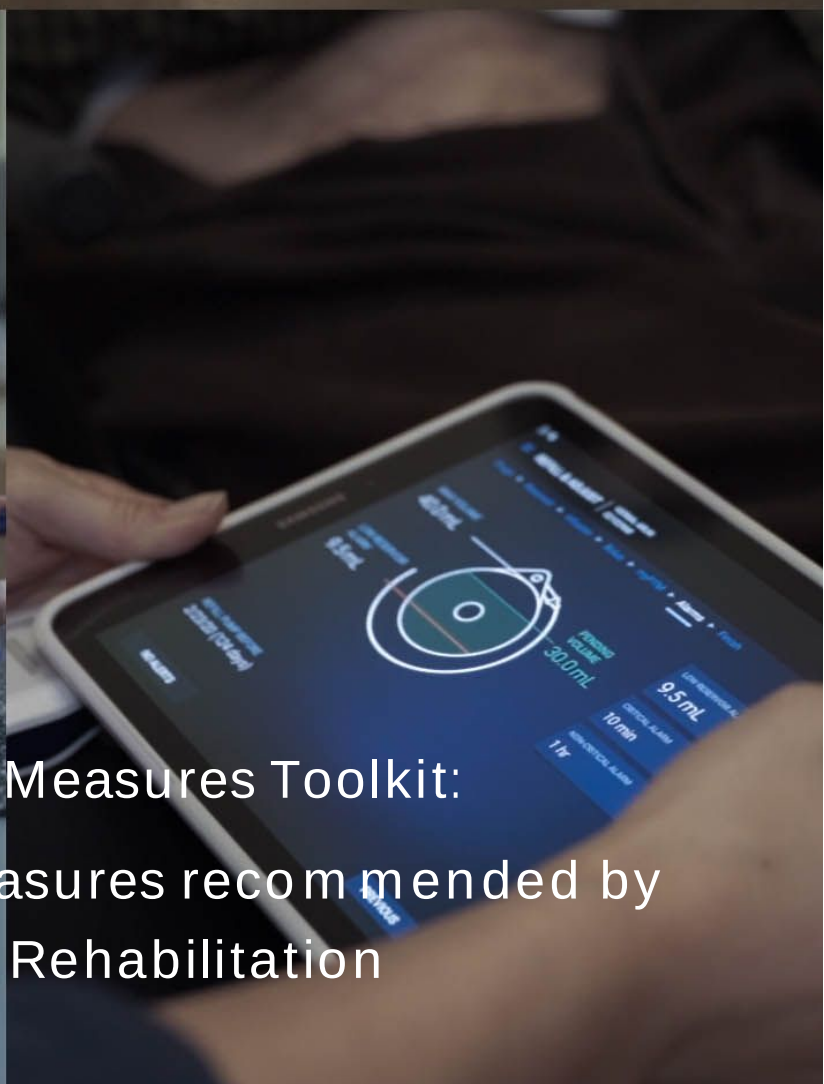
SCIRE

SPINAL CORD INJURY RESEARCH EVIDENCE

Professional



SCIRE Outcome Measures Toolkit:

A set of 33 Outcome Measures recommended by experts in SCI Rehabilitation

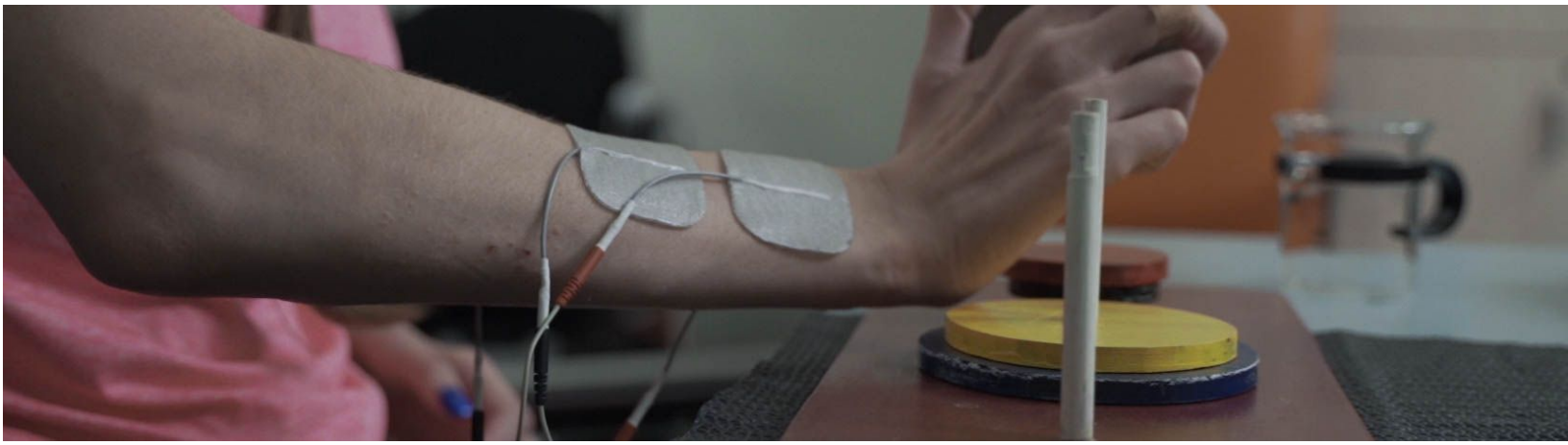


Table of Contents

Introduction

The SCIRE Outcome Measures Toolkit was developed through consensus using a 3-round online Delphi survey with a pan-Canadian panel of 63 experts with SCI clinical experience. With 33 psychometrically validated measures, the toolkit provides a standardized set of outcome measures for use in your SCI clinical practice.

The CAGE Questionnaire

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Mental Functions

You Will Need

Length:
5 minutes, 4 items
Scoring:
4 yes/no questions
Item responses on the CAGE are scored 0 or 1, with a higher score being an indication of alcohol problems. A total score of 2 or greater is considered clinically significant.

Summary

The CAGE is a 4 item self-report screening questionnaire used to identify those individuals for whom more extensive evaluation of alcohol use is recommended**.** It is the oldest and likely most extensively used questionnaire across a variety of clinical and research settings. Originally developed for use with adults, it has been used in elderly populations as well.
Typically, two or more of the questions answered affirmatively are considered to be "CAGE positive", though some suggest a positive response to a single item warrants more in-depth investigation of consumption.

Availability

Available for free here:
http://nationalpaincentre.mcmaster.ca/documents/cage_questionnaire.pdf

Languages: English

Assessment Interpretability

Minimal Clinically Important Difference	Statistical Error	Typical Values
Not established in SCI	Not established in SCI	**Mean (SD) scores:** Total sample: 0.75 (1.20) Drinkers: 1.00 (1.29) (Tate et al. 1993; n=155, 121 males, mixed injury types, traumatic SCI; no information on chronicity)

Measurement Properties

Validity – Low to Moderate

Moderate **correlation with self-reported alcohol abuse history:**
r = 0.53

Moderate **correlation with average number of drinks consumed weekly prior to injury:**
r = 0.38

Low **correlation with drug abuse history:**
r = 0.28

(Tate et al. 1993; n=155, 121 males, mixed injury types, traumatic SCI; no information on chronicity)

Number of studies reporting validity data: 1

Reliability

Not established in SCI

Number of studies reporting reliability data: 0

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

CAGE Substance Abuse Screening Tool

Directions: Ask your patients these four questions and use the scoring method described below to determine if substance abuse exists and needs to be addressed.

CAGE Questions

1. Have you ever felt you should cut down on your drinking?
2. Have people annoyed you by criticizing your drinking?
3. Have you ever felt bad or guilty about your drinking?
4. Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover (eye-opener)?

CAGE Questions Adapted to Include Drug Use (CAGE-AID)

1. Have you ever felt you ought to cut down on your drinking or drug use?
2. Have people annoyed you by criticizing your drinking or drug use?
3. Have you felt bad or guilty about your drinking or drug use?
4. Have you ever had a drink or used drugs first thing in the morning to steady your nerves or to get rid of a hangover (eye-opener)?

Scoring: Item responses on the CAGE questions are scored 0 for "no" and 1 for "yes" answers, with a higher score being an indication of alcohol problems. A total score of two or greater is considered clinically significant.

The normal cutoff for the CAGE is two positive answers, however, the Consensus Panel recommends that the primary care clinicians lower the threshold to one positive answer to cast a wider net and identify more patients who may have substance abuse disorders. A number of other screening tools are available.

CAGE is derived from the four questions of the tool: Cut down, Annoyed, Guilty, and Eye-opener

CAGE Source: Ewing 1984

Depression Anxiety Stress Scale – 21

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Mental Functions
Subscales:
Depression, anxiety, stress (7 items each)

You Will Need

Length:
10 minutes, 21 items
Scoring:
Items scored 0-3. Subscale scores are the sums of respective items multiplied by 2. Higher score represents greater distress
Training:
None, but training in psychological sciences and reading the manual is helpful.

Summary

The Depression Anxiety Stress Scale-21 (DASS-21) is a screening tool for identifying, differentiating and assessing depression, anxiety, and stress. The DASS-21 is the short form of the DASS-42 (or DASS).

The DASS-21 contains 21 items, divided into three 7-item subscales, where each item is a statement referring to the past week.

Availability

Available for free here: https://scireproject.com/wp-content/uploads/worksheet_dass-21.pdf
Languages: English, Portuguese, Arabic and Cantonese

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Mean (SD) Scores:
Depression subscale: 7.8 (9.33)
Anxiety subscale: 6.4 (5.87)
Stress subscale: 10.4 (10.00)

(Mitchell et al. 2008; n=40, 30 males, mixed injury types, mean time since injury=113.9 months)

Threshold Values:
Not established in SCI; but for the general population, scores for normal/mild/severe/extremely severe defined as:
Depression:

		0-9/10-13/14-20/21-27/28-42 Anxiety: 0-7/8-9/10-14/15-19/20-42 Stress: 0-14/15-18/19-25/26-33/34-42 (Lovibond & Lovibond 1995b; Manual for the Depression Anxiety & Stress Scales. (2nd Ed.)) **Normative Data:** Available from the manual, which must be purchased

Measurement Properties

Validity – Moderate to High

High **correlation between DASS-21 Depression subscale and Brief Symptom Inventory (BSI) Depression scale:**
r = 0.70

High **correlation between DASS-21 Anxiety subscale and BSI Anxiety scale:**
r = 0.61

(Mitchell et al. 2008; n=40, 30 males, mixed injury types, mean time since injury=113.9 months)

Moderate **to** ***High*** **inverse correlation with Moorong Self-Efficacy Scale (MSES):**
Depression scale: r = - 0.63
Anxiety scale: r = - 0.54
Stress scale: r = - 0.58

(Kilic et al. 2013; n=60, 41 males; mixed injury types, mean time since injury (SD) = 5.7 (7.3) years)

Number of studies reporting validity data: 2

Reliability – none

Not established in SCI

Number of studies reporting reliability data: 0

Responsiveness

Floor/Ceiling Effect: Not established in SCI	**Effect Size:** Not established in SCI	**Number of studies reporting responsiveness data:** 0

Depression, Anxiety and Stress Scales (DASS-21):

Adapted from Lovibond PF and Lovibond SH. The Structure of Negative Emotional States: Comparison of the Depression Anxiety Stress Scale (DASS) with the Beck Depression and Anxiety Inventories, Behav. Res. Ther., Vol 33: No 3, 335-343, 1995; Left column of Table 3. Used with permission from Elsevier Publishing.

For additional information on the DASS-21, please visit the instrument's homepage (http://www2.psy.unsw.edu.au/dass/DASSFAQ.htm#_2._Who_can_administer_and_interpre)

Scoring: Sum the score of each item to get a total score.

Please read each statement and select a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any one statement.

0 = Did not apply to me at all
1 = Applied to me to some degree or for some of the time
2 = Applied to me to a considerable degree or for a good part of time3 = Applied to me very much or most of the time

DASS-21 Worksheet:

Patient name: _____ Date: _____

Depression subscale:				
1. I felt downhearted and blue	0	1	2	3
2. I felt that I had nothing to look forward to	0	1	2	3
3. I felt that life was meaningless	0	1	2	3
4. I felt I wasn't worth much as a person	0	1	2	3
5. I was unable to become enthusiastic about anything	0	1	2	3
6. I couldn't seem to experience any positive feeling at all	0	1	2	3
7. I found it difficult to work up the initiative to do things	0	1	2	3
Anxiety subscale:				
8. I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	0	1	2	3
9. I was aware of dryness of my mouth	0	1	2	3
10. I experienced difficulty breathing (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
11. I experienced trembling (e.g. in the hands)	0	1	2	3
12. I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
13. I felt I was close to panic	0	1	2	3
14. I felt scared without any good reason	0	1	2	3
Stress subscale:				
15. I found it hard to wind down	0	1	2	3
16. I found it difficult to relax	0	1	2	3
17. I felt I was using a lot of nervous energy	0	1	2	3
18. I found myself getting agitated	0	1	2	3
19. I tended to over-react to situations	0	1	2	3
20. I felt that I was rather touchy	0	1	2	3
21. I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3

Total score _____

Patient Health Questionnaire 9 (PHQ-9)

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Mental Function

You Will Need

Length:
5 minutes, 9 items
Scoring:
Items are rated in terms of how persistent the symptoms have been in the past 2 weeks: 0 – not at all, 1 – several days, 2 – more than half of the days, 3 – nearly every day.
Score for each individual item is summed to produce a total score.
Higher scores indicate increased severity of depression.

Summary

The Patient Health Questionnaire 9-item (PHQ-9) is a self-report or interview-based screening measure devised to identify probable major depressive disorder (MDD) among adult primary care patients. Screening by PHQ-9 is compliant with the DSM-IV criteria.

Availability

Available for free here: *http://www.phqscreeners.com/*
Languages: Available in 60+ languages.

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Mean (SD) Scores:
5.57 (5.74)

(Krause et al., 2009; N=727, 70.2% male, mixed injury types, mean time since injury = 18.2 years)

Threshold Values:
Not established for SCI. But for the general population, a score of ≥ 10 has been reported to indicate major depression

(Kroenke et al 2001, N=6000)

Measurement Properties

Validity – Low to High

Moderate **correlation with Short Form-36:**
ρ = 0.5

(Bombardier et al., 2004; N=849, 645 male, mixed injury types, all 1 year post-SCI)

Low **to** ***Moderate*** **correlation with Satisfaction with Life Scale (SWLS):**
PHQ affective items: ρ= -0.368 to -0.463
PHQ somatic items: ρ= -0.248 to -0.415

(Richardson & Richards 2008; N=2570, 2013 male, mixed injury types, time post-injury range = 1-25 years)

ρ: -0.477 (P<.0001)

(N=727, 70.2% male; mean age: 47.9; mean time since injury: 18.2; 53.3% cervical injury)

High **correlation with the Hamilton Depression Rating Scale:**

Convergent Validity: r = 0.713 (P<0.001)

Discriminatory validity, between depressed SCI persons and non-depressed SCI subjects:
(11.8±5.2 vs. 5.8±4.5; P<0.001)

(PHQ9-Arabic version; N=51, 51M; mean age=37.2 ± 12.6; 37 paraplegic, 14 tetraplegic)

High **correlation with Major depressive disorder:**

r = 0.530 (P<0.001)

(Krause et al., 2009; N=727, 70.2% male, mixed injury types, mean time since injury = 18.2 years)

Number of studies reporting validity data: 7

Reliability – High

High **Internal Consistency:**
α = 0.71-0.87

(Richardson & Richards 2008; N=2570, 2013 male, mixed injury types, time post-injury range = 1-25 years)

(PHQ9-Arabic version; Summaka et al. 2019, N=51, 51M; mean age=37.2 ± 12.6; 37 paraplegic, 14 tetraplegic)

High **Test-Retest Reliability:**
ICC = 0.88 (0.711-0.955); P < 0.001

(PHQ9-Arabic version; Summaka et al. 2019, N=51, 51M; mean age=37.2 ± 12.6; 37 paraplegic, 14 tetraplegic)

Number of studies reporting reliability data: 4

Responsiveness

Floor/Ceiling Effect:
Floor: 22% reported no depressive symptoms

(Williams et al., 2009; N=202, 77% male, no info on injury types, median time since injury = 7 years)

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 1

Patient Health Questionnaire (PHQ-9)

- 9 item screening measure devised to identify probable major depressive disorder (MDD) among adult primary care patients.

ICF Domain:

Body Function – Subcategory: Mental Functions.

Number of Items:

9

Instructions for Administration and Scoring:

Administration:

- Self report; can also be done in interview format.
- Items are rated in terms of how persistent the symptoms have been in the past 2 weeks: 0 – not at all, 1 – several days, 2 – more than half of the days, 3 – nearly every day.
- Administration time is **approximately 5 minutes**.

Equipment: None.

Scoring:

- Score for each individual item is summed to produce a total score.

Interpretability:

MCID: not established for the SCI population, but for a sample of older primary care patients (*n* = 434, mean age = 71 (7.4) years, all participants enrolled in the Improving Mood-Promoting Access to Collaborative Treatment (IMPACT)):
MCID = 5 points

Reference: Lowe, B., Unutzer, J., et al. (2004). "Monitoring depression treatment outcomes with the patient health questionnaire-9." Med Care 42(12): 1194-1201.

SEM: not established for the SCI population, but for a sample of older primary care patients (see Lowe et al. 2004 reference above):
SEM for change due to treatment and no control of prior depression = 2.44
SEM for the same number of DSM-IV depressive symptoms at both assessments = 1.32
MDC: not established

- Higher scores indicate increased severity of depression
- A cut-off score of 10 has been reported to indicate major depression.
- Published data for the SCI population is available for comparison (see the Interpretability section of the Study Details sheet).

Languages:

English and Spanish versions available

Training Required:

None.

Availability:

Measure available online in PDF format Copyright © Pfizer Inc. after agreeing to several conditions including use for research, in clinical programs or physician education (http://www.pfizer.com/pfizer/phq-9/index.jsp) or http://www.depression-primarycare.org/clinicians/toolkits/materials/forms/phq9/ (includes scoring guide).

Clinical Considerations:

- Can be used as a tool to screen for major depression.
- Corresponds with the DSM-IV criteria.

Measurement Property Summary:

# of studies reporting psychometric properties: 5

Reliability:

- Internal consistency for the overall PHQ-9 scale was reported to be **excellent** (Cronbach's α=0.83-0.89)

[Bombardier et al. 2004, Richardson and Richardson 2008, Graves & Bombardier 2008, Krause et al. 2009]

Validity:

- Correlation of the PHQ-9 is:
  - **excellent** with the Older Adult Health and Mood Questionnaire (Spearman's ρ=0.781)
  - **adequate** with major depressive disorder (MDD) (Spearman's ρ=0.530)
  - **adequate** with the Satisfaction with Life Scale (Spearman's ρ=-0.477).
- PHQ-9 scores were inversely and **adequately** correlated with subjective health on the SF-1 (Spearman's ρ=0.37).
- For a 3-item screening test with a score cutoff of 3, a sensitivity of 0.87 and specificity of 0.93 were reported; with a score cutoff of 4, a sensitivity of 0.82 and a specificity of 0.95 were reported.
- For the total PHQ-9, a cutoff of 11 was determined to have optimal diagnostic accuracy of MDD. At this cutoff, the PHQ-9 detected 100% (sensitivity) of those with a diagnosis of MDD and had a specificity of 84%.

[Bombardier et al. 2004, Bombardier et al. 2012, Richardson and Richardson 2008, Krause et al. 2009]

Responsiveness:
No values were reported for the responsiveness of the PHQ-9 for the SCI population.

Floor/ceiling effect:
No values were reported for the presence of floor/ceiling effects in the PHQ-9 for the SCI population.

Reviewer:

Dr. Janice Eng, Christie Chan

Date Last Updated:

Feb 1, 2013

Pain

Brief Pain Inventory (BPI) – Interference Scale

Assessment Overview

Assessment Area

ICF Domain:
Body Functions
Subcategory:
Sensory Functions

You Will Need

Length:
7, 10, or 12 items, 5-10 minutes

Scoring:
0-10 rating scale for items
Mean of item scores is used as the Pain Interference score

Summary

The Brief Pain Inventory (BPI) is a self-report/interview-based assessment, modeled after the McGill Pain Questionnaire. It provides information on the intensity of pain (sensory dimension) and the degree to which pain interferes with function (reactive dimension). It also asks questions about pain relief, pain quality, and the patient's perception of the cause of pain.

The reactive dimension (i.e., the interference scale) of the inventory is often used alone. It is also the only part of the BPI that has been tested in the SCI population. **Therefore, the information presented here refers to the BPI-Interference scale only.**

Three modified versions of the BPI – Interference scale have been developed for the SCI population (7-item, 10-item, and 12-item). Pain is rated on a scale of 0 (no interference) to 10 (interferes completely).

Availability

Available for purchase here:
http://www3.mdanderson.org/depts/symptomresearch/

Languages: English, French, Chinese, Filipino, Hindi, Italian, Spanish, and Vietnamese

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Mean (SD) Scores:

7-item	3.63 (2.60)
10-item	3.53 (2.62)
12-item	3.31 (2.58)

(Raichle et al. 2006; n=127, 92 males; mixed injury types; community; mean (SD) time since injury = 16.6(10.6) years)

Measurement Properties

Validity – Moderate to High

High **correlation with Pain Intensity Numerical Ratings Scale:**
7-item: r = 0.62
10-item: r = 0.63
12-item: r = 0.61

High **correlation with Short Form-36 (SF-36) Mental Health Scale:**
7-item: r = -0.62
10-item: r = -0.60
12-item: r = -0.61

(Raichle et al. 2006; n=127, 92 males; mixed injury types; community; mean (SD) time since injury = 16.6(10.6) years)

High **correlation between BPI-Interference (12-item) and MPI-SCI Life Interference subscale:**
r = 0.75

Moderate **correlation between BPI-Interference (12-item) and MPI-SCI Pain Interference subscale:**
r = 0.50

(Soler et al. 2013; n=126, 78 males; mixed injury types; mean (SD) time since injury = 11.8(10.8) years)

Number of studies reporting validity data: 2

Reliability – High

High **Internal Consistency:**
7-item: α = 0.92
10-item: α = 0.95
12-item: α = 0.96

(Raichle et al. 2006; n=127, 92 males; mixed injury types; community; mean (SD) time since injury = 16.6(10.6) years)

Number of studies reporting reliability data: 1

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Classification System for Chronic Pain in SCI

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Sensory Function
Subscales (Categories):
Neuropathic Pain:
SCI, Transitional Zone, Radicular & Visceral Pain
Musculoskeletal Pain:
Mechanical Spine & Overuse Pain

You Will Need

Length:
18 items
Training:
None, but background in pain knowledge is useful
Scoring:
Table completed using "yes", "no", "maybe" indicators

Summary

The Classification System for Chronic Pain in SCI is a pain classification inventory with 2 major categories: neuropathic pain and musculoskeletal pain. It is designed to help with the standardization of pain terminology used in the SCI population. Pain is categorized by pain location and distribution, as related to level of spinal injury (e.g., above level, at level or below level). This information is combined with a classification of the person's pain (to form the 18 items).

