, Richardson S. The timed "up and go": A test of basic functional mobility for frail elderly persons. *J Amer Geriatr Soc.* 1991;39:142-8.
4. Rockwood K, Awalt E, Carver D, MacKnight C. Feasibility and measurement properties of the functional reach and the timed up and go tests in the Canadian study of health and aging. *J Gerontol:A.* 2000;55A(2):M70.
5. Knorr S, Brouwer B, Garland SJ. Validity of the Community Balance and Mobility Scale in Community-Dwelling Persons After Stroke. *Arch Phys Med Rehabil.* 2010;91(6):890-6.
6. Engberg W, Lind A, Linder A, Nilsson L, Sernert N. Balance-related efficacy compared with balance function in patients with acute stroke. *Physiother Theory Pract.* 2008;24(2):105-111.
7. Andersson AG, Kamwendo K, Sieger A, Appelros P. How to identify potential fallers in a stroke unit: Validity indexes of 4 test methods. *J Rehabil Med.* 2006;38(3):186-191.
8. Salbach NM, Mayo NE, Higgins J, Ahmed S, Finch LE, Richards CL. Responsiveness and predictability of gait speed and other disability measures in acute stroke. *Arch Phys Med Rehabil.* 2001;82(9):1204-1212.
9. Mangione KK, Craik RL, McCormick AA, et al. Detectable changes in physical performance measures in elderly African Americans. *Phys Ther.* 2010;90(6):921-927.
10. Ries JD, Echternach JL, Nof L, Blodgett MG. Test-retest reliability and minimal detectable change scores for the Timed "Up & Go" Test, the Six-Minute Walk Test, and gait speed in people with Alzheimer disease. *Phys Ther.* 2009;89(6):569-579.
11. Steffen T, Seney M. Test-retest reliability and minimal detectable change on balance and ambulation tests, the 36-Item Short-Form Health Survey, and the Unified Parkinson Disease Rating Scale in people with parkinsonism. *Phys Ther.* 2008;88(6):733-746.
12. Mathias S, Nayak U, Issacs B. Balance in elderly patients: The "Get up and go" test. *Arch Phys Med Rehabil.* 1986;67:387-389.
13. Heung THM, Ng SS. Effect of seat height and turning direction on the timed up and go test scores of people after stroke. *J Rehabil Med.* 2009;41:719-722.
14. Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up and Go test. *Phys Ther.* 2000;80(9):896-903.

Practice Setting	4	3	2	1	Comments
Acute	X				
Inpatient Rehab	X				
Home Health	X				
Skilled Nursing	X				
Outpatient	X				
Overall Comments:					

Practice Setting	4	3	2	1	Comments
Acute (<2 months)	X				
Sub- Acute (2-6 months)	X				
Chronic (>6 months)	X				
Overall Comments:					

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?	X			

Research Use	YES	NO	Comments
Is this tool appropriate for research purposes?	X		

VO_{2max} EDGE	
Reviewer: Kluding	
ICF Domain (check all that apply): __X___body function/structure ____ activity ____participation	
Type of measure: __X___ performance-based ___self-report	
Instrument properties : Maximal oxygen uptake (VO_{2max}) is a measure of aerobic fitness, traditionally assessed with a graded maximal exercise test. If criteria for a true maximal test are not met,[1] this measure may be more accurately reported as VO_{2peak}.[2] Different exercise modalities may be used for testing (treadmill, cycle, etc.), and submaximal tests may be used to predict VO_{2max}. For a review of submax tests written for physical therapy practice (not specific to stroke), see review by Noonan & Dean.[3] According to ACSM guidelines, people with stroke are in the high risk category because of known cardiovascular disease. Medical exam and graded exercise tests are recommended before beginning moderate or vigorous intensity exercise, with a physician in close proximity and readily available during the exercise test (submaximal or maximal).[1]	
Reliability (test-retest, intra-rater, inter-rater)	**Test-retest reliability**: Reliability is generally high for VO_{2max} tests in people with stroke but may be variable depending on exercise modality used, and whether test is maximal or submaximal: • High reliability for VO_{2max} from maximal cycle ergometer test (ICC 0.93), and a submaximal effort during that test (85% of age-predicted heart rate max).[4] • High reliability for VO_{2max} from maximal treadmill test (r=0.92).[5] • Moderate to high reliability of VO_{2max} with submax treadmill test: ICC=0.75[4] and r=0.89[5] • Low reliability of VO_{2peak} was found in 1 study of maximal tests (ICC =0.5), with higher values on 2nd