Availability

Available for free here:
https://scireproject.com/wp-content/uploads/worksheet_classification_system_for_chronic_pain_in_sci.docx
Languages: English

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Not established in SCI

Measurement Properties

Validity

Results of expert voting to determine Face Validity:
Valid and useful: 4%
Useful but requires more validation: 20 %
Useful but requires changes/improvement then further validation: 52%
Not useful or valid for research in SCI: 25%

It was determined to be less valid and useful than both the Bryce-Ragnarsson Pain Taxonomy (BRPT) and the International Association for the Study of Pain (IASP) SCI Classification.

(Bryce et al. 2007; n=59, participants at scientific meeting)

Number of studies reporting validity data: 1

Reliability – Moderate

Moderate **Inter-rater reliability:**
Strength of agreement between raters in categorizing pain problems **reported on questionnaires**:
Kappa =0.68

Strength of agreement between raters in categorizing pain problems **in person**:
Kappa =0.66

(Cardenas 2002; n=163, 114 males, mixed injury types, community living)

Number of studies reporting reliability data: 1

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Classification System for Chronic Pain in SCI

Adapted from Cardenas DD et al. Classification of chronic pain associated with spinal cord injuries, Arch Phys Med Rehabil, 83: 1708-14, 2002; Table 2. Used with permission from Elsevier Publishing.

Pain categorization is performed by first comparing the pain location and distribution with the subject's level of injury. This information is combined with a classification of chronic SCI pain that uses a matrix that compares the type of pain with location and with the effects of activity, position, and light touch on pain (see table below). If the pain does not seem to fit a specific category on the basis of the information, the subject's self-reported source of pain (musculoskeletal or nervous system) and pain exacerbators are used to help make the final categorization.

Categorization is outlined in the table below (fill out with +, - or ±):

Pain Category (major)	Pain Category (Specific)	Location	Related to activity	Affected by position	Worse with light touch
Neuropathic	SCI Pain	Below injury in area without normal Sensation			
	Transition zone pain	At level of injury, Bilateral			
	Radicular Pain	At any dermatome level, usually unilateral, usually radiates			
	Visceral	In abdomen			
Musculoskeletal	Mechanical spine pain	In back or neck, often bilateral			
	Overuse pain	Often above injury in areas of normal sensation in an incomplete, can be below			

+ yes, - no, ± maybe

Spasticity

Ashworth and Modified Ashworth Scale (MAS)

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Neuromusculoskeletal & Movement-related Functions and Structures

You Will Need

Length:
5 minutes or less (depending on muscles/joints tested)
Training:
Requires clinical judgment and experience with spasticity
Scoring:
Original Ashworth Scale: Tests resistance to passive movement about a joint, scores range from 0-4 with 5 choices, a score of 1 indicates no resistance, 5 indicates rigidity.
Modified Ashworth Scale: Similar to the Ashworth Scale but adds a 1+ scoring category to indicate resistance through less than half of the movement, scores range from 0 (no increase in muscle tone) to 4 (affected part(s) rigid in flexion or extension, with 6 choices.

Summary

The Ashworth Scale measures the effects of anti-spasticity drugs in individuals with multiple sclerosis (it has subsequently been adapted for other diagnoses, including SCI).

The Modified Ashworth Scale measures resistance during passive soft tissue stretching and is used as a simple measure of spasticity in patients with lesions of the Central Nervous System

Availability

Available for free here: https://www.scireproject.com/wp-content/uploads/worksheet_ashworth.docx
Video: https://scireproject.com/videos/outcome-measures-group/

Assessment Interpretability

Minimal Clinically Important Difference

Not established for SCI

In stroke, initial change in muscle tone/spasticity in response to Botox® treatment was approximately a 1-point decrease on the MAS scale, reflecting a clinically significant improvement

(Shaw et al. 2010, n=333, adults with upper limb spasticity due to stroke; >1 month post-stroke)

Statistical Error

Not established for SCI

Typical Values

Score Distributions (SD):

Score 0: 25.7%
Score 1: 34.0%
Score 2: 23.7%
Score 3: 16.5%

(Sherwood et al., 2000; N=97, 95 male, 62 cervical SCI; mixed injury types; 0.5-39 years post-SCI)

Measurement Properties

Validity – Low to High

Moderate **to** ***High*** **correlation with Spinal Cord Assessment Tool for Spastic reflexes (SCATS):**

		Ashworth		
		Hip	Knee	Ankle
SCATS	Clonus	0.56	0.65	0.60
	Flexion	0.55	0.47	0.40
	Extension	0.98	0.88	0.61

Moderate **correlation with Penn Spasm Frequency Scale (PSFS):**

Ashworth Hip: r = 0.43
Ashworth Knee: r = 0.43
Ashworth Ankle: r = 0.51

(Benz et al. 2005; n=17; mixed injury types; 24-372 months post-SCI)

Low correlation with Spasm Frequency Scale (SFS):

ρ: -0.13 to 0.21

(Baunsgaard et al. 2016; n=31; 20 males; mean age: 48.3 ± 20.2 years, age range: 15-88 years, 17 traumatic, 14 non-traumatic)

Moderate **to** ***High*** **correlation with Modified Tardieu Scale (MTS):**

r= 0.791 (Hip adductor muscles)
r=0.920 (hip extensor muscles)
r=0.539 (knee extensor muscles)

Reliability – *Moderate* to High

Moderate **Inter-rater Reliability (for MAS):**

ICC = 0.56

(Tederko et al 2007; n=30, 23 males; mixed injury type cervical SCI; inpatient; mean time since injury = 14.1 months)

Moderate **to High inter-rater reliability (MAS):**

Kappa: 0.531-0.774

Moderate **test-retest reliability (MAS):**

Kappa: 0.580-0.716

(Akpinar et al. 2017; n=58; 37 males; mean age: 44±14 years, age range: 18-88 years, mixed injury)

Number of studies reporting reliability data: 8

r=0.562 (knee flexor muscles)
r=0.864 (ankle plantar flexor muscles)

(Akpinar et al. 2017; n=58; 37 males; mean age: 44±14 years, age range: 18-88 years, mixed injury)

Number of studies reporting validity data: 8

Responsiveness

Floor/Ceiling Effect:
In a group of MS or SCI patients: with intrathecal baclofen treatment, Ashworth scores were found to significantly decrease

(Boviatsis et al. 2005; n=22, 15 with MS, 7 with SCI; no SCI type data available; 12 males; mean time since injury = 2.71 years)

Effect Size:
Not established for SCI

Number of studies reporting responsiveness data: 4

Modified Ashworth Scale Instructions:

Adapted from Bohannon, R and Smith, M. Interrater reliability of a modified Ashworth scale of muscle spasticity, Physical Therapy 67 (2): 206; 1987, with permission from APTA Publishing.

Procedure:
Place the patient in a supine position.

When testing a muscle that primarily flexes a joint, place the joint in a maximally flexed position and move to a position of maximal extension over one second.

When testing a muscle that primarily extends a joint, place the joint in a maximally extended position and move to a position of maximal flexion over one second.

Scoring:

Score	Modified Ashworth Scale
0	No increase in muscle tone
1	Slight increase in tone
1+	Slight increase in tone, with a catch, followed by minimal resistance
2	More marked increase in tone but affected part(s) easily moved.
3	Considerable increase in tone and passive movement difficult.
4	Affected part(s) rigid in flexion or extension.

Modified Ashworth Scale Testing Form

Patient name: _____ Date: _____

Muscle tested: _____ Score:_____

Muscle tested: _____ Score:_____

Muscle tested: _____ Score:_____

Muscle tested: _____ Score: _____

Wartenberg Pendulum Test

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Neuromusculoskeletal & Movement-related Functions and Structures

You Will Need

Length:
1 test, recommended to be repeated up to 4 times at 1 minute intervals
Less than 5 min per test
Equipment:
Typically either electro-goniometers, uni-planar video or 3D motion analysis systems
Training:
Knowledge of spasticity is recommended

Summary

The Wartenberg Pendulum Test was introduced in the 1950s as a diagnostic tool of spasticity. It was originally a qualitative measure (clinician simply observed the leg swing). The use of electronic equipment to generate quantitative data was introduced in the 1980's. This test has not been validated in a SCI specific population and its validity in other populations is debated.

Availability

Available for free here: http://www.scireproject.com/wp-content/uploads/worksheet_pendulum_test.docx

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Not established in SCI

Measurement Properties

Validity – Low to High

Low **to** ***High*** **correlation between pendulum test score and average velocity for three therapists:**
Therapist A: r = 0.223
Therapist B: r = 0.657
Therapist C: r = 0.67

(Smith et al. 2000; n=22, 21 male, mixed injury types, mean (SD) time since injury = 29.8 (43.2) months)

Number of studies reporting validity data: 1

Reliability – High

High **Inter-trial Reliability between seven pendulum tests:**
ICC = 0.92

(Smith et al. 2000; n=22, 21 male, mixed injury types, mean (SD) time since injury = 29.8 (43.2) months)

Number of studies reporting reliability data: 1

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Pendulum Test:

Adapted from Bohannon RW, Harrison S and Kinsella-Shaw J. Reliability and validity of pendulum test measures of spasticity obtained with the Polhemus tracking system from patients with chronic stroke, Journal of NeuroEngineering and Rehabilitation, 2009.

This test is performed with the subject half-lying. The patient is instructed to relax his/her knee. The leg is then dropped from a near-full extension and the characteristics of the knee oscillation are evaluated. Specifically, the administrator of the test should observe the number of oscillation following the drop of the leg.

Patient name: _____
Trial 1 Date: _____

Leg (circle): Left / Right # of oscillations: _____

Leg (circle): Left / Right # of oscillations: _____
Description of swing: _____

Trial 2 Date: _____
Leg (circle): Left / Right # of oscillations: _____

Leg (circle): Left / Right # of oscillations: _____

Description of swing: _____
Trial 3 Date: _____
Leg (circle): Left / Right # of oscillations: _____

Leg (circle): Left / Right # of oscillations: _____

Description of swing: _____
Trial 4 Date: _____

Leg (circle): Left / Right # of oscillations: _____

Leg (circle): Left / Right # of oscillations: _____
Description of swing: _____

Penn Spasm Frequency Scale (PSFS)

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Neuromusculoskeletal & Movement-related Functions and Structures

You Will Need

Length:
< 5 minutes, 2 items
Training:
None, but understanding of spasticity recommended
Scoring:
Item 1: spasm frequency
Scored 0 (no spasms) to 4 (spontaneous spasms occurring more than 10 times per hour)
Item 2: spasm severity
Scored 0 (mild) to 3 (severe); not answered if spasm frequency scores 0

Summary

The Penn Spasm Frequency Scale (PSFS) is a 2-component self-report measure of the frequency of reported muscle spasms, which is commonly used to quantify spasticity. The PSFS was developed to augment clinical ratings of spasticity and provide a more comprehensive understanding of an individual's spasticity status, as self-report measures of spasticity, in general, correlate only moderately with clinical examination. This suggests that the elements of spasticity evaluated in the physical examination do not represent what is important to persons with SCI spasticity. The PSFS is often subject to concomitant subclinical conditions such as bladder fullness, symptomatic urinary tract infection development, anxiety level, room temperature, subject comfort, and many other conditions. The spasm frequency item is more commonly reported than the spasm severity item.

Availability

Available for free here: https://www.sralab.org/rehabilitation-measures/penn-spasm-frequency-scale
Languages: English

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Mean (SD) Pre-treatment Scores: 3.3

(Spasm frequency item, modified from PSFS; Aydin et al., 2005 N=21; 15 females, 6 males; traumatic SCI; mixed injury types, mean (SD) time since injury = 11.48 (13.92) months)

Measurement Properties

Validity – Low to High

High **correlation with SCI Spasticity Evaluation Tool (SCI-SET):**
r = -0.66

Moderate **correlation with Quality of Life Index (QLI) Health & Functioning Subscale:**
r = -0.46

Low **correlation with Functional Independence Measure (FIM) Motor Subscale:**
r = -0.05

(Spasm frequency item; Adams et al., 2007; N=61, 45 male, mixed injury types, community-dwelling, chronic SCI, mean (SD) time since injury = 10.2 (8.6) years)

Moderate **correlation with Ashworth Scale**
Ashworth Hip: r = 0.43
Ashworth Knee: r = 0.43
Ashworth Ankle: r = 0.51

(Spasm frequency item; Benz et al., 2005; N=17; mixed injury types, time since injury = 24-372 months)

Number of studies reporting validity data: 3

Reliability – Moderate to High

Moderate **to** ***High*** **intra-rater reliability for PSFS Part 1 (spasm frequency):**
5-10 days: 0.822 (0.709, 0.935)
4-6 weeks: 0.734 (0.586, 0.883)

Moderate **to** ***High*** **intra-rater reliability for PSFS Part 2 (spasm frequency-severity combination):**
5-10 days: 0.812 (0.705, 0.919)
4-6 weeks: 0.729 (0.586, 0.872)

High **inter-rater reliability within a 3-day time interval:**
Part 1: 0.862 (0.759, 0.965)
Part 2: 0.857 (0.762, 0.952)

(Mills et al. 2018; N=66, 17M 49F; age: 44.1±12.3 years; mixed injury types; AIS A/B/C: 54, AIS D: 12)

Number of studies reporting validity data: 1

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
1.11

(Cohen's d; spasm frequency item modified from PSFS; Aydin et al. 2005; intrathecal Baclofen pump implantation; N=21, 6 male; traumatic SCI, mixed injury types; mean (SD) time post-SCI = 11.48 (13.92) months)

Number of studies reporting responsiveness data: 3

Penn Spasm Frequency Scale (PSFS)

- 2 component self---report measure of the frequency of reported muscle spasms which is commonly used to quantify spasticity.
- developed to augment clinical ratings of spasticity and provide a more comprehensive understanding of an individual's spasticity status.
- The first component is a 5-point scale assessing the frequency with which spasms occur ranging from "0 = No spasms" to "4 = Spontaneous spasms occurring more than ten times per hour". The second component is a 3-point scale assessing the severity of spasms ranging from "1 = Mild" to "3 = Severe". The second component is not answered if the person indicates they have no spasms in part 1.

ICF Domain:

Body Function – Subcategory: Neuromusculoskeletal & Movement---related Functions and Structures

Number of Items:

2

Instructions for Administration and Scoring:

Administration:

- self-report
- Patients report their perceptions of spasticity with regards to frequency and severity.

Equipment: None.

Scoring: N/A

Interpretability:

MCID: not established
SEM: not established
MDC: not established

- The specific grades are simple to interpret although no standardization of time frame is specified for test administration (i.e., within the last hour, day, week, etc.) and specific grades for spasm severity may mean different things to different people.
- No normative data have been reported so far for the SCI population
- Published data for the SCI population is available for comparison (see the Interpretability section of the Study Details sheet).

Languages:

English.

Training Required:

No training is required; however, understanding spasticity likely improves the scale's utility.

Availability:

See the article 'Penn et al. 1989' for details.

Clinical Considerations:

- The scale is subject to concomitant subclinical conditions such as fullness of the bladder, development of a symptomatic urinary tract infection, anxiety level, room temperature, subject comfort, and many other conditions.
- In general, self---report measures of spasticity correlate only moderately with clinical examination suggesting that the elements of spasticity evaluated in the physical examination do not represent what is important to persons with SCI spasticity. To more fully understand spasticity as experienced by the client, self--- report spasticity measures are an important adjunct to other clinical measures of spasticity.
- The PSFS is easy to understand, presents minimal patient burden (easy to administer during routine clinical visits).

Measurement Property Summary:

# of studies reporting psychometric properties: 6

Reliability:

No values have been reported on the reliability of the PSFS for the SCI population at this time.

Validity:

- Correlation of the PSFS is **adequate** with the Ashworth tested on the hip (Spearman's ρ=0.43), knee (Spearman's ρ=0.43) and ankle (Spearman's ρ=0.51), and the SCATS tested on the clonus (Spearman's ρ=0.59), flexor (Spearman's ρ=0.41) and extensor (Spearman's ρ=0.40).

[Benz et al. 2005, Priebe et al. 1996]

Responsiveness:

- After administration of IT Baclofen, Ashworth was reduced from 4±1 to 1.2±0.4 (P=.0001) with a concomitant decrease in spasm frequency of 3.3±1.2 to 0.4±0.8 (P<.0005).
- After mean follow---up of 19.2 months, Ashworth was 1.0± 0.1 and PSFS was 0.3± 0.6.

[Penn et al. 1989, Gianino et al. 1998, Aydin et al. 2005, Boviatsis et al. 2005]

Floor/ceiling effect:

No values were reported for the presence of floor/ceiling effects in the PSFS for the SCI population.

Reviewer:

Dr. Janice Eng, Christie Chan

Date Last Updated:

Feb 1, 2013

The American Spinal Injury Association Impairment Scale (AIS): International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI)

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Neuromusculoskeletal & Movement-related Functions and Structures

You Will Need

Length:
AIS: approx. 10-15 minutes
ISNCSCI: approx. 30-60 minutes
- Pin Prick: 56 locations
- Light Touch: 56 locations
- Upper Motor: 10 locations
- Lower Motor: 10 locations

Scoring:
The AIS is scored on a 5-point ordinal scale from A (sensory & motor complete SCI) to E (normal sensory and motor function).
On the ISNCSCI, Sensory scores rated 0 (sensation absent), 1 (impaired) and 2 (normal) for each dermatome. Light Touch & Pin Prick each scored out of 112 (28 locations bilaterally with a max score of 2 at each location).
Muscle function rated 0 (total paralysis) to 5 (active movement, full ROM against significant resistance) for each myotome. UEMS & LEMS each scored out of 50; ASIA Motor Score scored out of 100.

Summary

The **ASIA (American Spinal Injury Association) Impairment Scale (AIS)**, based on the Frankel scale, is a clinician-administered scale used to classify the severity (completeness) of injury in individuals with SCI. It identifies sensory and motor levels indicative of the highest spinal level demonstrating "unimpaired" function. Preservation of function in the sacral segments (S4-S5) is key for determining the AIS grade. AIS scores are considered essential when classifying persons with SCI as to their neurological status.

The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) is a comprehensive clinician-administered neurological exam for SCI. It is widely used for research and clinical (neurologic) description for to fully assess sensory and motor functioning and level of injury in traumatic SCI. From the ISNCSCI, several measures of neurological damage can be determined, such as: Sensory and Motor Levels (on right and left sides), Neurological Level of Injury (NLI), Sensory Scores (ASIA Pin Prick and Light touch Score), Motor Scores (ASIA Upper Extremity and Lower Extremity Motor Score (UEMS & LEMS), combined to give ASIA Motor Score), and Zone of Partial Preservation. The entire examination is conducted by testing and scoring 28 key points (dermatomes) for Sensory and 10 key paired points (myotomes) for Motor.

The ISNCSCI exam should be performed in the supine position (except for the rectal examination that can be performed side-lying) to ensure scores collected are standard and comparable.

The exam is generally well tolerated although sensory testing for those with severe hypersensitivity may be uncomfortable and testing for anal sensation/voluntary contraction can result in the stimulation of a bowel movement.

The test may pose a significant clinician/patient burden unless the clinician is experienced and well-practiced in the test.

The ISNCSCI is currently on its 7th edition, updated in 2015. Some research that supported the development of the ISNCSCI relates only to certain portions of the entire exam (e.g., the ASIA Motor Score).

The presence of anal sensation and voluntary anal contraction are assessed as a yes/no. Results can be entered into www.isncscialgorithm.com to calculate the key scores for neurological classification.

Training:
Training is mandatory.
The test may pose a significant clinician/patient burden and results may be inaccurate unless the clinician is experienced and well-practiced in the test.