	tests raising concerns about a possible practice effect.[6]
Validity (concurrent, criterion-related, predictive)	**Concurrent** Significant correlational relationships between VO_{2peak} and total lean body mass (r=0.6) and walking velocity (r=0.53) were found, with these values as strong independent predictors of VO_{2peak} in a regression analysis.[7] Significant correlational relationships were found between VO_{2peak} and a measure of fatigue (r=-0.74), fugl-meyer score (r=0.78), and 6 minute walk distance (r=0.73).[8] However, another study found no significant relationships between VO_{2max} and gait speed, balance, or heart rate / blood pressure in subjects with mild, chronic stroke.[4] Because these subjects were higher-functioning they may not have had the same range of values as in the other research.[7, 8] Measures of VO_{2max} from graded maximal exercise test with a total body recumbent stepper were strongly correlated (r=0.91) with measures from cycle ergometer. Higher values were found with the recumbent stepper in subjects with mild to severe lower extremity motor function.[9] **Predictive** In people with or without known cardiovascular disease, low VO_{2peak} is a strong, independent risk factor for all-cause and cardiovascular mortality.[1] For each 1 mLkg/min increase in VO_{2peak}, there is a 9-10% reduction in cardiac mortality.
Ceiling/ floor effects	Not specifically reported in stroke. Ceiling effects should not apply, as aerobic fitness can continuously improve. Floor effects may apply to people who are not safe to perform the test.
Sensitivity to change (responsiveness, MCID, MDC)	Not reported in stroke.

Instrument use	
Equipment required	Cycle ergometer, treadmill, or recumbent stepper. Site personnel certified in basic life support and automated external defibrillator training, with certification in first aid and advanced cardiac life support preferred. Equipment to monitor blood pressure and ECG changes. A metabolic cart is necessary for measures of gas exchange (required for measure of VO_{2peak} vs. estimation from heart rate using a prediction equation).
Time to complete	Approx 1 hour (including set up, exercise test of 15-20 min, and cool down).
How is the instrument scored? (e.g. total score, are there subscales, etc.)	Measures of VO_{2peak}, VCO_{2peak}, and respiratory exchange ratio are provided by metabolic cart equipment. Heart rate is typically used in submaximal testing.
Level of client participation required (is proxy participation available?)	No proxy participation available.

Limitations: Maximal exercise tests are not feasible in clinical practice settings, although recommended for anyone with known cardiovascular disease. Tests require extensive knowledge of exercise physiology, ECG interpretation, ability to respond to cardiac complications, expensive equipment, and physician supervision.

Comments:

Maximal tests are not recommended for PT clinical practice because of limitations above. However, referral to cardiac rehab settings for these tests is appropriate before initiating a moderate/vigorous aerobic training program. Submaximal exercise tests (such as 6 minute walk test) may be an acceptable substitute to use as an outcome measure of aerobic fitness for clinical practice,[4] although not acceptable for research purposes.

Practice Setting	4	3	2	1	Comments
Acute				X	
Inpatient Rehab				X	
Home Health				X	
Skilled Nursing				X	
Outpatient				X	

Overall Comments: Maximal tests are not recommended for clinical practice because of limited feasibility: tests require extensive knowledge of exercise physiology, ECG interpretation, ability to respond to cardiac complications, expensive equipment, and physician supervision. However, referral to cardiac rehab settings for these tests is appropriate before initiating a moderate/vigorous aerobic training program. Submaximal exercise tests (such as 6 minute walk test) may be an acceptable substitute for clinical practice as an outcome of aerobic fitness,[4] although not acceptable for research purposes.

Practice Setting	4	3	2	1	Comments
Acute (<2 months)				X	May be appropriate >1 month after stroke if mild stroke and medically stable
Sub- Acute (2-6 months)		X			
Chronic (>6 months)		X			

Overall Comments: Recommended for research purposes or where equipment and expertise is available, in patients who are medically stable following stroke and able to tolerate a test to exhaustion.

Entry-Level Criteria	Students should learn to administer tool	Students should be exposed to tool (e.g. to read literature)	Do not recommend	Comments
Should this tool be required for entry level curricula?		X		