Equipment:
No special equipment required

Availability

Motor Exam Guide from: http://asia-spinalinjury.org/wp-content/uploads/2016/02/Motor_Exam_Guide.pdf
Sensory Exam Guide from: http://asia-spinalinjury.org/wp-content/uploads/2016/02/Key_Sensory_Points.pdf
Scoring Diagram and Worksheet: http://asia-spinalinjury.org/wp-content/uploads/2016/02/International_Stds_Diagram_Worksheet.pdf Online ISNCSCI calculator: www.isncscialgorithm.com
Video: https://www.scireproject.com/outcome-measures/video/how-to/

Assessment Interpretability

Minimal Clinically Important Difference

Total Motor Score*: 4.48
Total Sensory Score: 5.19
ASIA UEMS: 2.72
ASIA LEMS: 3.66

(Scivoletto, et al. 2013; n=661, 478 males; mixed injury types; mean (SD) time since injury = 51.6(36.8) days)

*ASIA Motor Score

Statistical Error

Minimal Detectable Change:
Total Motor Score*: 1.87
Total Sensory Score: 3.87

Standard Error of Measurement:
Total Motor Score* = 0.67
Total Sensory Score = 1.40

(Scivoletto, et al. 2013; n=661, 478 males; mixed injury types; mean (SD) time since injury = 51.6(36.8) days)

*ASIA Motor Score

Typical Values

Mean (SD) Scores:
ASIA motor at 1-year post-injury: 45.2 (22.8)
ASIA motor at 5 years post-injury: 46.6 (23.3)

(Kirshblum et al., 2004; N=559 from Model SCI Systems Database; traumatic SCI; reported in Furlan et al., 2008)

Median (IQR) Scores:
ASIA motor at discharge: 50 (31-70)
ASIA UEMS at discharge: 44 (23-50)
ASIA LEMS at discharge: 0 (0-30)

(Marino & Graves 2004; n=4338, 3443 males, from Model SCI Systems Database; mixed injury types; median (IQR) time since injury = 15 (9-28) days)

Measurement Properties

Validity – Moderate to High

High **correlation with Quadriplegia index of function:**
ASIA Motor = 0.91
ASIA Light Touch = 0.64
ASIA Pin Prick = 0.65

Moderate **to** ***High*** **correlation with Functional Independence Measure (FIM):**
ASIA Motor = 0.91
ASIA Light touch = 0.58
ASIA Pin Prick = 0.55

(Yavuz et al. 1998; n=29, 20 males; tetraplegia; mean (range) time since injury = 20 (2-72) weeks)

Moderate **to** ***High*** **correlation with 6 Minute Walk Test (6MWT):**
ASIA Motor = 0.64
ASIA Motor (UEMS) = 0.24
ASIA Motor (LEMS) = 0.70

Moderate **to** ***High*** **correlation with 10 Meter Walk Test (10MWT):**
ASIA Motor = 0.63
ASIA Motor (UEMS) = 0.24
ASIA Motor (LEMS) = 0.69

Moderate **to** ***High*** **correlation with Berg Balance Scale**

ASIA Motor = 0.75

ASIA Motor (UEMS) = 0.30

ASIA Motor (LEMS) = 0.79

(Harkema et al. 2016; N=152, 123 male; mixed injury type; median (range) time post-SCI = 0.9 (0.1-45.2) years)

Moderate **correlation with Walking Index for SCI:**
ASIA Motor (LEMS) = 0.58

(Morganti et al. 2005; N=200; mixed injury types; mean (SD) time since injury = 56.9(43.9) days)

Number of studies reporting validity data: 26

Reliability – High

High **Inter-rater Reliability:**
ASIA Motor Score: ICC = 0.999
ASIA Light Touch: ICC = 0.997
ASIA Pin Prick: ICC = 0.988

(Savic et al. 2007; n=45, 38 males; mixed injury types; 3 months to 43 years post-SCI)

High **Intra-rater Reliability:**
ASIA UEMS: ICC = 0.98
ASIA Light Touch: ICC = 0.99
ASIA Pin Prick: ICC = 0.99

(Marino et al. 2008; n = 16 patients, n = 16 examiners, 10 male patients; mixed injury type; acute SCI)

Number of studies reporting reliability data: 5

Responsiveness

Floor/Ceiling Effect:
ASIA UEMS:
42% of subjects at ceiling (score 50)

ASIA LEMS:
53% of subjects at floor (score 0)

(Marino & Graves 2004; n=4338, 3443 males; mixed injury types; median (IQR) time since injury = 15 (9-28) days)

Effect Size:
ASIA UEMS: 0.69-1.29
ASIA Light Touch: -0.08-0.30

(Velstra et al. 2015; n=74, 51 males; mixed injury types; acute SCI at study enrollment, measured 1,3,6,12 months post-SCI)

Standardized Response Mean:
ASIA Motor: 0.33
ASIA Motor (UEMS): 0.38
ASIA Motor (LEMS): 0.23

Number of studies reporting responsiveness data: 5

(Post locomotor training; breakdown by AIS levels available in research summary; Harkema et al. 2016; N=152, 123 male; mixed injury type; median (range) time post-SCI = 0.9 (0.1-45.2) years)

https://www.isncscialgorithm.com/

INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY (ISNCSCI)

ASIA American Spinal Injury Association

ISCOS International Spinal Cord Society

Patient Name _____ Date/Time of Exam _____

Examiner Name _____ Signature _____

RIGHT

LEFT

	MOTOR KEY MUSCLES	SENSORY KEY SENSORY POINTS Light Touch (LTR)	SENSORY KEY SENSORY POINTS Pin Prick (PPR)		SENSORY KEY SENSORY POINTS Light Touch (LTL)	SENSORY KEY SENSORY POINTS Pin Prick (PPL)	MOTOR KEY MUSCLES
C2							C2
C3							C3
C4							C4
C5	*Elbow flexors*						C5 *Elbow flexors*
C6	*Wrist extensors*						C6 *Wrist extensors*
C7	*Elbow extensors*						C7 *Elbow extensors*
C8	*Finger flexors*						C8 *Finger flexors*
T1							T1
T2							T2
T3							T3
T4							T4
T5							T5
T6							T6
T7							T7
T8							T8
T9							T9
T10							T10
T11							T11
T12							T12
L1							L1
L2	*Hip flexors*						L2 *Hip flexors*
L3	*Knee extensors*						L3 *Knee extensors*
L4	*Ankle dorsiflexors*						L4 *Ankle dorsiflexors*
L5	*Long toe extensors*						L5 *Long toe extensors*
S1	*Ankle plantar flexors*						S1 *Ankle plantar flexors*
S2							S2
S3							S3
S4-5							S4-5
	RIGHT TOTALS (MAXIMUM)						*LEFT TOTALS* (MAXIMUM)
		(50)	(56)	(56)	(56)	(56)	(50)

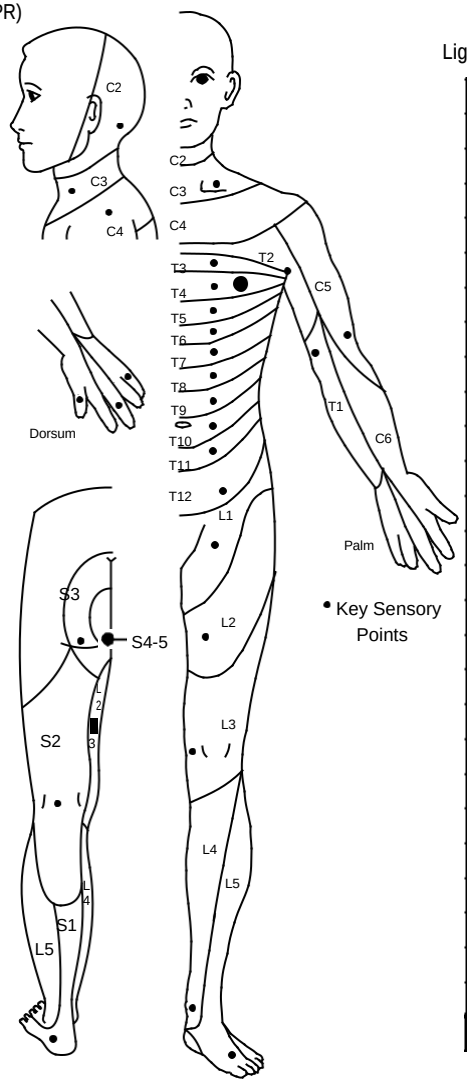
UER (Upper Extremity Right)

UEL (Upper Extremity Left)

LER (Lower Extremity Right)

LEL (Lower Extremity Left)

Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):



(VAC) Voluntary Anal Contraction (Yes/No) ☐

(DAP) Deep Anal Pressure (Yes/No) ☐

MOTOR (SCORING ON REVERSE SIDE)

0 = Total paralysis
1 = Palpable or visible contraction
2 = Active movement, gravity eliminated
3 = Active movement, against gravity
4 = Active movement, against some resistance
5 = Active movement, against full resistance
NT = Not testable
0, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present*

SENSORY (SCORING ON REVERSE SIDE)

0 = Absent *NT = Not testable*
1 = Altered *0*, 1*, NT* = Non-SCI*
2 = Normal *condition present*

MOTOR SUBSCORES

UER ☐ **+UEL** ☐ = *UEMS TOTAL* ☐ (MAX (25) (25) (50))

LER ☐ + LEL ☐ = *LEMS TOTAL* ☐ (MAX (25) (25) (50))

SENSORY SUBSCORES

LTR ☐ + LTL ☐ = *LT TOTAL* ☐ (MAX (56) (56) (112))

PPR ☐ + PPL ☐ = *PP TOTAL* ☐ (MAX (56) (56) (112))

NEUROLOGICAL LEVELS *as on reverse*	R	L	3. NEUROLOGICAL LEVEL OF INJURY (NLI)	4. COMPLETE OR INCOMPLETE? *Incomplete = Any sensory or motor function in S4-5* ☐	6. ZONE OF PARTIAL PRESERVATION *(In injuries with absent motor OR sensory function in S4-5 only) Most caudal levels with any innervation*	R	L
1. SENSORY	☐	☐	☐	5. ASIA IMPAIRMENT SCALE (AIS) ☐	SENSORY	☐	☐
2. MOTOR	☐	☐			MOTOR	☐	☐

REV 04/19

Muscle Function Grading

0 = Total paralysis

1 = Palpable or visible contraction

2 = Active movement, full range of motion (ROM) with gravity eliminated

3 = Active movement, full ROM against gravity

4 = Active movement, full ROM against gravity and moderate resistance in a muscle specific position

5 = (Normal) active movement, full ROM against gravity and full resistance in a functional muscle position expected from an otherwise unimpaired person

NT = Not testable (i.e. due to immobilization, severe pain such that the patient cannot be graded, amputation of limb, or contracture of > 50% of the normal ROM)

0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present [a]

Sensory Grading

0 = Absent 1 = Altered, either decreased/impaired sensation or hypersensitivity

2 = Normal NT = Not testable

0*, 1*, NT* = Non-SCI condition present [a]

[a] Note: Abnormal motor and sensory scores should be tagged with a '*' to indicate an impairment due to a non-SCI condition. The non-SCI condition should be explained in the comments box together with information about how the score is rated for classification purposes (at least normal / not normal for classification).

When to Test Non-Key Muscles:

In a patient with an apparent AIS B classification, non-key muscle functions more than 3 levels below the motor level on each side should be tested to most accurately classify the injury (differentiate between AIS B and C).

Movement	Root level
Shoulder: Flexion, extension, adbuction, adduction, internal and external rotation **Elbow:** Supination	C5
Elbow: Pronation **Wrist:** Flexion	C6
Finger: Flexion at proximal joint, extension **Thumb:** Flexion, extension and abduction in plane of thumb	C7
Finger: Flexion at MCP joint **Thumb:** Opposition, adduction and abduction perpendicular to palm	C8
Finger: Abduction of the index finger	T1
Hip: Adduction	L2
Hip: External rotation	L3
Hip: Extension, abduction, internal rotation **Knee:** Flexion **Ankle:** Inversion and eversion **Toe:** MP and IP extension	L4
Hallux and Toe: DIP and PIP flexion and abduction	L5
Hallux: Adduction	S1

ASIA Impairment Scale (AIS)

A = Complete. No sensory or motor function is preserved in the sacral segments S4-5.

B = Sensory Incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-5 (light touch or pin prick at S4-5 or deep anal pressure) AND no motor function is preserved more than three levels below the motor level on either side of the body.

C = Motor Incomplete. Motor function is preserved at the most caudal sacral segments for voluntary anal contraction (VAC) OR the patient meets the criteria for sensory incomplete status (sensory function preserved at the most caudal sacral segments S4-5 by LT, PP or DAP), and has some sparing of motor function more than three levels below the ipsilateral motor level on either side of the body. (This includes key or non-key muscle functions to determine motor incomplete status.) For AIS C – less than half of key muscle functions below the single NLI have a muscle grade ≥ 3.

D = Motor Incomplete. Motor incomplete status as defined above, with at least half (half or more) of key muscle functions below the single NLI having a muscle grade ≥ 3.

E = Normal. If sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had prior deficits, then the AIS grade is E. Someone without an initial SCI does not receive an AIS grade.

Using ND: To document the sensory, motor and NLI levels, the ASIA Impairment Scale grade, and/or the zone of partial preservation (ZPP) when they are unable to be determined based on the examination results.

AMERICAN SPINAL INJURY ASSOCIATION

INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

INTERNATIONAL SPINAL CORD SOCIETY

Steps in Classification

The following order is recommended for determining the classification of individuals with SCI.

1. Determine sensory levels for right and left sides.
The sensory level is the most caudal, intact dermatome for both pin prick and light touch sensation.

2. Determine motor levels for right and left sides.
Defined by the lowest key muscle function that has a grade of at least 3 (on supine testing), providing the key muscle functions represented by segments above that level are judged to be intact (graded as a 5).
Note: in regions where there is no myotome to test, the motor level is presumed to be the same as the sensory level, if testable motor function above that level is also normal.

3. Determine the neurological level of injury (NLI).
This refers to the most caudal segment of the cord with intact sensation and antigravity (3 or more) muscle function strength, provided that there is normal (intact) sensory and motor function rostrally respectively.
The NLI is the most cephalad of the sensory and motor levels determined in steps 1 and 2.

4. Determine whether the injury is Complete or Incomplete.
(i.e. absence or presence of sacral sparing)
If voluntary anal contraction = No AND all S4-5 sensory scores = 0 AND deep anal pressure = No, then injury is Complete.
Otherwise, injury is Incomplete.

5. Determine ASIA Impairment Scale (AIS)
Grade. Is injury Complete? If YES, AIS=A

NO ↓

Is injury Motor Complete? If YES, AIS=B

NO ↓ (No=voluntary anal contraction OR motor function more than three levels below the motor level on a given side, if the patient has sensory incomplete classification)

Are at least half (half or more) of the key muscles below the neurological level of injury graded 3 or better?

NO ↓ AIS=C YES ↓ AIS=D

If sensation and motor function is normal in all segments, AIS=E
Note: AIS E is used in follow-up testing when an individual with a documented SCI has recovered normal function. If at initial testing no deficits are found, the individual is neurologically intact and the ASIA Impairment Scale does not apply.

6. Determine the zone of partial preservation (ZPP).
The ZPP is used only in injuries with absent motor (no VAC) OR sensory function (no DAP, no LT and no PP sensation) in the lowest sacral segments S4-5, and refers to those dermatomes and myotomes caudal to the sensory and motor levels that remain partially innervated. With sacral sparing of sensory function, the sensory ZPP is not applicable and therefore "NA" is recorded in the block of the worksheet. Accordingly, if VAC is present, the motor ZPP is not applicable and is noted as "NA"

Surface Electromyography (sEMG)

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Neuromusculoskeletal & Movement-related Functions and Structures

You Will Need

Equipment:
- Surface electrodes
- Monitoring equipment

Training:
Special training is mandatory to conduct and interpret the results.
Administration:
Surface electrodes are placed on the skin overlying the muscles of interest.

Summary

Surface Electromyography (sEMG) is a non-invasive technique used to measure muscle activity (both voluntary and involuntary) in individuals with neuromuscular conditions using surface electrodes. sEMG provides quantifiable and objective measures of muscle activity and is less invasive than needle EMG. In general, EMGs are associated with high costs of administration and interpretation.

Availability

Refer to protocols in referenced article – Lim et al 2005, available for free here: http://www.ncbi.nlm.nih.gov/pubmed/15672098

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Normative Data (mV (SD)):
Frontalis: 1.93 (1.41)
Anterior temporalis: 2.22 (1.46)
Masseter: 1.73 (1.52)
Sternocliedomastoid: 1.32 (0.82)
Sternomastoid: 1.99 (1.83)
Occipitalis: 3.13 (2.78)
Splenius capitus: 5.01 (4.14)
Spenius cervicus: 3.59 (3.69)
Semispinalis capitus: 4.83 (3.87)
Semispinalis cervicus: 4.81 (7.68)
Trapezius: 3.54 (3.42)

Latissimus dorsi: 1.30 (1.16)
Paraspinalis: 1.07 (0.73)
Gastrocnemius: 0.91 (0.70)
Soleus: 1.33 (1.10)
Anterior tibialis: 3.53 (6.52)

(Matheson et al., 1988; N=103 college students; measurements taken while seated)

Measurement Properties

Validity – Moderate to High

Moderate **to** ***High*** **correlation (r-values) with Manual Muscle Testing (MMT):**

Biceps:	0.56/0.40
Triceps:	0.77/0.70
Extensor carpi radialis:	0.64/0.64
Abductor digiti minimi:	0.49/0.67
Psoas:	0.47/0.77
Quadriceps:	0.54/0.61
Tibialis anterior:	0.57/0.78
Soleus:	0.28/0.59

(Calancie et al., 2001; N=45, 34 cervical, acute SCI, < 1week post-injury)

Number of studies reporting validity data: 4

Reliability – High

High **Test-retest Reliability:**
Voluntary response index magnitude: ICC = 0.93

Voluntary response similarity index: ICC = 0.83

(One week interval; Lim & Sherwood, 2005; N=69, 65 male, incomplete SCI, mean (SD) time since injury = 54.8 (3.6) months)

Number of studies reporting reliability data: 1

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Skin Health

Braden Scale

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Functions of the Skin
Subscales (domains):
1) Sensory Perception, 2) Moisture, 3) Activity, 4) Mobility, 5) Nutrition, 6) Friction and Shear

You Will Need

Length:
5-10 minutes, 6 items
Scoring:
Each domain scored 1-4 (except for Friction and Shear, which is scored 1-3), total score (6-23) as sum of domains.
Higher scores reflect better prognosis.

Summary

The Braden Scale is a clinician-administered assessment tool for determining a patient's risk level for incurring skin breakdown and is useful for detecting pressure ulcer risk in people with SCI (though it includes two factors less related to risk for people with SCI - sensory perception and mobility). Moisture was found to be the most predictive variable for people with SCI. It has been tested in both acute care and long-term-care settings.

The scale items were developed based on expert consensus, and includes three factors (sensory perception, mobility and nutritional variables) that were not significantly related to pressure ulcer development for individuals with SCI.

Availability

Available for free here: www.bradenscale.com

Assessment form available here:
http://www.in.gov/isdh/files/Braden_Scale.pdf

Languages: English, French, Portuguese / Brazilian Portuguese, Spanish. Also available in other languages, but are not formally validated.

Video: https://www.scireproject.com/outcome-measures/video

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Mean (95%CI) Scores:
All patients: 11.1 (10.7-11.5)
Patients with ulcers (n=80): 9.9 (9.6-10.3)
Patients without ulcers (n=64): 12.6 (12-13.2)

(Ash 2002; n=144; mixed injury types; mean time since injury = 14 days)

Mean (SD) Scores:
13.8 (1.75) (range 10-18)

(Wellard, 2002; N=60; mixed injury types; non-acute SCI patients)

Threshold Values:
16 or less indicates risk of pressure ulcer
(Flett et al. 2019; n=754 (510 males); mean age (SD): 53.9 (18.5); Tetraplegic 43%, Paraplegic 7%; Complete injury 15%, Incomplete 77%; injury duration (SD): 84.6 (378.4) days)

Measurement Properties

Validity – **Moderate**

Moderate **correlation with the stage of the first pressure ulcer:**
r = -0.353

Moderate **correlation with the number of ulcers developed:**
r = -0.431

(Salzberg et al. 1999; n=226, 188 males; mixed injury types; acute, traumatic SCI)

Moderate **predictive validity for pressure ulcer development:**
Area Under Curve (AUC) = 0.73-0.81
CI (95%) = 0.74-0.88

(Ash 2002; n=144; mixed injury types; mean time since injury = 14 days)

Study findings suggest that a simple measure of mobility, admission FIM bed/chair transfer score of 1 (total assist), can identify at-risk individuals with greater accuracy than both an SCI specific instrument (SCIPUS) and a PI specific instrument (Braden)

(Flett et al. 2019; n=754 (510 males); mean age (SD): 53.9 (18.5); Tetraplegic 43%, Paraplegic 7%; Complete injury 15%, Incomplete 77%; injury duration (SD): 84.6 (378.4) days)

It was found that sensory perception, mobility and nutritional variables were not significantly related to pressure ulcer development. Moisture was the most important predictive variable

(Salzberg et al., 1999; N=226, 188 male; acute traumatic SCI, mixed injury types)

Number of studies reporting validity data: 4

Reliability

Not established in SCI

Responsiveness

Floor/Ceiling Effect:
A ceiling effect was reported in mixed populations (21% of patients attained a 'high risk' score)

(Wellard, 2002; N=60; mixed injury types; non-acute SCI patients)

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 2

BRADEN SCALE – For Predicting Pressure Sore Risk

SEVERE RISK: Total score 9 **HIGH RISK**: Total score 10-12
MODERATE RISK: Total score 13-14 **MILD RISK**: Total score 15-18

RISK FACTOR	SCORE/DESCRIPTION				DATE OF ASSESS ➡ 1	2	3	4
SENSORY PERCEPTION Ability to respond meaningfully to pressure-related discomfort	**1. COMPLETELY LIMITED** – Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation, **OR** limited ability to feel pain over most of body surface.	**2. VERY LIMITED** – Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness, **OR** has a sensory impairment which limits the ability to feel pain or discomfort over ½ of body.	**3. SLIGHTLY LIMITED** – Responds to verbal commands but cannot always communicate discomfort or need to be turned, **OR** has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	4. **NO IMPAIRMENT** – Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.				
MOISTURE Degree to which skin is exposed to moisture	1. **CONSTANTLY MOIST**– Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	2. **OFTEN MOIST** – Skin is often but not always moist. Linen must be changed at least once a shift.	3. **OCCASIONALLY MOIST** – Skin is occasionally moist, requiring an extra linen change approximately once a day.	4. **RARELY MOIST** – Skin is usually dry; linen only requires changing at routine intervals.				
ACTIVITY Degree of physical activity	1. **BEDFAST** – Confined to bed.	2. **CHAIRFAST** – Ability to walk severely limited or nonexistent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	3. **WALKS OCCASIONALLY** – Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	4. **WALKS FREQUENTLY**– Walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours.				
MOBILITY Ability to change and control body position	1. **COMPLETELY IMMOBILE** – Does not make even slight changes in body or extremity position without assistance.	2. **VERY LIMITED** – Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	3. **SLIGHTLY LIMITED** – Makes frequent though slight changes in body or extremity position independently.	4. **NO LIMITATIONS** – Makes major and frequent changes in position without assistance.				
NUTRITION Usual food intake pattern [1]NPO: Nothing by mouth. [2]IV: Intravenously. [3]TPN: Total parenteral nutrition.	**1. VERY POOR** – Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement, **OR** is NPO[1] and/or maintained on clear liquids or IV[2] for more than 5 days.	**2. PROBABLY INADEQUATE** – Rarely eats a complete meal and generally eats only about ½ of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement **OR** receives less than optimum amount of liquid diet or tube feeding.	**3. ADEQUATE** – Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally refuses a meal, but will usually take a supplement if offered, **OR** is on a tube feeding or TPN[3] regimen, which probably meets most of nutritional needs.	4. **EXCELLENT** – Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.				
FRICTION AND SHEAR	1. **PROBLEM**- Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.	2. **POTENTIAL PROBLEM**– Moves feebly or requires minimum assistance. During a move, skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	3. **NO APPARENT PROBLEM** – Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.					
TOTAL SCORE	**Total score of 12 or less represents HIGH RISK**							

ASSESS	DATE	EVALUATOR SIGNATURE/TITLE	ASSESS.	DATE	EVALUATOR SIGNATURE/TITLE
1	/ /		3	/ /	
2	/ /		4	/ /	

NAME-Last	First	Middle	Attending Physician	Record No.	Room/Bed

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BRADEN SCALE

Spinal Cord Injury Pressure Ulcer Scale (SCIPUS)

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Functions of the Skin

You Will Need

Length:
15 items
Scoring:
By adding domain scores together a summary score (0-25) is calculated. Lower scores indicate better prognosis.

Summary

The Spinal Cord Injury Pressure Ulcer Scale (SCIPUS) is a clinician-administered measure developed to assess the risk for pressure ulcer development for individuals with SCI who are in a rehabilitation centre. Rating is based on personal knowledge of the client or chart review. Blood tests are required if tests for diabetes, albumin and hemocrit are not already part of the patient's medical record.

Availability

Available for free here:
https://www.sralab.org/sites/default/files/2017-06/SCIPUS.pdf

Languages: English

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Threshold Values:
Score of ≥ 6 has been suggested to indicate risk for pressure ulcer development.