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?	X		

1. *ACSM's Guidelines for Exercise Testing and Prescription*. 8th ed. Philadelphia: Lippincott, Williams, and Wilkins; 2010.
2. Tang A, Sibley KM, Thomas SG, McIlroy WE, Brooks D. Maximal exercise test results in subacute stroke. *Archives of Physical Medicine and Rehabilitation.* Aug 2006;87(8):1100-1105.
3. Noonan V, Dean E. Submaximal exercise testing: clinical application and interpretation. *Phys Ther.* 2000;80(8):782-804.
4. Eng JJ, Dawson AS, Chu KS. Submaximal exercise in persons with stroke: test-retest reliability and concurrent validity with maximal oxygen consumption. *Archives of Physical Medicine and Rehabilitation.* 2004;85(1):113-118.
5. Dobrovolny CL, Ivey FM, Rogers MA, Sorkin JD, Macko RF. Reliability of treadmill exercise testing in older patients with chronic hemiparetic stroke. *Arch Phys Med Rehabil.* Sep 2003;84(9):1308-1312.
6. Tang A, Sibley K, Bayley M, McIlroy W, Brooks D. Do functional walk tests reflect cardiorespiratory fitness in sub-acute stroke? Vol 3; 2006:23.
7. Ryan AS, Dobrovolny CL, Silver KH, Smith GV, Macko RF. Cardiovascular fitness after stroke: Role of muscle mass and gait deficit severity. *Journal of Stroke and Cerebrovascular Diseases.* 2000;9(4):185-191.
8. Tseng BY, Kluding P. The relationship between fatigue, aerobic fitness, and motor control in people with chronic stroke: A pilot study. *J Geriatr Phys Ther.* 2009;32(3):97-102.
9. Billinger SA, Kluding P, Tseng BY. Modified total body recumbent stepper exercise test (mTBRS-XT) to obtain VO2 peak in people with chronic stroke. *Phys Ther.* 2008;88(10):1188-1195.

Wolf Motor Function Test	
Reviewer: Dorian Rose	
ICF Domain (check all that apply): _____body function/structure ___x__ activity _____participation	
Type of measure: __x___ performance-based _____self-report	
Instrument properties (please use footnotes)	
Reliability (test-retest, intra-rater, inter-rater)	Intra-rater: ICC=0.95[1] Inter-rater: ICC=0.94[1] Intra-rater: ICC=0.92[2] Inter-rater: *r*=0.97-0.99[3] Inter-rater: WMFT-Time: *r*=0.97; WMFT-FAS: *r*=0.88[4] Test-retest: WMFT-Time: ICC=0.90; WMFT-FAS: ICC=0.95[4] Test-retest: ICC=0.97[2]
Validity (concurrent, criterion-related, predictive)	Construct validity: WMFT-Time scores differentiated the more affected and the less affected UE from either UE of subjects without impairment ($p<0.0006$)[3] Concurrent validity: WMFT-FAS w/ARAT r=0.86; WMFT-TIME w/ARAT r=0.89[1] Concurrent validity: *r* = 0.93 (14 days post-stroke), *r* = 0.96 (30 days post-stroke), *r*=0.85 (90 days post-stroke); *r*=0.94 (180 days post-stroke) w/ UEFM[2] Concurrent validity: *r* = 0.92 (14 days post-stroke), *r* = 0.97 (30 days post-stroke), *r*=0.81 (90 days post-stroke); *r*=0.92 (180 days post-stroke) w/ ARAT[2] Criterion validity: WMFT and FMA were related ($p<0.02$) for the more affected UE post-stroke[3] Construct validity: WMFT-Time w/FMA: r=0.76; WMFT –time w/ARAT: *r*=0.63; WMFT-Time w/FIM-motor: *r*=0.40; WMFT-FAS w/FMA: *r*=0.71; WMFT-FAS w/ARAT: *r*=0.77; WMFT-FAS w/FIM-

	motor: *r*=0.29[5] Predictive validity: WMFT-Time w/FIM-total at post-treatment; *r*= 0.47; WMFT-Time w/FIM-motor at post-treatment; *r*= 0.43; WMFT-FAS w/FIM-total at post-treatment; *r*= 0.17; WMFT-FAS w/FIM-motor at post-treatment; *r*= 0.43; WMFT/FAS - 0.19[5]
Ceiling/ floor effects	No ceiling or floor effects: 17% of patients scored beyond the upper 5% limits; 5% scored below the lower 5% limits[1] Does not exhibit floor or ceiling effects when measured between 14-180 days post-stroke[2]
Sensitivity to change (responsiveness, MCID, MDC)	MDC_{95}: 0.7 seconds for the average WMFT Performance Time test[6] MDC_{95} : 0.1 points for the Functional Ability Scale score[6] $MDC_{90:}$ 4.36 seconds for WMFT Time [7] $MDC_{90:}$ 0.37 for WMFT-FAS[7] MCID: 1.5-2.0 seconds for WMFT-Time[7] MCID: 0.2-0.4 for WMFT-FAS[7] Responsiveness: WMFT-Time (SRM = 0.38, considered small); WMFT-FAS (SRM = 1.30, considered large)[5] Effect Size (14-180 days post-stroke) = 0.64 (moderate) [2] MCID: WMFT-Time: 19 seconds if dominant side is affected; WMFT-FAS: 1.0 pts if dominant side is affected; WMFT-FAS: 1.2 if non-dominant side is affected[8]
Instrument use	
Equipment required	Straight-back chair w/o arms, table, card board box, soda can (full), paper clip, pencil, 3 checkers, 3 index cards, dish towel, basket w/handles, bedside table, key in lock w/hardware, hand dynamometer, 1 lb wt, 3 lb wt, cuff weight w/slots to incrementally increase wt by 1 lb up to 20 lbs., stop watch, talcum powder
Time to complete	1 hour (for each UE tested)