(Salzberg et al. 1996; n=219, 217 male, traumatic SCI, mean (SD) time from injury to last follow up = 17.2 (12.1) years)

Measurement Properties

Validity – Low to Moderate

Moderate **correlation with stage of first pressure ulcer:**
ρ = 0.34

Moderate **correlation with number of pressure ulcers:**
ρ = 0.34

(Salzberg et al., 1999; N=226, 188 male, acute traumatic SCI, within 30 days of admission)

Low **accuracy of "high risk" categorization (cut-off scores of ≥ 6, ≥ 7, ≥ 8):**
AUC < 0.70

(Delparte et al., 2015; N=759, 509 male, mixed injury types, mean (SD) time since injury: 84.9 (379.7) days)

Number of studies reporting validity data: 3

Reliability – Low to High

High **Inter-rater Reliability:**
ICC = 0.91

(Delparte et al., 2015; N=759, 509 male, mixed injury types, mean (SD) time since injury: 84.9 (379.7) days)

Low **Internal Consistency:**
Person Separation Index (PSI)=0.44

(Higgins et al. 2019; N=886, 59% male; median age [interquartile range] 56 [28]; etiology: 56% non-traumatic, 44% traumatic)

Number of studies reporting reliability data: 2

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

6 Minute Walk Test (6 MWT)

Assessment Overview

Assessment Area

ICF Domain:
Activity
Subcategory:
Mobility

You Will Need

Length:
6 minutes
Equipment:

- Countdown timer
- Tape measure
- Mechanical lap counter
- Cones to mark the turnaround
- Chair that can be easily moved along the walking course.

Scoring:
Total distance walked (rounding to the nearest meter) and the number and duration of rests during the test is reported.

Summary

The 6 Minute Walk Test (6MWT) is a self-paced test that measures the distance a patient can walk on a flat, hard surface in 6 minutes. It assesses the sub-maximal level of functional capacity. The test in its entirety evaluates the integrated response of pulmonary, cardiovascular, and circulatory systems, in addition to level of motor control, functional neuromuscular units, and muscle. The 6MWT is widely used in many populations and primarily in incomplete SCI.

Availability

Available for free here: http://www.cscc.unc.edu/spir/public/UNLICOMMSMWSixMinuteWalkTestFormQxQ08252011.pdf

Video: https://www.scireproject.com/outcome-measures/video

Assessment Interpretability

Minimal Clinically Important Difference

0.10 m/s

(Forrest et al. 2014; n=249, 190 male, incomplete SCI, outpatient, median time since injury = 0.7 years)

Statistical Error

Standard Error of Measurement:

12.3 m; 0.0342 m/s

(Musselman and Yang 2013; n=20, 14 males, incomplete SCI, time since injury (SD) = 5.4 (8.8) years)

Minimal Detectable Change:

0.086 m/s

(Tester et al., 2016; N=72, 57 male; mixed injury types; median (range) time since SCI = 0.7 (0.1-14.7) years)

37.1 m; 0.103 m/s

(Duffell et al. 2015; n=83, 57 males, outpatient, incomplete SCI, >12 months post-injury, AIS C or D)

Typical Values

Mean (SD) Scores:

Within 1st month = 314 (137.0)
After 3 months = 473 (110.1)
After 6 months = 502 (132.6)
After 12 months = 495 (125.1)

(van Hedel et al. 2006; n=22, 18 males, incomplete SCI, tests performed between 1 month and 12 months post-injury)

Measurement Properties

Validity – Low to High

High **correlation with 10 Meter Walk Test:**
r = 0.94

(Forrest et al. 2014; n=249, 190 male, incomplete SCI, outpatient, median time since injury = 0.7 years)

High **correlation with Walking Index for SCI:**
At 3 months: r = 0.76
At 6 months: r = 0.68
At 12 months: r = 0.69

High **correlation with Functional Independence Measure-Locomotor Score:**
At 3 months: r = 0.78
At 6 months: r = 0.69
At 12 months: r = 0.62

(Ditunno et al. 2007; n=146, 114 males, incomplete SCI, inpatient)

Low **to** ***High*** **correlation with ASIA Motor Scales:**
Upper Extremity Motor Score: r = 0.24
Lower Extremity Motor Score: r = 0.70
ASIA Motor Score: r = 0.64

(Harkema et al. 2016; n=156, 123 male, mixed injury types; median (range) time since injury = 0.9 (0.1-45.2) years)

Moderate to ***High*** **correlation with WISCI-II:**
r=0.36-0.69

Moderate correlation with LEMS
r=0.49-0.55

(Perez-Sanpablo et al. 2017; n=23, 15 males, mean age: 45.6 ± 12.6 years, chronic and subacute injury types).

Number of studies reporting validity data: 9

Reliability – High

High **Test-retest Reliability:**
ICC = 0.989

(Musselman and Yang 2013; n=20, 14 males, incomplete SCI, time since injury (SD) = 5.4 (8.8) years)

High **Inter-rater Reliability:**
ICC = 0.970

High **Intra-rater Reliability:**
ICC = 0.981, P<.001

(Van Hedel et al. 2005; n=22, 14 males, mixed injury types, no information on chronicity)

Number of studies reporting reliability data: 4

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
23+ sessions of locomotor training: SRM = 0.48

(Harkema et al. 2016; n=156, 123 male, mixed injury types; median (range) time since injury = 0.9 (0.1-45.2) years)

2-month endurance training: SRM = 0.88

(Musselman and Yang 2013; n=20, 14 males, incomplete SCI, mean (SD) time since injury = 5.4 (8.8) years)

Number of studies reporting responsiveness data: 3

6-Minute Walk Test (6MWT)

- A self---paced test. It measures the distance that a patient can walk on a flat, hard surface in 6 minutes.
- assesses the sub---maximal level of functional capacity.
- The test in its entirety evaluates the integrated response of pulmonary, cardiovascular, and circulatory systems, in addition to level of motor control, functional neuromuscular units, and muscle.

ICF Domain:

Activity – subcategory: Mobility

Number of Items:

N/A

Instructions for Administration and Scoring:

Administration:

- clinician-administered
- may be performed either indoors or outdoors, along a long, flat, straight, and hard surface.
- **6 minutes** is required for the actual test
- **5-10 minutes** is required to set up and explain the test to the patient
- the American Thoracic Society (ATS) recommends that the walking course should be:
  - 30 meters in length
  - marked at every 3 meters
  - marked with a cone at turn---around points

Equipment required:

- countdown timer
- tape measure
- mechanical lap counter
- cones to mark the turnaround
- chair that can be easily moved along the walking course.

Because the test was originally developed for stroke patients, the American Thoracic Society also recommends that a source of oxygen, sphygmomanometer, telephone, and an automated electronic defibrillator be available.

Scoring:

- total distance walked (rounding to the nearest meter) and the number and duration of rests during the test is reported.

- Physiological measures such as dyspnea and fatigue level can be measured using the Borg Scale and pulse oximetry (baseline heart rate and oxygen saturation) can also be recorded at the beginning and end of the test.

Interpretability:

MCID: not established for the SCI population, but for a population with Coronary Artery Disease (CAD): [N=81 stable patients with CAD, mean (SD) age: 58.1 (8.7) yrs, 77M/4F] MCID = 23 metres (determined using distribution method)

Reference: Gremeaux et al. "Determining the minimal clinically important difference for the six---minute walk test and the 200---meter fast---walk test during cardiac rehabilitation program in coronary artery disease patients after acute coronary syndrome." Arch Phys Med Rehabil. 2011 Apr;92(4):611---9.

SEM: 16.5 metres (Lam et al. 2008 – calculated from measurements made in van Hedel et al. 2005)
MDC: 45.8 metres (Lam et al. 2008– calculated from measurements made in van Hedel et al. 2005)

- Normative data and published data is available for comparison for the SCI population (see the Interpretability section of the Study Details sheet).
- Scores range from 0 meters or feet for patients who are non---ambulatory to the maximum biological limits for normal healthy individuals (approximately 900 meters or 2953 feet).

Languages:

N/A

Training Required:

No training is required.

Availability:

No administration cost. For protocol details, refer to ATS Statement: Guidelines for the Six--- Minute Walk Test. Test instructions are available (Function ATSCoPSfCP. ATS statement: guidelines for the six---minute walk test. American Journal of Respiratory and Critical Care Medicine. 2002; 166(1):111---7.)

Clinical Considerations:

- According to the American Thoracic Society, the 6MWT is easier to administer, better tolerated, and more reflective of activities of daily living than other walking tests.
- There are many sources of variability including height, age, body weight, sex, and motivation.
- The participant uses their typical walking aid during the test.
- Other versions of the test such as the 2 Minute Walk Test and the 10 Meter Walk Test can be administered as part of the 6 MWT.

Measurement Property Summary:

# of studies reporting psychometric properties: 6

Reliability:

- Intra---rater reliability is **excellent** (r=0.981---0.99)
- Inter---rater reliability is **excellent** (r=0.970---1.00). [Van Hedel et al., 2005, Scivoletto et al. 2011]

Validity:

- Correlation at 3 months post injury is **excellent** with:
  - 50 foot walking speed (r=0.95)
  - Walking Index for Spinal Cord Injury (WISCI I) (r=0.76)
  - Timed Up and Go (Spearman ρ =0.88)
- Correlation at 3 months post injury is **adequate** with:
  - the Berg Balance Scale (Spearman ρ =0.48)
  - Lower Extremity Motor Score (r=0.34)
  - WISCI II (Spearman ρ =0.60).

[Van Hedel et al. 2005, Van Hedel et al. 2006, Ditunno et al. 2007, Datta et al. 2009]

Responsiveness:

- The 6MWT differed between 1 month and 3 months (mean score increased from 314 to 473 metres, P<.001) and between 3 months and 6 months (mean score increased from 473 to 502 metres, P=.01) but not between 6 months and 12 months (mean score decreased from 502 to 495 metres, P=.76)

[van Hedel et al., 2006]

Floor/ceiling effect:

No values were reported for the presence of floor/ceiling effects in the 6MWT for the SCI population.

Reviewer:

Dr. William Miller, Christie Chan

Date Last Updated:

Feb 1, 2013

10 Meter Walking Test (10 MWT)

Assessment Overview

Assessment Area

ICF Domain:
Activity
Subcategory:
Mobility

You Will Need

Length:
Less than 5 minutes
Equipment:
14m corridor
Stopwatch
Scoring:
The time (to the nearest second) is reported.
Walking speed (m/s) can be calculated by dividing 10 metres by time in seconds.

Summary

The 10 Meter Walking Test (10 MWT) assesses short duration walking speed (m/s). It has been used in various patient populations including stroke, Parkinson's disease, general neurologic movement disorders and SCI.
The 10 Meter Walking Test (10 MWT) is clinician-administered, and measures the time required to walk 10 meters. The test is performed using a "flying start": the patient walks 14 meters and the time is measured for the intermediate 10 meters.

The individual performing the test:

- Walks at his/her preferred walking speed,
- May use their usual assistive devices (e.g., braces, walker), and
- Must wear shoes.

Availability

Available for free here (Under How to Use):
https://scireproject.com/outcome-measures/outcome-measure-tool/10-meter-walking-test-10-mwt/#1467983894177-6b9fb7a3-f550

Video: https://www.scireproject.com/outcome-measures/video

Assessment Interpretability

Minimal Clinically Important Difference

0.15 m/s

(Forrest et al. 2014; n=249, 190 male, incomplete SCI, outpatient, median time since injury = 0.7 years)

Statistical Error

Standard Error of Measurement:
0.05 m/s

(Lam et al. 2008, calculated from measurements made in van Hedel et al. 2005; n=22, 14 males, mixed injury types, no information on chronicity)

Minimal Detectable Change:
0.105 m/s

(Tester et al. 2016; N=72, 57 male; 20 sessions of locomotor training; mixed injury type; median (range) time post-SCI = 0.7 (0.1-14.7) years)

Typical Values

Median (range) Scores:
All individuals: 0(0-2.0)-0(0-2.6)
AIS-A/B: All non-ambulatory
AIS-C: 0(0-0.5)-0(0-1.7)
AIS-D: 0.3(0-2.0)-0.8(0-2.6)

(Post locomotor training; Harkema et al. 2016; N=152, 123 male; mixed injury type; median (range) time post-SCI = 0.9 (0.1-45.2) years)

Threshold Values:
Not established in SCI, but for stroke patients:
Household ambulation: < 0.4 m/s
Limited community ambulation:
0.4 – 0.8 m/s
Full community ambulation: > 0.8 m/s

(Perry et al., 1995, N=147, stroke patients)

Measurement Properties

Validity – Low to High

High **correlation with Walking Index for SCI:**
At 3 months r = 0.78
At 6 months r = 0.85
At 12 months r = 0.77

High **correlation with Functional Independence Measure-Locomotor Score:**
At 3 months r = 0.80
At 6 months > 0.80
At 12 months r = 0.66

High **correlation with 6-Minute Walk Test:**
At 3 months r = 0.95
At 6 months > 0.80
At 12 months r = 0.92

(Ditunno et al. 2007; n=146, 114 males, inpatient, incomplete SCI, within 1 year post-injury)

Low **to** ***Moderate*** **correlation with ASIA Motor Scale:**
UEMS r = 0.24
LEMS r = 0.69
ASIA Motor Score r = 0.63

(Harkema et al. 2016; N=152, 123 male; mixed injury type; median (range) time post-SCI = 0.9 (0.1-45.2) years)

Moderate ***to*** ***High*** **correlation with WISCI-II**
r=-0.37 to -0.795

Moderate **correlation with LEMS**
r= -0.4 to -0.39

(Perez-Sanpablo et al. 2017; n=23, 15 males, mean age: 45.6 ± 12.6 years, chronic and subacute injury types).

Number of studies reporting validity data: 15

Reliability – High

High **Test-retest Reliability:**
ICC = 0.977-0.981

(Musselman and Yang 2013; n=20, 14 males, incomplete SCI, time since injury (SD) = 5.4 (8.8) years)

High **Inter-rater Reliability:**
ICC = 0.997

(Srisim et al. 2015; n=83, chronic SCI, mixed injury types, mean time since injury (multiple and non-multiple fallers) = 46.72-58.70 months)

High **Intra-rater Reliability:**
ICC = 0.974

(Van Hedel et al. 2005; n=22, 14 males, mixed injury types, no information on chronicity)

High **Test-retest Reliability:**
ICC = 0.983-0.97

(Perez-Sanpablo et al. 2017; n=23, 15 males, mean age: 45.6 ± 12.6 years, chronic and subacute injury types).

High **Test-retest Reliability:**
ICC = 0.99

(Rini et al. 2018; n=25, 22 males, mean age: 27 years, AIS A/B)

Number of studies reporting reliability data: 8

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Mean change (m/s):
1 to 3 months post-injury = 0.92
3 to 6 months post-injury = 0.47

(Lam et al. 2008, calculated from measurements made in van Hedel et al. 2007; n=51, 42 males, incomplete SCI, 46 with traumatic injury)

Standardized Response Mean:
All individuals: 0.51
AIS-A/B: 0.51
AIS-C: 0.50
AIS-D: 0.98

(Post locomotor training; Harkema et al. 2016; N=152, 123 male; mixed injury type; median (range) time post-SCI = 0.9 (0.1-45.2) years)

Number of studies reporting responsiveness data: 3

Timed 10-Meter Walk Test

General Information:

- individual walks without assistance 10 meters (32.8 feet) and the time is measured for the intermediate 6 meters (19.7 feet) to allow for acceleration and deceleration
    - o start timing when the toes of the leading foot crosses the 2-meter mark
    - o stop timing when the toes of the leading foot crosses the 8-meter mark
    - o assistive devices can be used but should be kept consistent and documented from test to test
    - o if physical assistance is required to walk, this should not be performed
- can be performed at preferred walking speed or fastest speed possible
    - 6. documentation should include the speed tested (preferred vs.
- fast) collect three trials and calculate the average of the three trials

Set-up (derived from the reference articles):

- measure and mark a 10-meter walkway
- add a mark at 2-meters
- add a mark at 8-meters

Patient Instructions (derived from the reference articles):

- Normal comfortable speed: *"I will say ready, set, go. When I say go, walk at your normal comfortable speed until I say stop"*
- Maximum speed trials: *"I will say ready, set, go. When I say go, walk as fast as you safely can until I say stop"*

10 Meter Walk Testing Form

Name:_____

Assistive Device and/or Bracing Used:_____

Date:_____

Seconds to ambulate 10 meters (only the middle 6 meters are timed)

Self-Selected Velocity: Trial 1_____sec.___ Fast Velocity: Trial 1_____sec.___

Self-Selected Velocity: Trial 2_____sec.___ Fast Velocity: Trial 2_____sec.___

Self-Selected Velocity: Trial 3 _____sec.___ Fast Velocity: Trial 3_____sec.___

Self-Selected Velocity: Average time___sec.__ Fast Velocity: Average time___sec.__

Actual velocity: Divide 6 by the average seconds

Average Self-Selected Velocity:_____m/s

Average Fast-Velocity:_____m/s

Date:_____

Seconds to ambulate 10 meters (only the middle 6 meters are timed)

Self-Selected Velocity: Trial 1_____sec.___ Fast Velocity: Trial 1_____sec.___

Self-Selected Velocity: Trial 2_____sec.___ Fast Velocity: Trial 2_____sec.___

Self-Selected Velocity: Trial 3 _____sec.___ Fast Velocity: Trial 3_____sec.___

Self-Selected Velocity: Average time___sec.__ Fast Velocity: Average time___sec.__

Actual velocity: Divide 6 by the average seconds

Average Self-Selected Velocity:_____m/s

Average Fast-Velocity:_____m/s

References:

Bohannon, R. W. Comfortable and maximum walking speed of adults aged 20-79 years: reference values and determinants." *Age Ageing.* 1997;26(1): 15-9.

Bohannon RW, Andrews AW, Thomas MW. Walking speed: reference values and correlates for older adults. *J Orthop Sports Phys Ther*. 1996;24(2):86-90.

Wolf SL, Catlin PA, Gage K, Gurucharri K, Robertson R, Stephen K. Establishing the reliability and validity of measurements of walking time using the Emory Functional Ambulation Profile. *Phys Ther*. 1999;79(12):1122-33.

Berg Balance Scale (BBS)

Assessment Overview

Assessment Area

ICF Domain:
Activity
Subcategory:
Mobility

You Will Need

Length:
Approximately 20 minutes
Equipment:

- 2 standard chairs (1 with arms and 1 without)
- Stopwatch
- Step or stepstool
- Ruler

Scoring:
Each task is rated on a 5-point scale from 0 (cannot perform) to 4 (normal performance). Task scores are summed to yield a total score (0-56).

Summary

The Berg Balance Scale (BBS) is a performance-based measure of balance with a number of clinical walking evaluations. Tasks progress in difficulty and include functional activities related to balance while reaching, bending, transferring, and standing. The BBS has been found to be an appropriate assessment of standing balance as shown by its strong associations with various clinical walking evaluations. The tool is applicable to people with incomplete SCI.

Availability

Available for free here: http://scireproject.com/wp-content/uploads/worksheet_berg_balance_scale_bbs-1.doc

Video: https://www.scireproject.com/outcome-measures/video

Languages: English, Italian, Turkish, Brazilian-Portuguese, German, Korean, and Dutch.

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Standard Error of Measurement:
0.66

(Srism et al. 2015; n=83, chronic SCI, mixed injury types, mean time since injury (multiple and non-multiple fallers) = 46.72-58.70 months)

Minimal Detectable Change:
%MDC = 17.2%

MDC_{95} = 5.74

(Lemay & Nadeau 2010; N=32, 25 male, AIS D mixed injury types, mean time since injury (SD) = 77.2 (44.3) days)

Typical Values

Mean (SD) Admission-Discharge Scores:
All individuals: 11(16)-17(20)
AIS-A/B: 3(2)-4(2)
AIS-C: 5(6)-13(15)
AIS-D: 26(19)-36(20)

(Post locomotor training; Harkema et al. 2016; N=152, 123 male; mixed injury type; median (range) time post-SCI = 0.9 (0.1-45.2) years)

Threshold Values:
No effective threshold for distinguishing fallers from non-fallers

(Wirz et al 2010; N=42, 33 male, 35 AIS-C, mixed injury type, mean 66.5(66.2) months post-SCI)

Score ≤46 effective threshold for distinguishing high vs. low participant concerns about falling

Jørgensen et al. 2017; n=46 (32 males); AIS D=85%, duration of injury (range): 6.5 years (1-41))

Score >47 effective threshold for distinguishing participants with vs. without mobility aids

Jørgensen et al. 2017; n=46 (32 males); AIS D=85%, duration of injury (range): 6.5 years (1-41))

Measurement Properties

Validity – Low to High

High **correlation with Walking Index for SCI:**
r = 0.89-0.92

High **correlation with Functional Independence Measure (FIM):**
r = 0.72-0.77

High **correlation with FIM Locomotor Score:**
r = 0.86-0.89

(Ditunno et al. 2007; n=146, 114 males, inpatient, incomplete SCI, within 1 year post-injury)

Low **to** ***High*** **correlation with ASIA Motor Scale:**
UEMS = 0.30
LEMS = 0.79
ASIA Motor Score = 0.75

(Harkema et al. 2016; N=152, 123 male; mixed injury type; median (range) time post-SCI = 0.9 (0.1-45.2) years)

High **correlation with Mini-BESTest scale:**
r = 0.899 (P<0.001)

High **correlation with Timed Up and Go (TUG) assessment:**
r = -0.75 (P<0.001)

High **correlation with Spinal Cord Independence Measure version III (SCIM):**
r = 0.88 (P<0.001)

Reliability – High

High **Inter-rater Reliability:**
ICC = 0.998

(Srism et al. 2015; n=83, chronic SCI, mixed injury types, mean time since injury (multiple and non-multiple fallers) = 46.72-58.70 months)

High **Intra-rater Reliability:**
ICC = 0.97

(Tamburella et al. 2014; n=23, 14 males, AIS D, time Since Injury (SD): 16.43 (19.03) months)

High **Internal Consistency:**
IC = 0.94

(Jørgensen et al. 2017; n=46 (32 males); AIS D=85%, duration of injury (range): 6.5 years (1-41))

Number of studies reporting reliability data: 4

High **correlation with Walking Index for Spinal Cord Injury version II (WISCI):**
r = 0.63 (P<0.001)

High **correlation with Fall Efficiency Scale – International (FES-I):**
r = -0.68 (P<0.001)

Low **correlation with participants' fear of falling:**
r = -0.32 (P=0.83)

Low **correlation with Quality of Life (QOL) questionnaire:**
r = -0.75 (P=0.20)

(Jørgensen et al. 2017; n=46 (32 males); AIS D=85%, duration of injury (range): 6.5 years (1-41))

Number of studies reporting validity data: 8

Responsiveness

Floor/Ceiling Effect:
Significant ceiling effect; 28.3%-37.5% of subjects reached maximal score

(Lemay & Nadeau 2010; N=32, 25 male, AIS D mixed injury types, mean time since injury (SD) = 77.2 (44.3) days)

(Jørgensen et al. 2017; n=46 (32 males); AIS D=85%, duration of injury (range): 6.5 years (1-41))

Effect Size:
Standardized Response Mean:
All individuals: 0.59
AIS-A/B: 0.52
AIS-C: 0.65
AIS-D: 0.91

(Post locomotor training; Harkema et al. 2016; N=152, 123 male; mixed injury type; median (range) time post-SCI = 0.9 (0.1-45.2) years)

Number of studies reporting responsiveness data: 3

Berg Balance Scale

Adapted from Berg K, Wood-Dauphinee S, Williams JI, Gayton D. Measuring balance in the elderly: preliminary development of an instrument, Physiotherapy Canada, 1989; 41(6): 304-311.

Scoring: Task scores are summed to yield a total score. Total scores range from 0 (severely impaired balance) to 56 (excellent balance).

Patient name: _____ Date: _____

Grading: Please mark the lowest category which applies.

1. Sitting to Standing

Instruction: Please stand up. Try not to use your hands for support.

Grading:
4: Able to stand no hands and stabilize independently.
3: Able to stand independently using hands.
2: Able to stand using hands after several tries.
1: Needs minimal assistance to stand or to stabilize.

0: Needs moderate or maximal assistance to stand.

Score:

2. Standing Unsupported

Instruction: Stand for two minutes without holding.

Grading:
4: Able to stand safely 2 minutes.
3: Able to stand 2 minutes with supervision.
2: Able to stand 30 seconds unsupported.
1: Needs several tries to stand 30 seconds unsupported.
0: Unable to stand 30 seconds unassisted.

Score:

3. Sitting Unsupported Feet on Floor

Instruction: Sit with arms folded for two minutes.

Grading:

4: Able to sit safely and securely 2 minutes.
3: Able to sit 2 minutes under supervision.
2: Able to sit 30 seconds.
1: Able to sit 10 seconds.
0: Unable to sit without support 10 seconds.

Score:

4. Standing to Sitting

Instruction: Please sit down.

Grading:

4: Sits safely with minimal use of hands.
3: Controls descent by using hands.
2: Uses back of legs against chair to control descent.

Score:

1: Sits independently but has uncontrolled descent.
0: Needs assistance to sit.

5. Transfers

Instruction: Please move from chair to bed and back again. One way toward a seat with arm rests and one way toward a seat without arm rests.

Grading:
4: Able to transfer safely with minor use of hands.
3: Able to transfer safely definite need of hands.
2: Able to transfer with verbal cuing and/or supervision.
1: Needs one person to assist.
0: Needs two people to assist or supervise to be safe.

Score:

6. Standing Unsupported with Eyes Closed

Instruction: Close your eyes and stand still for 10 seconds.

Grading:

4: Able to stand 10 seconds safely.
3: Able to stand 10 seconds with supervision.
2: Able to stand 3 seconds.
1: Unable to keep eyes closed 3 seconds but stays steady.
0: Needs help to keep from falling.

Score:

7. Standing Unsupported with Feet Together

Instruction: Place your feet together and stand without holding.
Grading:
4: Able to place feet together independently and stand 1 minute safely.
3: Able to place feet together independently and stand for 1 minute with supervision.
2: Able to place feet together independently but unable to hold for 30 seconds.
1: Needs help to attain position but able to stand 15 seconds with feet together.
0: Needs help to attain position and unable to hold for 15 seconds.

Score:

8. Reaching Forward with Outstretched Arm

Instruction: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position.)

Grading:
4: Can reach forward confidently more than 10 inches.
3: Can reach forward more than 5 inches safely.

Score:

2: Can reach forward more than 2 inches safely.
1: Reaches forward but needs supervision.
0: Needs help to keep from falling.

9. Pick Up Object from the Floor

Instruction: Pick up the shoe/slipper which is placed in front of your feet.
Grading:

Score:

4: Able to pick up slipper safely and easily.
3: Able to pick up slipper but needs supervision.
2: Unable to pick up but reaches 1 to 2 inches from slipper and keeps balance independently.
1: Unable to pick up and needs supervision while trying.
0: Unable to try/needs assistance to keep from falling.

9. Turning to Look Behind Over Left and Right Shoulders

Instruction: Turn to look behind you over toward left shoulder. Repeat to the right.

Grading:

Score:

4: Looks behind from both sides and weight shifts well.
3: Looks behind one side only; other side shows less weight shift.
2: Turns sideways only but maintains balance.
1: Needs supervision when turning.
0: Needs assistance to keep from falling.

11. Turn 360 Degrees

Instruction: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

Score:

Grading:
4: Able to turn 360 degrees safely in less than 4 seconds each side.
3: Able to turn 360 degrees safely one side only – less than 4 seconds.
2: Able to turn 360 degrees safely but slowly.
1: Needs close supervision or verbal cuing.
0: Needs assistance while turning.

12. Count Number of Times Step Touch Measured Stool

Instruction: Place each foot alternately on the stool. Continue until each foot has touched the stool four times.

Grading:
4: Able to stand independently and safely and complete 8 steps in 20 seconds.
3: Able to stand independently and complete 8 steps in more than 20 seconds.
2: Able to complete 4 steps without aid with supervision.
1: Able to complete more than 2 steps – needs minimal assistance.

Score:

0: Needs assistance to keep from falling – unable to try.

13. Standing Unsupported One Foot in Front

Instruction: Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (DEMONSTRATE to subject.)

Grading:

4: Able to place foot tandem independently and hold 30 seconds.
3: Able to place foot ahead of the other independently and hold 30 seconds.
2: Able to take small step independently and hold 30 seconds.
1: Needs help to step but can hold 15 seconds.
0: Loses balance while stepping or standing.

Score:

14. Standing on One Leg

Instruction: Stand on one leg as long as you can without holding.

Grading:

4: Able to lift leg independently and hold more than 10 seconds.
3: Able to lift leg independently and hold 5 to 10 seconds.
2: Able to lift leg independently and hold at least 3 seconds.
1: Tries to lift leg, unable to hold 3 seconds but remains standing independently.
0: Unable to try or needs assistance to prevent fall.

Score:

Timed Up and Go (TUG) Walking Test

Assessment Overview

Assessment Area

ICF Domain:
Activity
Subcategory:
Mobility

You Will Need

Length:
5-10 minutes
Equipment:

- A chair
- A 3m walkway
- A cone or line to demarcate 3-meter boundary
- A stopwatch

Scoring:
The time for the up and go test is measured in seconds. Instability during turning and walking aid used are also noted.

Summary

The Timed Up and Go (TUG) walking test measures gait performance and balance. The task of this test incorporates mobility, balance and lower extremity leg strength. The individual is instructed to stand up from an armchair, walk 3 meters, return to the chair, and sit down at their preferred walking speed.
This test is used to discriminate balance and ambulatory function between patients and evaluate change over time in a single patient.
The distance walked in the TUG is only 3 meters and so it is not a test of walking endurance.
The test is simple and fairly easy to administer, however, it is not appropriate for many individuals with SCI.
The TUG test is originally developed to measure walking balance in older adults and has yet to be widely used in the SCI population.
Some proponents have advocated for use of a mean time from 3 successive trials due to potential learning effect.

Availability

http://www.scireproject.com/wp-content/uploads/worksheet_tug.docx
Video: https://www.scireproject.com/outcome-measures/video

Languages: English

Assessment Interpretability

Minimal Clinically Important Difference

14.5 seconds

(Duffell et al. 2015; n=83, 57 males, outpatient, incomplete SCI, >12 months post-injury, AIS C or D)

Statistical Error

Standard Error of Measurement:
3.9 seconds

Minimal Detectable Change:
10.8 seconds

(Lam et al. 2008, calculated from measurements made in van Hedel et al. 2005; n=22, 14 males, mixed injury types, no information on chronicity)

Typical Values

Mean (SD) Scores:
36 (27) seconds; range = 8-156 seconds

(van Hedel et al. 2005; n=75, 45 males, mixed injury types, no information on chronicity)

Threshold Values:
Not established in SCI; but for community-dwelling older adults, a time of > 13.5s indicates a risk of falling.

(Shumway-Cook et al 2000; N=30, mean age 78±6; sensitivity=80%, specificity=100%)

Measurement Properties

Validity – **High**

High **correlation with Berg Balance Scale (BBS):**
Correlation = -0.815

High **correlation with SCI-Functional Ambulation Inventory (SCI-FAI):**
Correlation = -0.724 to -0.802

High **correlation with 10 Meter Walk Test (10MWT):**
Correlation with 10MWT speed = -0.646

(Lemay & Nadeau 2010; N=32, 25 male, AIS D mixed injury types, mean time since injury (SD) = 77.2 (44.3) days)

Correlation with 10MWT time = 0.81-0.96

(van Hedel, 2008; N=6-127 (depending on time-point), calculated at 2 weeks, 1 month, 3 months, 6 months, and 12 months post-injury, no info on injury types)

High **correlation with Walking Index for SCI (WISCI-II):** Correlation = -0.76

High **correlation with 6 Minute Walk Test (6MWT):**
Correlation = -0.88

(van Hedel et al. 2005; n=62; mixed injury types, no information on chronicity)

Number of studies reporting validity data: 6

Reliability – **High**

High **Inter-rater Reliability:**
ICC = 0.999

(Srism et al. 2015; n=83, chronic SCI, mixed injury types, mean time since injury (multiple and non-multiple fallers) = 46.72-58.70 months)

High **Intra-rater Reliability:**
Correlation = 0.979

(van Hedel et al. 2005; n=22, 14 males, mixed injury types, no information on chronicity)

Number of studies reporting reliability data: 4

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Walking Index for Spinal Cord Injury (WISCI II)

Assessment Overview

Assessment Area	Summary
ICF Domain: Activity **Subcategory:** Mobility	

You Will Need

Length:
30 minutes
Equipment:
Equipment is typically available in the clinical setting: 5-meter parallel bars and mobility aids (e.g., braces, cane, walker).
Scoring:
The clinician observes walking and rates the level (0-20), which the person is considered safe. Level 0: "patient is unable to stand and/or participate in walking"
Level 20: "ambulates with no devices, with brace and no assistance"

The Walking Index for Spinal Cord Injury (WISCI) is a functional capacity scale designed to measure improvements in ambulation in persons with spinal cord injury, by evaluating the amount of physical assistance, braces or devices required to walk 10 meters. A score is possible even if the person cannot walk 10 m. However, because the furthest walk distance is 10m, it may not be suitable for people with minor impairments. The WISCI II is currently the most recent version.
People with SCI are progressed systematically through a validated sequence of capacity levels, incorporating devices and personal assistance, to their maximum walking capacity. There is minimal additional burden for clinicians to use the WISCI II as the test falls into typical clinical practice parameters. The purpose of the WISCI II is to understand the severity of underlying impairment on walking rather than the prescription for aids or the need for support.
Given its ceiling effect with incomplete SCI, additional tests may be necessary to assess endurance (e.g., 6MWT) and/or walking speed (e.g., 10MWT), especially for individuals with greater walking capacity.

Availability

Available for free here:
http://www.scireproject.com/wp-content/uploads/worksheet_wisci_i.docx
http://www.scireproject.com/wp-content/uploads/worksheet_wisci_ii.docx
Languages: English

Assessment Interpretability

Minimal Clinically Important Difference

0.06 m/s (Musselman, 2007; N=19, chronic incomplete SCI, mean time since injury = 6.97 years)

Statistical Error

Std Error of Measurement:
WISCI level = 0.318 (Scivoletto et al., 2014; N=33, subacute and chronic incomplete SCI, median days since SCI = 40)

WISCI speed = 0.05 m/s (Musselman, 2007; N=19, chronic incomplete SCI, mean time since injury = 6.97 years)

Minimal Detectable Change:
WISCI level: 0.785 (Comfortable), 0.597 (Max)
Comfortable WISCI speed: 0.254 (Comfortable), 0.163 (Max) m/s

(Burns et al. 2011, N=76, 60 male, 74 chronic incomplete SCI, mean time since injury (SD) = 6.32 (5.99) years)

Typical Values

Mean (SD) Scores:
16.9 (3.4); range = 11-20

(Wirz et al. 2010; n=42, 33 male, chronic SCI, mixed injury types, mean time since injury (SD) = 66.5 (66.2) months)

Measurement Properties

Validity – Moderate to High

High **correlation with Spinal Cord Independence Measure (SCIM-III):**
r = 0.607

High **correlation with Barthel Index (BI):**
r = 0.633
(Menon et al., 2015; N=66, 20 male, mixed injury types)

High **correlation with 6 Minute Walk Test (6MWT):**
r = 0.68-0.76

High **correlation with Berg Balance Scale (BBS):**
r = 0.89-0.92
(Ditunno et al., 2007; N=146, 114 male, inpatient, incomplete SCI)

Moderate **to** ***High*** **correlation with ASIA Motor Score:**
UEMS: Correlation = 0.496-0.502
(Burns et al., 2011; N=41, tetraplegic only)

LEMS: Correlation =0.572-0.717
(Burns et al. 2011, N=76, 60 male, 74 chronic incomplete SCI, mean time since injury (SD) = 6.32 (5.99) years)

High **correlation with Spinal Cord Independence Measure (SCIM-indoor mobility item):**
r=0.96

Number of studies reporting validity data: 12

Reliability – High

High **Test-retest Reliability:**
ICC = 0.930-0.995
(Burns et al. 2011, N=76, 60 male, 74 chronic incomplete SCI, mean time since injury (SD) = 6.32 (5.99) years)

High **Inter-rater Reliability:**
ICC = 0.975-0.996

High **Intra-rater Reliability:**
ICC = 0.979-0.999
(Scivoletto et al., 2014; N=33, subacute and chronic incomplete SCI, median days since SCI = 40)

Number of studies reporting reliability data: 5

Responsiveness

Floor/Ceiling Effect:
44.8% at ceiling (Lemay & Nadeau 2010; N=32, 25 male, AIS D mixed injury types, mean time since injury (SD) = 77.2 (44.3) days)

95.5% at ceiling (van Hedel et al., 2006; N=22, 18 male, incomplete SCI, within 1-year post-injury)

Effect Size:
0.46 (Musselman, 2007; N=19, chronic incomplete SCI, mean time since injury = 6.97 years)

Number of studies reporting responsiveness data: 6

Walking Index for Spinal Cord Injury (WISCI II) Descriptors

Physical limitation for walking secondary to impairment is defined at the person level and indicates the ability of a person to walk after spinal cord injury. The development of this assessment index required a rank ordering along a dimension of impairment, from the level of most severe impairment (0) to least severe impairment (20) based on the use of devices, braces and physical assistance of one or more persons. The order of the levels suggests each successive level is a less impaired level than the former. The ranking of severity is based on the severity or the impairment and not on functional independence in the environment. The following definitions standardize the terms used in each item:

Physical assistance:	'Physical assistance of two persons' is moderate to maximum assistance. 'Physical assistance of one person' is minimal to moderate assistance. 'Contact guarding' is minimal assistance
Braces:	'Braces' means one or two braces, either short or long leg. (Splinting of lower extremities for standing is considered long leg bracing). 'No braces' means no braces on either leg.
Walker:	'Walker' is a conventional rigid walker without wheels.
Crutches:	'Crutches' can be Lofstrand (Canadian) or axillary.
Cane:	'Cane' is a conventional straight cane.

Level Description

0 Unable to stand and/or participate in assisted walking.
1 Ambulates in parallel bars, with braces and physical assistance of two persons, but less than 10 meters.
2 Ambulates in parallel bars, with braces and physical assistance of two persons, 10 meters.
3 Ambulates in parallel bars, with braces and physical assistance of one person, 10 meters.
4 Ambulates in parallel bars, no braces and physical assistance of one person, 10 meters.
5 Ambulates in parallel bars, with no braces and no physical assistance, 10 meters.
6 Ambulates with walker, with braces and physical assistance of one person, 10 meters.
7 Ambulates with two crutches, with braces and physical assistance of one person, 10 meters.
8 Ambulates with walker, no braces and physical assistance of one person, 10 meters.
9 Ambulates with walker, with braces and no physical assistance, 10 meters.
10 Ambulates with one cane/crutch, with braces and physical assistance of one person, 10 meters.
11 Ambulates with two crutches, no braces and physical assistance of one person, 10 meters.
12 Ambulates with two crutches, with braces and no physical assistance, 10 meters.
13 Ambulates with walker, no braces and no physical assistance, 10 meters.
14 Ambulates with one cane/crutch, no braces and physical assistance of one person, 10 meters.
15 Ambulates with one cane/crutch, with braces and no physical assistance, 10 meters.
16 Ambulates with two crutches, no braces and no physical assistance, 10 meters.
17 Ambulates with no devices, no braces and physical assistance of one person, 10 meters.
18 Ambulates with no devices, with braces and no physical assistance, 10 meters.
19 Ambulates with one cane/crutch, no braces and no physical assistance, 10 meters.
20 Ambulates with no devices, no braces and no physical assistance, 10 meters.

Scoring Sheet for the Walking Index for Spinal Cord Injury II (WISCI II)

Name_____ Date_____

Check descriptors that apply to current walking performance, and then assign the highest level of walking performance. (In scoring a level, one should choose the level at which the patient is safe as judged by the therapist, with patient's comfort level described. If devices other than those stated in the standard definitions are used, they should be documented as descriptors. If there is a discrepancy between two observers, the higher level should be chosen.)

Descriptors: Make ONE selection only in each section

Devices		Comments	Braces		Comments
D1 Parallel bars < 10 meters			B1 Long Leg Braces - Uses 2 - Locked at knee		
D2 Parallel bars 10+ meters			B2 Long Leg Braces - Uses 1 - Locked at knee		
D3 Walker - Standard			B3 Short Leg Braces - Uses 2 - Unlocked		
D4 Walker - rolling platform			B4 Short Leg Braces - Uses 1 - Unlocked		
D5 Walker - other > describe >>>			B5 Alpine boots		
D6 Crutches - Uses 2			B6 Ace bandages		
D7 Crutches - Uses 1			B7 High tops		
D8 Canes- Quad - Uses 2			B8 Other braces / bracing methods > describe >		
D9 Canes- Quad - Uses 1			B9 No braces		
D10 No devices					
Assistance		**Comments**	**Patient reported comfort level**		**Comments**
A1 Max assist x 2 people*			C1 Very comfortable		
A2 Min/Mod assist x 2 people*			C2 Slightly comfortable		
A3 Min/Mod assist x 1 person‡			C3 Neither comfortable nor uncomfortable		
A4 No assistance			C4 Slightly uncomfortable		
Patient safety comments					

*Applies only to WISCI II levels 1 and 2; ‡Applies to WISCI II levels 3,4,6,7,8,10,11,14,17

WISCI Levels

Level	Devices	Braces	Assistance	Distance
0				Unable
1	Parallel bars	Braces	2 persons	Less than 10 meters
2	Parallel bars	Braces	2 persons	10 meters
3	Parallel bars	Braces	1 person	10 meters
4	Parallel bars	No braces	1 person	10 meters
5	Parallel bars	Braces	No assistance	10 meters
6	Walker	Braces	1 person	10 meters
7	Two crutches	Braces	1 person	10 meters
8	Walker	No braces	1 person	10 meters
9	Walker	Braces	No assistance	10 meters
10	One cane/crutch	Braces	1 person	10 meters
11	Two crutches	No braces	1 person	10 meters
12	Two crutches	Braces	No assistance	10 meters
13	Walker	No braces	No assistance	10 meters
14	One cane/crutch	No braces	1 person	10 meters
15	One cane/crutch	Braces	No assistance	10 meters
16	Two crutches	No braces	No assistance	10 meters
17	No devices	No braces	1 person	10 meters
18	No devices	Braces	No assistance	10 meters
19	One cane/crutch	No braces	No assistance	10 meters
20	No devices	No braces	No assistance	10 meters

Baseline/Self-Selected Level assigned_____
Maximum WISCI Level assigned _____

Capabilities of Upper Extremities Instrument (CUE)

Assessment Overview

Assessment Area

ICF Domain:
Activity
Subcategory:
Mobility

You Will Need

Length:
32 item – around 30 minutes

Scoring:
7-point scale (1 = "Totally limited, can't do at all", 7 = "Not at all limited". Sum of item scores range from 32 to 224 (higher scores reflecting better function). Left and right arm/hand function can be derived separately. Percent of normal function score calculated using: (total score – 32) / 192 * 100%.

Summary

The Capabilities of Upper Extremity Instrument (CUE) measures functional limitation and assesses the amount of difficulty experienced in performing specific actions with one or both arms and hands in people with tetraplegia.

Questions focus on someone's ability to reach or lift; pull and push with their arms; move and position their arm and wrist; use their hand and fingers; and press with the tip of the index finger.

Availability

Available for free here:
http://www.scireproject.com/sites/default/files/worksheet_capabilities_of_upper_extremity_questionnaire_cue.docx

Languages: English

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

SEM = 12.2

(Marino et al. 1998; n=154)

Typical Values

Mean CUE score: 78.8 (SD: 29, range: 4-124, median = 78)

(Kalsi-Ryan et al. 2012; n=72, chronic tetraplegia)

Measurement Properties

Validity – **High**

High Spearman's ρ correlation with GRASSP subtests (All P<.0001):
Sensation total $_{(R+L)}$: ρ = 0.77
Strength total $_{(R+L)}$: ρ = 0.76
Prehension performance total $_{(R+L)}$: ρ = 0.83

(Kalsi-Ryan et al. 2012; n=72, chronic tetraplegia)

High correlation with ASIA Upper Extremity Motor Score:
r = 0.782

(P<.05; Marino et al. 1998; n=154)

High correlation with Functional Independence Measure:
r = 0.738

(P<.05; Marino et al. 1998; n=154)

Number of studies reporting validity data: 3

Reliability – **High**

High **Internal consistency:**
α = 0.96

(Marino et al. 2012, N=30, 30 males, Mean age: 44.8 years, 10 incomplete, 20 complete injury)

Number of studies reporting reliability data: 1

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data:
Not established in SCI

Capabilities of Upper Extremity Questionnaire

Adapted from Marino RJ, Shea JA and Stineman MG. The capabilities of upper extremity instrument: reliability and validity of a measure of functional limitation in tetraplegia, Arch Phys Med Rehabil, 79 (12): 1512-21, 1998; Appendix. Used with permission from Elsevier Publishing.

Scoring:

Item by item results of the test are straightforward to interpret. Total scores range from 32 to 224 with higher scores reflecting better function. Left and right arm/hand function can be derived separately. A percent of normal function score is also possible using the following algorithm ((total score – 32) / 192 * 100%. Read the following instructions to the patient and be sure he/she understands the responses before proceeding to the questions.