How is the instrument scored? (e.g. total score, are there subscales, etc.)	The WMFT yields two scores: WMFT-Time is a timed score quantifying speed of performance of 15 functional items in seconds. There are 2 strength-based items. Functional Ability Scale (FAS) is a 6-point (0-5) ordinal scale where 0 = does not attempt with the involved arm and 5=arm does participate/movement appears to be normal. The summary score for the performance time is the median as it is less sensitive to outliers than the mean. IN addition, the mean score for individual subjects would include arbitrary truncated scores of 120 seconds, which are assigned to tasks that are not completed; means are therefore not veridical. In calculating the median, a low rank is assigned to these items whether they have long performance times or are not completed. Thus, score truncation does not affect the median, which is therefore the preferable measure[4]. Others have used total time of all 15 tasks.
Level of client participation required (is proxy participation available?)	Client participation required

Limitations: Time to administer
Should this tool be required for entry level curricula? Yes _x__ No _____ Comments: **This is an easy test to administer. Students could be taught to use it rather easily. This is a tool that students should be exposed to at a minimum as it is often seen in the literature.** **Need sentence about UE examination being addressed in curricula.Dorian, you and I may want to develop a "tag sentence" to put on all the UE measures as we discussed.**
Is this tool appropriate for research purposes? Yes _x_ No _____ Comments:

References

1. Nijland R, Wegen E, Verbunt J, Wijk R, Kordelaar J, Kwakkel G. A Comparison of Two Validated Tests for Upper Limb Function after Stroke: The Whole Motor Function Test and the Action Research Arm Test. J Rehabil Med. 2010;42:694-696.
2. Lin J, Hsu M, Sheu C, Wu T, Lin R, Chen C, Hsieh C. Psychometric Comparisons of 4 Measures for Assessing Upper-Extremity Function in People with Stroke. Phys Ther. 2009;89:84-850.
3. Wolf SL, Catlin PA, Ellis M, Archer AL, et al. Assessing Wolf Motor Function Test as Outcome Measure for Research in Patients after Stroke. Stroke. 2001;32:1635-1639.
4. Morris DM, Uswatte G, Crago JE, Cook EW, Taub E. The Reliability of the Wolf Motor Function Test for Assessing Upper Extremity Function after Stroke. Arch Phys Med Rehabil. 2001;82:750-5.
5. Hsieh Y, Wu C, Lin K, Chang Y, Chen C, Liu J. Responsiveness and Validity of Three Outcome Measures of Motor Function after Stroke Rehabilitation. Stroke. 2009;40:1386-1391.
6. Fritz SL, Blanton S, Uswatte G, Taub E, Wolf SL. Minimal Detectable Change Scores for the Wolf Motor Function Test. Neurorehab Neural Repair. 2009;23:662-667.
7. Lin K, Hsieh Y, Wu C, chen C, Jang Y, Liu J. Minimal Detectable Change and Clinically Important Difference of the Wolf Motor Function Test in Stroke Patients. Neurorehab Neural Repair. 2009;23:429-434.
8. Lang CE, Edwards DF, Birkenmeier RL, Dromerick AW. Estimating Minimally Clinically Important Differences of Upper-Extremity Measures Early After Stroke. Arch Phys Med Rehabil. 2008; 89:1693-700.

9.

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute					
Inpatient Rehab		**x**			
Home Health		**x**			
Skilled Nursing					
Outpatient		**x**			
Overall Comments: Easy to administer, but length of time to administer is a weakness. Highly correlated with ARAT which is quicker to administer.					

Practice Setting	**4**	**3**	**2**	**1**	**Comments**
Acute (<2 months)		x			
Sub- Acute (2-6 months)		x			
Chronic (>6 months)		x			
Overall Comments:					

Entry-Level Criteria	**Students should learn to administer tool**	**Students should be exposed to tool (e.g. to read literature)**	**Do not recommend**	**Comments**
Should this tool be required for entry level curricula?		x		

Research Use	YES	NO	**Comments**
Is this tool appropriate for research purposes?	x		