"*This questionnaire is designed to find out how well you are able to use your arms and hands. I will ask you about a number of actions which some people with spinal cord injury have limitations performing. Please consider whether, on an average day, you have difficulties or limitations performing these actions. By this I mean difficulty doing the action, or trouble doing it as often as you would like or need in order to complete everyday activities. Consider only the specific part of your arm or hand asked about in each question. For example, if asked about pulling something with your arm, do not worry about whether or not you can grab it with your hand.*

Pick one of the following responses to indicate how much, if any, limitation you have:"

7. not at all limited
6. a little limited
5. some limitation
4. moderately limited
3. very limited
2. extremely limited
1. totally limited, can't do it at all

Capabilities of Upper Extremity (CUE) Worksheet:

Patient name: _____ Date: _____

The following questions are about your ability to reach or lift:

- Think about reaching out with your arm to touch something directly in front of you that is at shoulder level:
  How limited are you doing this using your RIGHT ARM? _____
  How limited are you doing this using your LEFT ARM? _____

- Think about raising your arm directly over your head, with your arm straight:

a. How limited are you doing motion using your RIGHT ARM? _____

b. How limited are you doing motion using your LEFT ARM? _____

- Think about reaching down to touch the floor and sitting back up straight, without hooking with your other arm or using it to pull yourself up:
  How limited are you doing this with your RIGHT HAND? _____
  How limited are you doing this with your LEFT HAND? _____

- Think about raising a 5-pound object like a heavy blanket over your head using both arms. (Don't worry about whether you could grab it with your hands, just if you could raise something that heavy over your head.):

How limited are you doing this using BOTH ARMS? _____

The following questions are about your ability to pull and push with your arms:

- Think about pulling or sliding (without grasping) a light object such as a can of soda, that is on a table, towards you:

  How limited are you doing this kind of thing using your RIGHT ARM? _____

  How limited are you doing this kind of thing using your LEFT ARM? _____

- Think about pulling or sliding (without grasping) a heavy object (up to 10 Ibs.), that is on a table, towards you:
  How limited are you doing this kind of thing using your RIGHT ARM? _____
  How limited are you doing this kind of thing using your LEFT ARM? _____

- Think about pushing a light object such as a can of soda on a table, away from you:
  How limited are you doing this kind of thing using your RIGHT ARM? _____
  How limited are you doing this kind of thing using your LEFT ARM? _____

- Think about pushing a heavy object (up to 10 Ibs.) on a table, away from you:
  How limited are you doing this kind of thing using your RIGHT ARM? _____
  How limited are you doing this kind of thing using your LEFT ARM? _____

- Think about pushing down with both arms into your chair enough to lift your buttocks (both sides) off the seat (do a push-up weight shift):
  How limited are you doing this? _____

The following questions are about moving and positioning your arm and wrist:

p With your hand on your lap palm down, think about curling your wrist upwards, keeping your arm on your lap:

a. How limited are you doing this motion using your RIGHT HAND? _____

b. How limited are you doing this motion using your LEFT HAND? _____

- Think about turning your hand over-from your palm facing up to facing the floor, keeping your elbow bent at your side (the arm motion someone would make when turning a doorknob or a dial):
  How limited are you doing this motion using your RIGHT ARM? _____
  How limited are you doing this motion using your LEFT ARM? _____

The following question are about using your hands and fingers:

12. Think about grasping and holding an object like a hammer with your hand:

a. How limited are you doing this kind of thing using your RIGHT HAND? _____
b. How limited are you doing this kind of thing using your LEFT HAND? _____

13. Think about picking up a small object such as a paper clip or the cap of a tube of toothpaste with the tips of your thumb and first two fingers:
a. How limited are you doing this kind of thing using your RIGHT HAND? _____

b. How limited are you doing this kind of thing using your LEFT HAND? _____

14. Think about pinching and holding an object between your thumb and the side of your index finger, such as holding a key:
a. How limited are you doing this kind of thing using your RIGHT HAND? _____
b. How limited are you doing this kind of thing using your LEFT HAND? _____

15. Think about grasping a large object like the lid of a 2 pound jar of mayonnaise with the tips of the fingers hard enough to pick the jar up or open the lid:
a. How limited are you doing this kind of thing using your RIGHT HAND? _____
b. How limited are you doing this kind of thing using your LEFT HAND? _____

16. Think about using your fingers to manipulate objects, such as holding a coin and turning it over and over with your fingers:
a. How limited are you doing this kind of thing using your RIGHT HAND? _____
b. How limited are you doing this kind of thing using your LEFT HAND? _____

17. Think about pressing something with the tip of your index finger (not knuckle) such as dialing a touch-tone phone or ringing a doorbell:
a. How limited are you doing this kind of thing using your RIGHT HAND? _____
b. How limited are you doing this kind of thing using your LEFT HAND? _____

Total Score: _____

Graded Redefined Assessment of Strength, Sensibility and Prehension (GRASSP)

Assessment Overview

Assessment Area

ICF Domain:
Body Function & Structures
Subcategory:
Neuromusculoskeletal & Movement-Related Functions & Structures
Subscales (domains):
Sensation
Strength
Prehension

You Will Need

Length:
Sensation: 3 dorsal locations and 3 palmar locations for each hand
Strength: 10 arm and hand muscles for each arm
Prehension: 3 grasping tasks; 6 prehension tasks for each arm
Equipment:
GRASSP kit and manual muscle test equipment
Scoring:
Scores for tasks in each section are summed for each subscale score. There is no total score.
Training:
Reading the GRASSP manual is recommended.

Summary

The Graded Redefined Assessment of Strength, Sensibility and Prehension (GRASSP) is a clinical impairment measure that incorporates three domains vital to upper limb function: sensation, strength, and prehension. It is a multimodal test comprising 5 subtests for each upper limb: dorsal sensation, palmar sensation, strength, prehension ability and prehension performance. The GRASSP results in 5 numerical scores that provide a comprehensive profile of upper-limb function.

Availability

Available for purchase here: http://www.grassptest.com

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Standard Error of Measurement:
Strength: Right=1.8, Left=1.9
Sensation: No data available
Prehension ability: R=0.6, L=0.6

Typical Values

Mean (SD) Scores:
Strength: Right=24.3 (13), Left=25.1 (13.5)
Dorsal Sensation: R=6.5 (3.2), L=6.7 (3.1)

	Prehension performance: R=2.5, L=1.8 **Minimal Detectable Change:** Strength: Right=5.1, Left=5.3 Sensation: No data available Prehension ability: R=1.8, L=1.7 Prehension performance: R=7.0, L=4.9 (Kalsi-Ryan et al. 2012; n=72, chronic traumatic tetraplegia, mean time since injury (SD)=7.6 (6.1) years)	Palmar Sensation: R=7.1 (3.6), L=7.2 (3.3) Prehension ability: R=4.9 (4.5), L=5.1 (4.3) Prehension performance: R=15.6 (9.6), L=14.7 (8.9) (Kalsi-Ryan et al. 2012; n=72, chronic traumatic tetraplegia, mean time since injury (SD)=7.6 (6.1) years)

Measurement Properties

Validity – Moderate to High

Moderate **to** ***High*** **correlation between the GRASSP subtests, SCIM-self care, & ASIA UEMS:**
At 1 month post-injury:
Strength & SCIM-self-care: r = 0.78
Strength & ASIA UEMS: r = 0.95
Sensation & SCIM-self-care: r = 0.63
Prehension performance & SCIM-self-care: r = 0.85

At 12 month post-injury:
Strength & SCIM-self-care: r = 0.82
Strength & ASIA UEMS: r = 0.88
Sensation & SCIM-self-care: r = 0.56
Prehension performance & SCIM-self-care: r = 0.82

Moderate **to** ***High*** **predictive validity:**
ROC analysis AUC: r = 0.71-0.86

(Velstra et al. 2015; n=74, 51 males, acute tetraplegia, 16-40 days post-injury)

Moderate **to** ***High*** **correlation between GRASSP and CUE-Q:**
r=0.40-0.84

Moderate **to** ***High*** **correlation between GRASSP and SCIM/SCIM-SC:**
SCIM: r=0.37-0.70
SCIM-SC: r=0.40-0.84

(Mulcahey et al. 2017; n=47, AIS: 14A, 4B, 10C, 8D, 11 Unknown)

Number of studies reporting validity data: 8

Reliability – High

High **Test-retest Reliability for all domains of the GRASSP:**
ICC = 0.86-0.99

(Kalsi-Ryan et al. 2012; n=45, chronic traumatic tetraplegia)

(Mulcahey et al. 2017; n=47, AIS: 14A, 4B, 10C, 8D, 11 Unknown)

High **Inter-rater Reliability for all domains of the GRASSP:**
ICC = 0.84-0.96

(Kalsi-Ryan et al. 2012; n=72, chronic traumatic tetraplegia, mean time since injury (SD)=7.6 (6.1) years)

Number of studies reporting reliability data: 3

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Between 1-12 months post-injury:
Strength: 1.48
Sensation: 0.64
Prehension ability: 0.99
Prehension performance: 1.03

(Velstra et al. 2015; n=74, 51 males, acute tetraplegia, 16-40 days post-injury)

Number of studies reporting responsiveness data: 2

Graded Redefined Assessment of Strength, Sensibility and Prehension (GRASSP)

- clinical impairment measure that incorporates three domains vital to upper limb function: sensation, strength, and prehension.
- multimodal test comprising 5 subtests for each upper limb: dorsal sensation, palmar sensation, strength, prehension ability and prehension performance.
- results in 5 numerical scores that provide a comprehensive profile of upper--- limb function.

ICF Domain:

Body Function and Structures – Neuromusculoskeletal and Movement---Related Functions & Structures

Number of Items:

Sensation: 3 dorsal locations and 3 palmar locations for each

hand Strength: 10 arm and hand muscles for each arm

Prehension: 3 grasping tasks; 6 prehension tasks for each arm

Instructions for Administration and Scoring:

Administration:

- Sensation: Key test locations (palmar and dorsal) that represent significant anatomical levels of sensory innervation and functionally important areas of the hand are tested using the Semmes Weinstein monofilament (SMW) mini-kit.
- Strength: traditional motor grading (Daniels and Worthington 1995) is performed for 10 muscles with strong representation at each anatomical neurological level; each muscle is tested with resistance through its full range and graded from 0-5.
- Prehension – divided into ability vs. performance; included to represent the influence of sensation and strength on goal---oriented upper limb tasks
  - Ability test: involves 3 types of grasp tasks to ensure that the presence or absence of movement of the hand during the early stages post-injury is not missed. Graded by an assessor (0-4) using specific components of grasp acquisition outlined in the GRASSP manual.
  - Performance test: assesses movement within a functional paradigm and evaluates how the movement is performed. Tasks are scored 0-5.

Equipment:

- GRASSP kit (contains SMW mini-kit and standardized equipment ex. wooden blocks)
- manual muscle test equipment

Scoring:

- Scores for tasks in each section (sensation---dorsal, sensation---palmar, strength, prehension---ability, prehension---performance) are summed for each subscale score.
  - Dorsal sensation subscale score ranges from 0-12 (3 locations for dorsal side of each hand, scored from 0-4)
  - Palmar sensation subscale score ranges from 0-12 (3 locations for palmar side of each hand, scored from 0-4)
  - Strength subscale score ranges from 0---50 (10 muscles graded 0-5) o Prehension ability subscale score ranges from 0-12 (3 grasps graded 0-4)
  - Prehension performance subscale score ranges from 0-30 (6 grasps graded 0-5)
- A total score is not calculated.

Interpretability:

SEM and **MDC:**

SEM and MDC for GRASSP items for right and left hand (calculated from data in Kalsi-Ryan et al. 2012):

GRASSP items:	SEM		MDC	
	R	L	R	L
Strength (0---50)	1.8	1.9	5.1	5.3
Dorsal sensation (0---12)	----	----	----	----
Palmar sensation (0---12)	----	----	----	----
Prehension ability (0---12)	0.6	0.6	1.8	1.7
Prehension performance (0---30)	2.5	1.8	7.0	4.9

MCID: not established

No cut-points or normative data have been established for the SCI population; however, published data is available (see the Study Details sheet of this tool).

Languages:

N/A

Training Required:

Reading the GRASSP manual is recommended.

Availability:

Purchase link is found here: http://www.sci---grassp.org/Purchase.html.

The GRASSP Version 1.0 Kit retails for $850.00 CDN.

Clinical Considerations:

- Authors recommend that a partial GRASSP (sensibility, strength, tone and qualitative prehension) be administered prior to 3-4 weeks post-injury as it

is unlikely that the patient will tolerate enough sitting (45 min) for the quantitative grasp portion of the test.

Measurement Property Summary:

# of studies reporting psychometric properties: 3

Reliability:

- Both inter-rater reliability and test-retest reliability are **excellent** and significant for all GRASSP subtests:

GRASSP Subtest:	Inter---rater reliability		Test---retest reliability	
	ICC	CI	ICC	CI
Sensation right	0.84	0.75---0.89	0.95	0.91---0.97
Sensation left	0.91	0.86---0.94	0.86	0.76---0.92
Strength right	0.95	0.93---0.97	0.98	0.98---0.99
Strength left	0.95	0.92---0.97	0.98	0.96---0.98
Prehension ability right	0.95	0.92---0.97	0.98	0.96---0.99
Prehension ability left	0.95	0.92---0.97	0.98	0.97---0.99
Prehension performance right	0.95	0.92---0.97	0.93	0.88---0.96
Prehension performance left	0.96	0.93---0.97	0.96	0.93---0.98

[Kalsi-Ryan et al. 2009, Kalsi-Ryan et al. 2012]

Validity:

- Correlation of the GRASSP subtest Sensation Total (R & L) is **adequate** with the Spinal Cord Independence Measure (SCIM) (0.57), and **excellent** with both the SCIM-self-care subscale (0.74) and the Capabilities of Upper Extremity (CUE) (0.77).
- Correlation of the GRASSP subtest Strength Total (R & L) is **adequate** with the SCIM (0.59), and **excellent** with both the SCIM-self-care subscale (0.74) and the CUE (0.76).
- Correlation of the GRASSP subtest Strength Total (R & L) is **excellent** with the SCIM (0.68), the SCIM-self-care subscale (0.79) and the CUE (0.83).

[Kalsi-Ryan et al. 2009, Kalsi-Ryan et al. 2012, Kalsi-Ryan et al. 2013]

Responsiveness:

No values were reported for the responsiveness of the GRASSP for the SCI population.

Floor/Ceiling effect:

No values were reported for the presence of floor/ceiling effects in the GRASSP for the SCI population.

Reviewer:

Christie Chan

Date Last Updated:

July 8, 2013

Hand-Held Myometer

Assessment Overview

Assessment Area

ICF Domain:
Body Function & Structures
Subcategory:
Neuromusculoskeletal and Movement-Related Functions & Structures

You Will Need

Length:
30 minutes
Equipment:
A myometer
Scoring:
The recommended unit of measurement is kg in order avoid interpretation issues. Measurements are generally rounded to the nearest kg.
Training:
No formal training required, but examiners should be familiar with the techniques, appropriate body positioning for patient and tester, and proper administration.

Summary

The Hand-Held Myometer is a portable device used as a quantitative method of measuring muscle contraction (primarily for upper limb). Testing is performed using one of two techniques, 1) make or 2) break.
The 'make' technique requires the examiner to resist a maximal voluntary contraction by the patient, thereby producing an isometric contraction.
In the 'break' technique, the examiner applies adequate force to overcome the patient, thereby producing an eccentric contraction.

Availability

http://www.scireproject.com/wp-content/uploads/worksheet_hand-held_myometer.docx

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Standard Error of Measurement (lbs) – Tester 1, Tester 2:
Left biceps = 5.05, 1.84
Right biceps = 2.94, 2.96
Left triceps = 2.91, 2.17
Right triceps = 3.26, 2.44
Left wrist extensors = 2.71, 1.73
Right wrist extensors= 2.94, 0.26
Minimal Detectable Change (lbs) – Tester 1, Tester 2:
Left biceps = 14.01, 5.10
Right biceps = 8.15, 8.21
Left triceps = 8.08, 6.01

Typical Values

Mean (SD) Scores (lbs) – Tester 1, Tester 2:
Left biceps = 46.79 (11.91), 37.92 (8.23)
Right biceps = 46.20 (14.70), 34.97 (9.37)
Left triceps = 26.28 (11.90), 26.33 (12.51)
Right triceps = 30.74 (9.41, 27.21 (14.09)
Left wrist extensors = 23.80 (13.55), 23.26 (10.00)
Right wrist extensors= 31.39 (11.99), 23.05 (10.52)

	Right triceps = 9.04, 6.76 Left wrist extensors = 7.51, 4.80 Right wrist extensors= 8.14, 0.73 (Aufsesser et al. 2003; n=25, chronic SCI, mean time since injury (SD)=13 (10), mixed injury types, 2 testers)	(Aufsesser et al. 2003; n=25, chronic SCI, mean time since injury (SD)=13 (10), mixed injury types, 2 testers)

Measurement Properties

Validity – Low to High

Low **to** ***High*** **correlation with Manual Muscle Testing:**

Paraplegics = 0.26-0.67

(Noreau & Vachon 1998; n=38, 31 males, mixed injury type, mean time since injury (SD) at admission=1.6 (0.7) months, mean time since injury (SD) at discharge=2.1(2.1) months)

Tetraplegics = 0.59-0.94

(Schwartz et al. 1992; n=122, all male, quadriplegia, over 6 time points b/w 72 hours and 12 months post-injury)

Moderate **to** ***High*** **correlation with Isokinetic Dynamometry:**

Paraplegics = 0.70-0.90

Tetraplegics = 0.57-0.96

(Noreau & Vachon 1998; n=38, 31 males, mixed injury type, mean time since injury (SD) at admission=1.6 (0.7) months, mean time since injury (SD) at discharge=2.1(2.1) months)

Number of studies reporting validity data: 5

Reliability – High

High **Inter-rater Reliability:**

Make Technique: ICC = 0.94-0.97

Break Technique: ICC = 0.94-0.95

High **Intra-rater Reliability:**

Make Technique: ICC = 0.91-0.94

Break Technique: ICC = 0.93-0.94

(Burns et al. 2005; n=19, 19 males, mixed injury types, inpatient, 3 < 6 months post-injury, 16 >1 year post-injury, 2 testers)

Number of studies reporting reliability data: 7

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Hand-held Myometer worksheet:

Patient name: _____ Date: _____

Muscle tested: _____ Technique (circle one): Make / Break

Myometer measurement (kg): _____

Muscle tested: _____ Technique (circle one): Make / Break

Myometer measurement (kg): _____

Muscle tested: _____ Technique (circle one): Make / Break

Myometer measurement (kg): _____

Muscle tested: _____ Technique (circle one): Make / Break
Myometer measurement (kg): _____

Jebsen Hand Function Test (JHFT)

Assessment Overview

Assessment Area

ICF Domain:
Activity
Subcategory:
Mobility

You Will Need

Length:
15-45 minutes to complete 7 items
Scoring:
Total score is the sum of time taken for each subtest, which are rounded to the nearest second. Shorter times indicate better performance
Equipment:
-Stopwatch
-Chair (18" seat height)
-Desk/table (30" high)
-4 sheets of unruled white paper
-Clipboard
-Sentences typed in upper case centered on a 5x8" index card on a bookstand
-5 index cards (ruled on one side only)
-Empty 1 pound coffee can
-2 paper clips
-2 regular sized bottle caps
-2 U.S. pennies
-5 kidney beans (~5/8" long)
-1 regular teaspoon
-Wooden board (41 ½" long, 11 ¼" wide, ¾" thick)
-"C" clamp
-Plywood (20" long, 2" wide, ½" thick) glued to the board
-4 standard size (1 ¼" diameter) red wooden checkers
-5 No. 303 cans

Summary

The Jebsen Hand Function Test (JHFT/JTT) was developed to provide a standardized and objective evaluation of fine and gross motor hand function using simulated activities of daily living. The JHFT is one of the oldest standardized tests of hand function and used individuals with SCI during its initial development.

Items to be performed on both the dominant and non-dominant hand. The JHFT only assesses the speed and not the quality of performance (slow times reflect a less desirable performance). It is a clinician-administered; performance-based measure

Weighted and non-weighted hand function is assessed through: writing; turning over 3 by 5 inch cards; picking up small common objects; simulated feeding; stacking checkers; picking up large objects; and picking up large heavy objects. Time to complete each task is recorded. Patients are required to perform all of the subtests with both the right and left hands, with the non-dominant hand tested first.

Caution
The JHFT is not recommended for individuals with C5 tetraplegia with hand neuroprosthesis outcomes
May not assess function of intrinsic hand muscles and allows participants to complete tasks by compensating with trunk and shoulder movements.

Availability

An assessment form can be found here:
http://www.scireproject.com/wp-content/uploads/worksheet_jebsen.docx
https://www.scireproject.com/outcome-measures-new/jebsen-hand-function-test-jhft#
A test kit is sold commercially through multiple vendors, which usually includes instructions, all items needed to perform seven subtests, a carrying bag, and pad of 50 blank record forms. Cost is generally in the $300+ range.
Languages: English and Portuguese.

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Normative (dominant, non-dominant; ±SD) Values:

For women:	**For men:**
Writing:	**Writing:**
11.7±2.1, 30.2±8.6*	12.2±3.5,
15.7±4.7,	32.3±11.8*
38.9±14.9**	19.5±7.5,
Card turning:	48.2±19.1**
4.3±1.4, 4.8±1.1*	**Card turning:**
4.9±1.2, 5.5±1.1**	4.0±0.9, 4.5±0.9*
Small objects:	5.3±1.6, 6.1±2.2**
5.5±0.8, 6.0±1.0*	**Small objects:**
6.6±1.3, 6.6±0.8**	5.9±1.0, 6.2±0.9*
Simulated feeding:	6.8±1.2, 7.9±1.9**
6.7±1.1, 8.0±1.6*	**Simulated feeding:**
6.8±1.1, 8.7±2.0**	6.4±0.9, 7.9±1.3*
Checkers:	6.9±0.9, 8.6±1.5**
3.3±0.6, 3.8±0.7*	**Checkers:**
3.6±0.6, 4.4±1.0**	3.3±0.7, 3.8±0.6*
Large, light objects:	3.8±0.7, 4.6±1.0**
3.1±0.5, 3.3±0.6*	**Large, light objects:**
3.5±0.6, 3.4±0.6**	3.0±0.4, 3.2±0.6*
Large, heavy objects:	3.6±0.7, 3.9±0.7**
3.2±0.5, 3.3±0.5*	**Large, heavy objects:**
3.5±0.6, 3.7±0.7**	3.0±0.5, 3.1±0.4*

		3.5±0.7, 3.8±0.7** *20-59 years old (n=120) **60-94 years old (n=30) (Jebsen et al 1969; n = 360; age 20-94 years)

Measurement Properties

Validity – Moderate to High

Moderate **to** ***High*** **correlation with Klein-Bell ADL Scale (K-B Scale):**
K-B Scale – dressing subscale = -0.69
K-B Scale – bathing/hygiene subscale = -0.57
K-B Scale – eating subscale = -0.45)
K-B Scale – overall = -0.635

(Lynch & Bridle 1989; n=18, mixed injury types, chronic SCI)

Number of studies reporting validity data: 1

Reliability – Moderate to High

Moderate **to** ***High*** **Test-retest reliability:**
Correlation for items = 0.60-0.99

(Jebsen et al. 1969, n=26, mixed conditions, mean (SD) age = 34.5 (20) years)

Number of studies reporting reliability data: 2

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Jebsen Hand Function Test

Adapted from Jebsen RH et al. An Objective and Standardized Test of Hand Function, Arch Phys Med Rehabil, 50 (6): 311-318, 1969; Methods. Used with permission from Elsevier Publishing.

The Jebsen Hand Function Test was designed to provide a short, objective test of hand function for activities of daily living. It has 7 items and takes approximately 15-45 minutes to administer.

7 items include: writing, turning over 3-by-5 inch cards, picking up small common objects, simulated feeding, stacking checkers, picking up large light objects and picking up large heavy objects. The results are measured by timing the time taken to accomplish each task. The tests are always presented in the same order and are performed with the non-dominant hand first.

For a video of the Jebsen Hand function test being performed by 2 lab students, click here:
Items 1-3: http://www.youtube.com/watch?v=k4Am5NVVcK8
Items 4-7: http://www.youtube.com/watch?v=qFWQXcnljgo&feature=relmfu

Item 1: Writing

The examiner has a small index card with the blank side facing the subject propped up so the subject can easily read it. The index card has a sentence of third-grade reading difficulty with 24 letters.
The subject is seated and given a pen and several sheets of white paper attached to a clipboard. The subject is instructed to begin copying the sentence from the index card onto the sheet when the examiner flips the index card and says "go".
Record the time taken from "go" until the subject lifts their pen off the page after finishing the sentence.
Repeat with the dominant hand using a new sentence.

Verbal Instructions:

"Do you require glasses for reading? If so, put them on. Take this pen in your left hand and arrange everything so that it is comfortable for you to write with your left hand. On the other side of this card (indicate) is a sentence. When I turn the card over and say 'Go', write the sentence as quickly and as clearly as you can using your left hand. Write, do not print. Do you understand? Ready? Go."
For the dominant hand – "All right, now repeat the same thing, only this time using your right hand. I've given you a different sentence. Are you ready? Go."

Item 2: Card Turning

Place 5 index cards (3x5 in) in a horizontal row 2 in apart on a desk in front of the subject. Each card should be placed 5 inches from the front edge of the desk (indicate this with tape).

Record the time from “go” until the subject turns the last card over. The cards do not have to be in the same placement after turning.
Repeat with the dominant hand.
Verbal Instructions:

“Place your left hand on the table please. When I say “go”. Use your left hand to turn these cards over one at a time as quickly as you can, beginning with this one (indicate card to extreme right). You may turn them over in any way that you wish and they need not be in a neat pattern when you finish. Do you understand? Ready? Go.”

For the dominant hand – “Now the same thing with the right hand beginning with this one (indicate extreme left card). Ready? Go.”

Item 3: Small Common Objects

Place an empty 1-pound coffee can in front of the subject, 5 inches from the front edge of the desk. Next, place 2 United States pennies (closest to coffee can), 2 bottle caps with the inside facing up and 2 one-inch paper clips (farthest from coffee can) to the left, each of these items should be separated by 2 inches.
Record the time from “go” until the last item is placed inside the coffee can.

Repeat with the dominant hand – with the layout as a mirror image of the non-dominant setup.
Verbal instructions:

“Place your left hand on the table please. When I say “go”, use your left hand to pick up these objects one at a time and place them in the can as fast as you can beginning with this one (indicate paper clip on the extreme left). Do you understand? Ready? Go.”

For the dominant hand – “Now the same thing with the right hand beginning here (indicate paper clip now on the extreme right). Ready? Go.”

Item 4: Simulated feeding

Place 5 kidney beans and an empty coffee can on a board clamped to the desk in front of the subject, 5 inches from the front edge of the desk. The beans should be oriented to the left of center, parallel to and touching the upright of the board 2 inches apart, the coffee can should be in the center. Give the subject a teaspoon. Record the time from the word “go” until the last bean hits the bottom of the coffee can.

Repeat with the dominant hand – placing the beans on the right side of the can if right hand, left side of the can if left hand.
Verbal instructions:

"Take the teaspoon in your left hand please. When I say "go", use your left hand to pick up these beans one at a time with the teaspoon and place them in this can as fast as you can beginning with this one (indicate bean on the extreme left). Do you understand? Ready? Go."

For the dominant hand – "now the same thing with the right hand beginning here (indicate bean on extreme right). Ready? Go."

Item 5: Checkers

Place 4 standard sized (1.25 inch diameter) wooden checkers in front of a board clamped to the desk in front of the subject, 5 inches from the front edge of the desk. The checkers should be placed 4 in a row, 2 on each side of the center. Record the time from the word "go" until the fourth checker makes contact with the third checker (subject is stacking the checkers one on top of another).

Repeat with the dominant hand.

Verbal instructions:

"Place your left hand on the table please. When I say "go", use your left hand to stack these checkers on the board in front of you as fast as you can like this, one on top of the other (demonstrate). You may begin with any checker. Do you understand? Ready? Go."

For the dominant hand – "Now the same thing with the right hand. Ready? Go."

Item 6: Large Light Object

Place 5 empty cans in front of a board clamped to the desk, 5 inches from the front edge of the desk, in front of the subject. Space the cans 2 inches apart with the open end of the can facing down. The subject is to place each can onto the board in front of the cans. Record the time from the word "go" until the subject releases the fifth can.

Repeat with the dominant hand.

Verbal instructions:

"Place your left hand on the table please. When I say 'Go', use your left hand to stand these cans on the board in front of you like this (demonstrate). Begin with this one (indicate can on extreme left). Do you understand? Ready? Go."

Dominant hand – "Now the same thing with the right hand beginning here (indicate extreme right can). Ready? Go."

Item 7: Large Heavy Objects

Place 5 full (1 pound) cans in front of a board clamped to the desk in front of the subject, 5 inches from the front edge of the desk. Space the cans 2 inches apart with the open end of the can facing down. The subject is to place each can onto the board

]

in front of the cans. Record the time from the word “go” until the subject releases the fifth can.
Repeat with the dominant hand.
Verbal instructions:

“Now do the same thing with these heavier cans. Place your left hand on the table. When I say “Go”, use your left hand to stand these cans on the board as fast as you can. Begin here (indicate can on extreme left). Do you understand? Ready? Go.”

For the dominant hand – “Now the same thing with your right hand beginning here (indicate can on far right). Ready? Go.”

Jebsen Hand Function Test Worksheet:

Patient Name: _____ Date: _____

The tests are performed with the non-dominant hand first.

The results are measured by timing the time taken to accomplish each task.

Writing: _____ seconds

Card turning: _____ seconds

Small common object: _____ seconds

Simulated feeding: _____ seconds

Checkers: _____ seconds

Large light object: _____ seconds

Large heavy object: _____ seconds

Sollerman Hand Function Test (SHFT)

Assessment Overview

Assessment Area

ICF Domain:
Activity
Subcategory:
Mobility

You Will Need

Length:
20-25 minutes, 20 items
Equipment:
A variety of tools used for ADLs are required.
Scoring:
Patients are scored on a 5-point scale from 0 (task cannot be performed at all) to 4 (task is completed without any difficulty within the time frame (20 seconds).
The subtest scores are added up for a total sum score (0-80).
Training:
None, but knowledge of hand function recommended

Summary

The Sollerman Hand Function Test (SHFT) is a performance-based measure developed for tetraplegic individuals that assesses grips that are needed for certain activities of daily living (ADLs) using tests that represent common handgrips and activities. The SHFT (unlike the Jebsen Hand Function Test) considers the quality and level of difficulty with the performance, which are important components with respect to hand function.

Availability

Available for free here:
http://www.agedcaretests.com/Sollermann_Hand_Function_Test_(SHFT)_SAMPLE.pdf
Languages: English

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Mean (SD) Scores:
70.94 (38.28)

(Fattal 2004; N=52, 41 male, complete tetraplegia, mean time since injury = 11.54 years)

Measurement Properties

Validity – **High**

High **correlation with Motor Capacities Scale (MCS):**
ρ = 0.959

(Fattal 2004; N=52, 41 male, complete tetraplegia, mean time since injury = 11.54 years)

Number of studies reporting validity data: 2

Reliability – **High**

High **Inter-rater Reliability:**
r = 0.98

(Sollerman & Ejeskär 1995; n=59, tetraplegia, no information on chronicity, 2 testers)

Number of studies reporting reliability data: 1

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Sollerman Hand Function Test

- Designed to measure grips that are needed for certain ADLs such as eating, driving, personal hygiene, and writing.
- Includes subtests that represent common handgrips (volar, transverse volar, spherical volar and pinch positions --- pulp, lateral, tripod, and the five finger) and activities (using a key; picking up coins from a flat surface; writing with a pen; using a phone; and pouring water from a jug).

ICF Domain:

Activity – Subcategory: Mobility.

Number of Items:

20

Instructions for Administration and Scoring:

Administration:

- Clinician-administered standardized performance test.
- A test box is placed in front of the patients who are required to start each subtask in a seated position (but they may stand to complete a task). Three subtasks are completed using the hands bilaterally while the rest are completed with each hand separately. The subtests are timed and the performance is observed.

  Ex. Pick up key, put into Yale---lock and turn 90^0.
- Administration time is usually **20-25 minutes**.

Equipment:

- Yale-lock with bolts mounted on a vertical wall 30 cm above bottom level.
- Yale-key
- 4 coins of different size
- Two purses mounted on a wall (20 cm above bottom level) w/ zips of different size
- 2 wooden blocks (size 7.5 and 10 cm)
- Box (5cm edges)
- Iron weight (3 kg)
- 2 screws with nuts (1 with spring resistance, the other without resistance)
- Screwdriver with handle (2.5 cm diameter)
- 4 bolts of different size
- 4 nuts
- 2 jars (lid size 7.5 and 10cm diameter)
- 4 buttons with different button---hole sizes on pieces of cloth mounted on a plate.
- Plate

- Knife
- Fork
- Lump of Play-Doh
- 2 Tubi-Grip stockings of different sizes
- Paper
- Pen
- Paper (A4 size)
- Envelope (C6 size)
- 2 paper clips of different size
- telephone
- empty water jug (1 litre) with handle

Scoring:

- Scoring takes into account the time taken, level of difficulty displayed, and the quality of performance using the correct pinch or grip position.
- Patients are then scored on a 5-point scale from 0 (task cannot be performed at all) to 4 (task is completed without any difficulty within the time frame (20 seconds) and with the prescribed hand-grip of normal quality).
- Scoring the test can be challenging as the assessor must be aware of multiple factors occurring simultaneously (passage of time, difficulty, correct positioning and quality of performance).
- Definitions for interpreting the scoring scheme are not inherently obvious.
- A total sum score (0-80) is created by adding up the scores from the different subtests.

Interpretability:

MCID: not established

SEM: not established for the SCI population, but for a sample of patients with burned hands (N=12 (21 hands), mean (SD) age: 45.1 (13.3) yrs, 7M/5F, mean (SD) time since injury: 13.3 (6.9) months):

SEM=2.6

Reference: Weng, L. Y., Hsieh, C. L., et al. (2010). "Excellent reliability of the Sollerman hand function test for patients with burned hands." J Burn Care Res 31(6): 904-910.

MDC: not established for the SCI population, but for a sample of patients with burned hands (N=12 (21 hands), mean (SD) age: 45.1 (13.3) yrs, 7M/5F, mean (SD) time since injury: 13.3 (6.9) months):

MDC =6.7-6.9

Reference: Weng, L. Y., Hsieh, C. L., et al. (2010). "Excellent reliability of the Sollerman hand function test for patients with burned hands." J Burn Care Res 31(6): 904-910.

- Higher scores reflect a better performance.
- Subjects with no hand function impairment typically score 80 with the dominant hand and 77-79 for the non-dominant hand.
- No meaningful cut points or norms have been established for the SCI population
- Published data for the SCI population is available for comparison (see Interpretability section of the Study Details sheet).

Languages:

N/A

Training Required:

It can be used by clinicians who have little experience, though knowledge of hand function is an asset when scoring.

Availability:

Can be found at:
http://www.swisswuff.ch/images/adl/adl---pdf/sollermann1995handfunctiontest.pdf

Clinical Considerations:

- The Sollerman (unlike the Jebsen Hand Function Test) considers the quality and level of difficulty with the performance which are important components with respect to hand function.
- The test was designed with tetraplegic patients in mind and therefore reflects the needs of this group.

Measurement Property Summary:

# of studies reporting psychometric properties: 2

Reliability:

- Inter-rater reliability is **excellent** (r=0.98).

[Sollerman & Ejeskar 1995, Fattal 2004]

Validity:

- Correlation of the Sollerman Hand Function test is **excellent** with:
  - the International Classification for Surgery of the Hand in Tetraplegia (Pearson's r=0.88)
  - the Motor Capacities Scale (Spearman's ρ=0.959). [Sollerman & Ejeskar 1995, Fattal 2004]

Responsiveness:

No values have been reported at this time for the responsiveness of the Sollerman hand Function Test.

Floor/ceiling effect:

No values were reported for the presence of floor/ceiling effects in the Sollerman Hand Function Test for the SCI population.

Reviewer:

Dr. William Miller, Christie Chan

Date Last Updated:

Feb 1, 2013

Wheelchair Skills Test (WST)

Assessment Overview

Assessment Area

ICF Domain:
Activity
Subcategory:
Mobility

You Will Need

Administration:
Approx. 30 min. for WST and 10 min. for WST-Q (Questionnaire version)
Number of tasks:
Manual: 33
Power: 25

Scoring

- Each skill is scored from 0-3 (Fail = 0; Pass with Difficulty or Assistance = 1; Pass = 2; Advanced Pass = 3)
- Some skills may be marked NP (Not Possible); they can be subtracted from the denominator to avoid affecting the Total Score
- The tester should also record any comments that are instructive (e.g., reasons for failures, left-right asymmetry).
- To get a percentage WST Capacity Score add up all scores, divide by number of possible skills (minus number of NP scores and number of TE scores) and multiply by 3 (and 100%).

Summary

The Wheelchair Skills Test (WST) is a performance-based measure designed to objectively evaluate manual wheelchair skills and safety. There are multiple versions of this measure for manual chairs, powered chairs, and scooters, for both wheelchair users and their caregivers. The WST may be administered by a tester/trainer that supervises and scores the test or in self-report/questionnaire form (WST-Q). It may be necessary to have a spotter in addition to the tester/trainer for supervision and safety.

The Wheelchair Skills Test assesses the level of wheelchair skills required for daily functioning. The WST can be used during the initial provision of the wheelchair and as necessary at follow-up. As of July 2019, the current version of all tests and forms is 5.0. The materials are continuously being updated for free so visit www.wheelchairskillsprogram.ca for the latest.

Availability

As of July 2019, the current version is 5.0 and a full instruction manual are available at:
www.wheelchairskillsprogram.ca

Languages: English, French

Equipment:

- Approximately 1000 square feet of space
- A standardized wheelchair circuit or access to a variety of natural barriers (e.g., ramps, curbs, potholes, etc.)

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Standard Error of Measurement:
5.0
Smallest Real Difference / Minimal Detectable Change:
6.2

(Rushton et al. 2016; N = 72, 19% SCI; 36 males; mean(SD) age 60.7 (7.3))

Typical Values

Mean (SD) total score:
All participants: 80.7±11.8
Tetraplegia: 72.1±7.9
High paraplegia: 82.8±9.1
Low paraplegia: 84.0±12.4
Threshold Values:
55.6% of participants (28.6% of tetraplegic participants) scored over 80% (empirical cut-off for distinguishing people with advanced MWC skills, mainly skills required to control wheelies)

(Lemay et al., 2011; N=54, 41 male; mixed injury types; 12+ months of manual WC use)

Measurement Properties

Validity – Moderate to High

Moderate **Correlation with Wheeled Distance per Day:**
r = 0.36

Moderate **Correlation with age:**
r = -0.32

(Lemay et al., 2011; N=54, 41 male; mixed injury types; 12+ months of manual WC use)

Moderate **Correlation with Measured Speeds:**
r = 0.57-0.75
(Absolute values of correlations; Pradon et al., 2012; N=40, 30 male; mixed injury types; mean (range) 79.8 (1-360) months in rehabilitation)

High **Correlation between WST and WST-Q:**
r = 0.65

(Rushton et al. 2016; N = 72, 19% SCI; 36 males; mean(SD) age 60.7 (7.3))

Predictive validity:
WST predicts CHART and SWLS scores
(Hosseini et al., 2012; N=214; mixed injury types; mean(SD) 11.7(11) years post SCI)

Number of studies reporting validity data: 8

Reliability – Moderate to High

Moderate **to** ***High*** **Test-retest Reliability:**

ICC = 0.84-0.94
(For measured speeds; Pradon et al., 2012; N=40, 30 male; mixed injury types; mean (range) 79.8 (1-360) months in rehabilitation)

α = 0.65
(Kirby et al., 2002; N=24, 3 SCI; 16 male; mixed diagnoses)

ICC = 0.91

(WST v.4.1 for manual wheelchair users; Lindquist et al., 2010; N=11, 9 SCI, 9 male; no info on SCI types)

Moderate **to** ***High*** **Inter-rater Reliability:**

ICC = 0.92-0.95
(For measured speeds; Pradon et al., 2012; N=40, 30 male; mixed injury types; mean (range) 79.8 (1-360) months in rehabilitation)

α = 0.95
(Kirby et al., 2002; N=24, 3 SCI; 16 male; mixed diagnoses)

ICC = 0.855

(WST v.4.1 for manual wheelchair users; Lindquist et al., 2010; N=11, 9 SCI, 9 male; no info on SCI types)

High **Intra-rater Reliability:**

α = 0.96
(Kirby et al., 2002; N=24, 3 SCI; 16 male; mixed diagnoses)

ICC = 0.950

(WST v.4.1 for manual wheelchair users; Lindquist et al., 2010; N=11, 9 SCI, 9 male; no info on SCI types)

High **Internal Consistency:**

α = 0.90

(Rushton et al. 2016; N = 72, 19% SCI; 36 males; mean(SD) age 60.7 (7.3))

High **Inter-rater Reliability for Spanish Version:**
ICC = 0.998

(Passuni et al. 2018; N=11, 10 male, mean (SD) age: 29.81 (12.18) years, 11 wheelchair users, 10 cannot walk)

Number of studies reporting reliability data: 6

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Self Care and Daily Living

Frenchay Activities Index (FAI)

Assessment Overview

Assessment Area

ICF Domain:

Activity

Subcategory:

Self-Care

You Will Need

Length:

13 items – less than 15 minutes

Scoring:

4 items (washing up, washing clothes, driving a car/bus travel, and gainful work) are scored on a 2-point scale; the remaining 9 items are scored on a 3-point scale.

Response categories are 0 = never, 1 = occasionally or more, and 2 = most days.

Summary

The Frenchay Activities Index assesses frequency of performing Instrumental Activities of Daily Living, including items that reflect the patient's behavior in areas of domestic chores, leisure/work and outdoor activities.

The raw scores of the 13-item FAI can be transformed to interval scores, thereby enabling clinicians and researchers to quantify and monitor IADL function in SCI patients.

Availability

Available for free here:

https://www.strokengine.ca/en/family/fai_family/

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Standard Error (SE) of the items:

1. Washing up	0.17
2. Preparing main meals	0.13
3. Washing clothes	0.17
4. Driving car/bus travel	0.17
5. Light housework	0.11
6. Heavy housework	0.12
7. Local shopping	0.11
8. Social occasions	0.13
9. Actively pursuing hobby	0.12
10. Gainful work	0.16
11. Travel outings/car rides	0.15
12. Gardening	0.15
13. Household/car maintenance	0.15

(Hsieh et al. 2007)

Typical Values

Not established in SCI

Measurement Properties

Validity – Low to Moderate

Low **to** ***Moderate*** **Correlation between R-FAI administered at 3, 6, and 12 months after injury and the 4 domains of the WHOQOL- BREF administered at 12 months after injury:**

WHOQOL-BREF 12 months post injury	FAI 3 months post injury	FAI 6 months post injury	FAI 12 months post injury
Physical	r = 0.39	r = 0.41	r = 0.50
Psychology	r = 0.38	r = 0.28	r = 0.37
Social relations	r = 0.20	r = 0.28	r = 0.35
Environment	r = 0.39	r = 0.31	r = 0.37

(Chern et al. 2013, N=2339 (1454 male), mean age: 45 (SD 18.5), traumatic limb injuries)

Not Ranked The Frenchay Activities Index was validated as a unidimensional construct through revision of the scale after Rasch analysis.

(Hsieh et al. 2007, N=233 (193 male), mean age: 41.1 (SD 12.6), 33 Complete, 57 Incomplete tetraplegia; 151 Complete, 48 Incomplete paraplegia)

Number of studies reporting validity data: 2

Reliability – High

High **Internal Consistency:**

b = >0.90

(Chern et al. 2013, N=2339 (1454 male), mean age: 45 (SD 18.5), traumatic limb injuries)

Not Ranked **Rasch analysis reliability coefficient:**

Rasch coefficient = 0.78

(Hsieh et al. 2007, N=233 (193 male), mean age: 41.1 (SD 12.6), 33 Complete, 57 Incomplete tetraplegia; 151 Complete, 48 Incomplete paraplegia)

Number of studies reporting reliability data: 2

Responsiveness

Floor/Ceiling Effect:

# months post injury	% Ceiling	% Floor
3	0.3	7.3
6	3.5	4.3
12	2.5	2.4

(Chern et al. 2013, N=2339 (1454 male), mean age: 45 (SD 18.5), traumatic limb injuries)

Effect Size:

# months post injury	Effect size
3	0.10
6	0.35
12	0.15

(Chern et al. 2013, N=2339 (1454 male), mean age: 45 (SD 18.5), traumatic limb injuries)

Number of studies reporting responsiveness data: (1)

(Chern et al. 2013, N=2339 (1454 male), mean age: 45 (SD 18.5), traumatic limb injuries)

7. months	Standardized Response Mean
post injury	0.20
3 6 12	0.52
	0.2

Spinal Cord Independence Measure III (SCIM-III)

Assessment Overview

Assessment Area

ICF Domain:
Activity
Subcategory:
Self-care
Subscales:
Self-care
Respiration & Sphincter Mgmt.
Mobility

You Will Need

Length:
30 minutes by observation or 10-15 minutes by interview; 17 items (Q2 and Q3 have 2 parts, so there are 19 questions to answer)
Scoring:
Items scores ranges from 0-2 to 0-15. Subscale scores and total scores are the sums of the respective items.

Summary

The Spinal Cord Independence Measure (SCIM) is a clinician-administered disability scale developed to specifically address the ability of SCI patients to perform basic activities of daily living independently. The SCIM assesses 3 areas: Self-Care, Respiration and Sphincter Management, and Mobility (including toileting). Clinicians score the SCIM based on their observations of patients' performance of a number of tasks. The SCIM is currently in its third version. It is quickly becoming one of the most frequently used research tools within the SCI population and has high clinical relevance for the rehabilitation for individuals with SCI. Ceiling and floor effects may be an issue for individuals at either who have very high or low level lesions.
Minimal staff/patient burden is required as the variables collected are important to patient care, reflect basic areas of patient concern, and are routinely collected as a component of standard practice.
A self-report version of SCIM (SCIM-SR) is also available and is comparable to the observation-based SCIM in reliability and validity. Since the SCIM-SR does not require task observation, it generally takes less time to complete.

Availability

Available for free here:
http://www.rehab.research.va.gov/jour/07/44/1/pdf/catzappend.pdf
Languages: English, Brazilian, Greek, Spanish, Thai, Turkish

Assessment Interpretability

Minimal Clinically Important Difference

Total: 4.20
Self-Care: 1.15
Resp. Sphinct. Mgmt.: 1.82
Mobility Rm. & Toilet: 0.61
Mobility In/Outdoors: 1.21

(Scivoletto et al., 2013; N=255, 199 male, traumatic or ischemic SCI, mixed injury types, mean (SD) time since injury = 51.6(36.8) days)

Statistical Error

Minimal Detectable Change:
Total: 8.20
Self-Care: 2.64
Resp. Sphinct. Mgmt.: 6.07
Mobility Rm. & Toilet: 1.59
Mobility In/Outdoors: 1.96

(Scivoletto et al., 2013; N=255, 199 male, traumatic or ischemic SCI, mixed injury types, mean (SD) time since injury = 51.6(36.8) days)

Typical Values

Mean (SD) Admission/Discharge Scores:
Total: 29.6-29.8(16.9-17.7) / 50.5-50.6(21.7-22.1)
Self-Care: 7.2(5.3-5.5) / 11.4 (5.6-5.7)
Respiration & Sphincter Mgmt.: 15.8-15.9(8.8) / 15.3-25.5(10.1-10.2)
Mobility Rm. & Toilet: 3.0(2.9-3.0) / 5.8-5.9(3.5-3.7)
Mobility In/Outdoors: 3.5-3.7(3.4-4.0) / 7.0-7.8(21.7-22.1)

(Anderson et al., 2011; N=390, 294 male, mixed injury types, inpatient, mean(SD) age at injury = 45.3(17.9))

Measurement Properties

Validity – Low to High

High **correlation with Modified Barthel Index:**
r = 0.905

(Korean QUEST 2.0; Hwang et al., 2015; N=70, 55 male, mixed injury types, mean (SD) time since injury = 31 (59) years)

High **correlation with Functional Independence Measure (FIM):**
r = 0.839-0.835

(Bluvshtein et al., 2011; N=261, male/female ratio = 5:2, mixed injury types, study conducted between admission and discharge of rehabilitation)

r = 0.77-0.92

(Mulcahey et al. 2018; N=127, 69 male, mean age: 10.8 years, mixed injury types)

High **correlation with Capabilities of Upper Extremity Test (CUE-T):**
ρ = 0.617

(Marino et al., 2015; N=50, 36 male, mixed injury types, outpatient)

Moderate **to** ***High*** **correlation with Graded Redefined Assessment of Strength, Sensibility and Prehension (GRASSP) subscales:**
ρ = 0.56-0.90 (SCIM self-care subscale only)

(Velstra et al. 2015; N=74, 51 male, cervical SCI, mixed injury severity, ≤ 10 days post-SCI at enrollment, study conducted over 1 year post-SCI)

Moderate **correlation with Short Form 36 (SF-36):**
r = 0.339

Reliability – Moderate to High

Moderate **to** ***High*** **Inter-rater Reliability:**
Cohen's κ = 0.683-1.000

(Turkish SCIM; Unalan et al., 2015; N=204, 144 male, mixed injury types, mean (SD) time since injury = 75.4 (85.2) months)

Cohen's κ = 0.56-0.81

(Anderson et al., 2011; N=390, 294 male, mixed injury types, inpatient, mean(SD) age at injury = 45.3(17.9))

ICC = 0.880-0.977

(Itzkovich et al., 2007; N=425, 309 male, mixed injury types, study conducted between admission and discharge of rehabilitation)

(Itzkovich et a., 2018; N=35, 19 male, Mean age: 62±15 years, 4 traumatic, 31 non traumatic injuries)

High **Internal Consistency:**
α = 0.828-0.832

(Turkish SCIM; Unalan et al., 2015; N=204, 144 male, mixed injury types, mean (SD) time since injury = 75.4 (85.2) months)

α = 0.850-0.890

(Anderson et al., 2011; N=390, 294 male, mixed injury types, inpatient, mean(SD) age at injury = 45.3(17.9))

α = 0.847-0.849

(Itzkovich et al., 2007; N=425, 309 male, mixed injury types, study conducted between admission and discharge of rehabilitation)

Number of studies reporting reliability data: 14

(Turkish SCIM; Unalan et al., 2015; N=204, 144 male, mixed injury types, mean (SD) time since injury = 75.4 (85.2) months)

Low **correlation with Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST):**
r = -0.075

(Korean QUEST 2.0; Hwang et al., 2015; N=70, 55 male, mixed injury types, mean (SD) time since injury = 31 (59) years)

Number of studies reporting validity data: 28

Responsiveness

Floor/Ceiling Effect:
No overall floor/ceiling effect detected

(Prodinger et al., 2016; N=1530, 1093 male, mixed injury types, mean (SD) time post-SCI = 16.84 (12.7) years)

>= 50% at ceiling for: 2 items (T1-12), 1 item (C5-8), 1 item (T7-12)**;**
>= 50% at floor for: 2 items (C1-4), 6 item (C1-5), 1 item (C1-6), 1 item (all levels except T7-12), 1 item (all levels)

(Ackerman et al., 2010; N=114, 92 male, mixed injury types, ≤ 12 months post-SCI)

Floor effect evident for “transfer ground/wheelchair” item (62%)

(Glass et al., 2009; N=86, 72 males, mixed injury types, inpatient)

When examined for the total sample, each of the four age groups, type (paraplegia/tetraplegia), severity (complete/incomplete) and NL, SCIM-III total scale showed negligible ceiling effects (<2%).
However, ceiling effects were present in the *SC subscale for*:
the oldest age group (16-17yrs) (24%)
neurological level (NL) L1-S4/5 (35.5%)

and the *In-room mobility subscale:*
Age 6–12 years (45.7%)

Effect Size:
Self-care subscale:
Between 1 and 12 months post-enrollment: 1.28
Between 6 and 12 months post-enrollment: 0.42

(Velstra et al. 2015; N=74, 51 male, cervical SCI, mixed injury severity, ≤ 10 days post-SCI at enrollment, study conducted over 1 year post-SCI; other time periods available in article)

Number of studies reporting responsiveness data: 11

Age 13–15 years (30.43%)
Age 16–17 years (60%)
paraplegia (42.4%)
tetraplegia (37.1%)
Incomplete injuries (50%)
T2-T12 (38%)
NL L1-S4/5 (100%)

(Mulcahey et al. 2018; N=127, 69 male, mean age: 10.8 years, mixed injury types)

Community Reintegration

The Craig Handicap Assessment & Reporting Technique (CHART)

Assessment Overview

Assessment Area

ICF Domain:
Participation
Subscales (dimensions):
Physical Independence
Cognitive Independence
Mobility
Occupation
Social Integration
Economic Self-sufficiency

You Will Need

Length:
CHART: 32 items, 30 minutes
CHART-SF: 19 items, 15 minutes
Training:
None, but reading the manual is recommended
Scoring:
Each dimension scored 0-100; 100 = role fulfillment equivalent to individuals without disabilities

Summary

The CHART is a patient-reported outcome measure designed to measure the level of handicap in a community setting. CHART collects information on the degree to which the respondent fulfills the roles typically expected from people without disabilities.
A short form (CHART-SF) has been developed, containing the same domains as the CHART.

Availability

Available for free here:
http://tbims.org/combi/chart/CHART.pdf
Languages: English, Spanish, Japanese, Chinese, Korean and Italian

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Standard Error of Measurement:
40.7

(Japanese version; Tozato et al. 2005; n=293, 246 males, mixed injury types, mean time since injury (SD) = 8.7 (6.6) years)

Minimal Detectable Change
53.3

(De Wolf et al. 2010; n=58, 45 male, traumatic SCI, mixed injury types, data collected at 6 weeks and 1 year post-discharge from inpatient rehab)

Typical Values

Mean (SD) Scores:
CHART Total = 378.7 (86.8)

(Tozato et al. 2005; n=293, 246 males, chronic SCI)

CHART-SF Total = 332.6 (145.8)

(Gontkovsky et al. 2009; n=28, 21 males, mixed injury types, chronic SCI)

Median (IQR) Scores:
Phys. Indep. = 93 (80-100)
Cog. Indep. = 100 (94-100)
Mobility = 81 (65-95)
Occupation = 79 (37-100)
Social Integration = 85 (70-100)
Econ. Self-suff. = 100 (50-100)

(Whiteneck et al, CHART Guide; SCI individuals; no injury type, duration & sample size data available)

Measurement Properties

Validity – Low to High

High **correlation with Sydney Psychosocial Reintegration Scale (SPRS):**
ρ = 0.72

High **correlation between CHART-SF and Community Integration Questionnaire (CIQ):**
r = 0.79

(Gontkovsky et al. 2009; n=28, 21 males, mixed injury types, chronic SCI)

Moderate **correlation with Community Integration Measure (CIM):**
r = 0.47

(De Wolf et al. 2010; n=58, 45 male, traumatic SCI, mixed injury types, data collected at 6 weeks and 1 year post-discharge from inpatient rehab)

Low **to** ***Moderate*** **correlation with self-report FIM:**
CHART total score: r= 0.26
CHART mobility subscale: r = 0.30
CHART physical subscale: r = 0.49

(Masedo et al. 2005; n=84, 67 males, mixed injury types, mean time since injury (SD) = 13.96 (9.36) years)

Number of studies reporting validity data: 10

Reliability – Low to High

High **Test-retest Reliability (CHART total score):**
ICC = 0.93

(Whiteneck 1992; n=135, 113 males, mixed injury types, 2-35 years post-injury living in the community)

Low **to** ***High*** **Participant-proxy agreement:**
Total CHART: ICC=0.84
Physical Independence: ICC=0.69
Cognitive Independence: ICC=0.34
Mobility: ICC=0.86
Occupation: ICC=0.60
Social Integration: ICC=0.57
Economic Independence: ICC=0.59

(Cusick 2001; n=983 + their proxies, 560 males, SCI (n=224) and other disabilities, community living)

High **Test-retest Reliability:**
ICC = 0.87

(Walker et al. 2003; N SCI = 236, 75% male)

Number of studies reporting reliability data: 5

Responsiveness

Floor/Ceiling Effect:
Ceiling effects occurred for the Social and Cognitive dimensions at both 6 weeks post-discharge from inpatient rehab (57-66% and 65-66%, respectively) and 1-year post-discharge (44-66% and 84-86%, respectively)

(De Wolf et al. 2010; n=58, 45 male, traumatic SCI, mixed injury types, data collected at 6 weeks and 1 year post-discharge from inpatient rehab)

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 2

Rating Form

CHART

Revised July, 1996

WHAT ASSISTANCE DO YOU NEED?

People with disabilities often need assistance. We would like to differentiate between personal care for physical disabilities and supervision for cognitive problems. First, focus on physical "hands on" assistance: This includes help with eating, grooming, bathing, dressing, management of a ventilator or other equipment, transfers etc. Keeping in mind these daily activities...

q How many hours in a typical 24-hour day do you have someone with you to provide physical assistance for personal care activities such as eating, bathing, dressing, toileting and mobility?

_____ hours paid assistance _____ hours unpaid (family, others)

- Not including any regular care as reported above, how many hours in a typical month do you occasionally have assistance with such things as grocery shopping, laundry, housekeeping, or infrequent medical needs because of the disability?

  _____ hours per month

- Who takes responsibility for instructing and directing your attendants and/or caregivers?

  _____ Self
  _____ Someone Else
  _____ Not applicable, does not use attendant care

Now, focus on supervision for cognitive problems instead of physical assistance. This includes remembering, decision making, judgment, etc.

- How much time is someone with you in your home to assist you with activities that require remembering, decision making, or judgment?

  _____ Someone else is always with me to observe or supervise.

  _____ Someone else is always around, but they only check on me now and then.

  _____ Sometimes I am left alone for an hour or two.

_____ Sometimes I am left alone for most of the day

_____ I have been left alone all day and all night, but someone checks in on me.

_____ I am left alone without anyone checking on me.

- How much of the time is someone with you to help you with remembering, decision making, or judgment when you go away from your home?

_____ I am restricted from leaving, even with someone else.

_____ Someone is always with me to help with remembering, decision making or judgment when I go anywhere.

_____ I go to places on my own as long as they are familiar.

_____ I do not need help going anywhere.

- How often do you have difficulty communicating with other people?

_____ I almost always have difficulty.

_____ I sometimes have difficulty.

_____ I almost never have difficulty.

- How often do you have difficulty remembering important things that you must do?

_____ I almost always have difficulty.

_____ Sometimes I have difficulty.

_____ I almost never have difficulty.

- How much of your money do you control?

_____ None, someone makes all money decisions for me.

_____ A small amount of spending money is given to me periodically.

_____ Most of my money, but someone does help me make major decisions.

_____ I make all my own money decisions (or if married, in joint participation with my partner).

Now, I have a series of questions about your typical activities.

ARE YOU UP AND ABOUT REGULARLY?

9. On a typical day, how many hours are you out of bed? _____ hours

- In a typical week, how many days do you get out of your house and go somewhere? ____days
- In the last year, how many nights have you spent away from your home (excluding hospitalizations?) _____ none _____ 1-2 _____3-4 _____5 or more

q Can you enter and exit your home without any assistance from someone? yes_____ no_____

r In your home, do you have independent access to your sleeping area, kitchen, bathroom, telephone, and TV (or radio)? _____yes _____no

IS YOUR TRANSPORTATION ADEQUATE?

- Can you use your transportation independently? _____yes _____no
- Does your transportation allow you to get to all the places you would like to go? _____ yes _____ no
- Does your transportation let you get out whenever you want? _____ yes _____ no
- Can you use your transportation with little or no advance notice? _____ yes _____ no

HOW DO YOU SPEND YOUR TIME?

18. How many hours per week do you spend working in a job for which you get paid? hours _____ (occupation: _____)

14. How many hours per week do you spend in school working toward a degree or in an accredited technical training program (including hours in class and studying)? _____ hours

20. How many hours per week do you spend in active homemaking including parenting, housekeeping, and food preparation? _____ hours

21. How many hours per week do you spend in home maintenance activities such as gardening, house repairs or home improvement? _____ hours

18. How many hours per week do you spend in ongoing volunteer work for an organization? _____ hours

19. How many hours per week do you spend in recreational activities such as sports, exercise, playing cards, or going to movies? Please do not include time spent watching TV or listening to the radio. _____ hours

20. How many hours per week do you spend in other self-improvement activities such as hobbies or leisure reading? Please do not include time spent watching TV or listening to the radio. _____ hours

WITH WHOM DO YOU SPEND TIME?

25. Do you live alone? ___Yes ___No (If yes, skip to question 26.)

25a. (If you don't live alone) do you live with a spouse or significant other?
___Yes ___No

25b. How many children do you live with? _____

25c. How many other relatives do you live with? _____

25d. How many roommates do you live with? _____

25e. How many attendants do you live with? _____

26. (If you don't live with a spouse or significant other) are you involved in a romantic relationship?
____ Yes ____ No ____ N/A (Subject lives with spouse or significant other)

27. How many relatives (not in your household) do you visit, phone, or write to at least once a month? _____ relatives

28. How many business or organizational associates do you visit, phone, or write to at least once a month? _____ associates

29. How many friends (non-relatives contacted outside business or organizational settings) do you visit, phone, or write to at least once a month? _____friends

30. With how many strangers have you initiated a conversation in the last month (for example, to ask information or place an order)?

___ none ___ 1-2 ___ 3-5 ___6 or more

WHAT FINANCIAL RESOURCES DO YOU HAVE?

31. Approximately what was the combined annual income, in the last year, of **all family members in your household**? (consider all sources including wages and earnings, disability benefits, pensions and retirement income, income from court settlements, investments and trust funds, child support and alimony, contributions from relatives, and any other source.)

$ _____ .

32. Approximately how much did you pay last year for medical care expenses? (Consider any amounts paid by yourself or the family members in your household and **not reimbursed** by insurance or benefits.)

$ _____ .

Reintegration to Normal Living (RNL) Index

Assessment Overview

Assessment Area

ICF Domain:
Participation

You Will Need

Length:
10 minutes, 11 items
Scoring:
3 alternate scoring systems:
1) 10-point visual analogue scale 2) 3-point scale
3) 4-point scale
The most commonly used scoring system is the Visual Analog scale where each item is scored using a 10 cm line and accompanying phrases for participants to rate themselves.
Higher scores indicate greater reintegration.
Total score is 0-110, can be scaled to 100 for adjusted score.

Summary

The Reintegration to Normal Living (RNL/RNLI) index is a self-report questionnaire that assesses a person's satisfaction with performance in life activities. The RNL index assesses mobility, self-care, daily activity, recreational activity, and family roles. The RNL was originally developed based on interviews with clinicians and people who have had a stroke, but it has since been tested with people who have SCI, TBI, Cancer and Heart Disease. The RNL is commonly used as part of the national reporting system in Canada for people with SCI..

Availability

Available for free here: *http://www.scireproject.com/wp-content/uploads/worksheet_reintegration_to_normal_living_index_rnl.docx*
Languages: English, French

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Mean (SD) Scores:
17.2 (4.4)

(Using 3-point scale, ranges 0-2; Hitzig et al., 2012; N=618, 501 male, mixed injury types, community living, mean (range) time since injury = 16.3 (1-60) years)

Measurement Properties

Validity – Low to High

High **correlation with Quality of Life Index (QLI):**
r = -0.654

Moderate **correlation with Functional Independence Measure (FIM):**
r = -0.348

Low **correlation with ASIA Motor Score:**
r = -0.196

(May & Warren, 2002; N=98, 76 male, mixed injury types, mean (range) time since injury = 15.5 (1-78) years)

Number of studies reporting validity data: 3

Reliability – High

High **Internal Consistency:**
α = 0.84-0.97

Kappa coefficient range: 0.38-0.92

Total item correlations: 0.37-0.67

(Hitzig et al., 2012; N=618, 501 male, mixed injury types, community living, mean (range) time since injury = 16.3 (1-60) years)

(Daneski et al. 2003; N=76, 42 male, Mean age: 67.1±12.72 years, stroke patients)

Number of studies reporting reliability data: 3

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Life Satisfaction Questionnaire (LISAT-9, LISAT-11)

Assessment Overview

Assessment Area

ICF Domain:
Quality of Life
Subscales (domains):
Life as a whole, vocational situation, financial situation, leisure situation, contacts with friends, sexual life, self-care management, family life, and partner relationships

You Will Need

Length:
5 minutes, 9 or 11 items
Scoring:
Item scores can be summed and an average score is produced.
Maybe more appropriate to use mean domain scores instead of total score in order to maintain information on each domain available for clinical interventions

Summary

The Life Satisfaction Questionnaire (LISAT) was originally developed as a checklist rather than a measure of life satisfaction. It targets important life domains: life as a whole, vocational situation, financial situation, leisure situation, contacts with friends, sexual life, self-care management, family life, and partner relationships. The LISAT-11 has 2 extra items asking about the level of satisfaction of the individual's physical health and psychological health respectively.

Availability

Available for free here: https://scireproject.com/outcome-measures/outcome-measure-tool/life-satisfaction-questionnaire-lisat-9-lisat-11/#1467983894177-6b9fb7a3-f550
Languages: Available in 8 languages

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Standard Error of Measurement for LISAT-9:
Life as a whole: 0.07
Self-Care: 0.05
Leisure situation: 0.06
Vocational situation: 0.06
Financial situation: 0.06
Sexual life: 0.06
Partner relations: 0.07
Family life: 0.06
Contact with friends: 0.07

Typical Values

LISAT-9 Mean (SD) Total Score:
31.6 (9.4)

(Geyh et al. 2010; n-243, 193 males, mixed injury types, outpatient, mean (SD) time since injury = 140 (139) months)

Minimal Detectable Change for LISAT-9:
Life as a whole: 0.19
Self-Care: 0.14
Leisure situation: 0.17
Vocational situation: 0.17
Financial situation: 0.17
Sexual life: 0.17
Partner relations: 0.19
Family life: 0.17
Contact with friends: 0.19

(Geyh et al. 2010; n-243, 193 males, mixed injury types, outpatient, mean (SD) time since injury = 140 (139) months)

Measurement Properties

Validity – Moderate to High

High **correlation with Satisfaction with Life Scale (SWLS):**
ρ = 0.60

Moderate **correlation with Mental Health subscale of SF-36 (MHI-5):**
ρ = 0.52

Moderate **correlation with Social Dimension of SIP-68 (SIP-SOC)**
ρ = - 0.45

(Post et al. 2012; n=145; 104 males, mixed injury types, 5 years after discharge from inpatient rehabilitation)

Number of studies reporting validity data: 1

Reliability – Moderate to High

High **Overall Internal Consistency:**
α = 0.86

(Geyh et al. 2010; n-243, 193 males, mixed injury types, outpatient, mean (SD) time since injury = 140 (139) months)

Moderate **Internal Consistency:**
α = 0.75

(Post et al. 2012; n=145; 104 males, mixed injury types, 5 years after discharge from inpatient rehabilitation)

Number of studies reporting reliability data: 2

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Mean LISAT-9 total score differences before & after SCI = 1.0

(Van Koppenhagen; n-147, wheel-chair dependent, data was collected retrospectively at the start of active rehabilitation and one year after discharge from inpatient rehabilitation.)

Number of studies reporting responsiveness data: 1

Life-Satisfaction Questionnaire-9 (LISAT-9)

Adapted from Fugl-Meyer AR, Branholm IB, and Fugl-Meyer KS, Happiness and domain-specific life satisfaction in adult northern Swedes, Clin Rehabil, 5: 25-33, 1991; Table 3. Used with permission from Sage Publishing.

Life-Satisfaction Questionnaire-9 (LISAT-9) Worksheet:

Patient Name: _____ Date: _____

How satisfactory are these different aspects of your life? Indicate the number which best suits your situation.

1 = very dissatisfying	4 = rather satisfying
2 = dissatisfying	5 = satisfying
3 = rather dissatisfying	6 = very satisfying

Score: (1-6)

Life as a whole is _____

My ability to manage my self-care (dressing, hygiene, transfers, etc.) is _____

My leisure situation is _____

My vocational situation is _____

My financial situation is _____

My sexual life is _____

My partnership relation is _____

My family life is _____

My contacts with friends and acquaintances are _____

Sum: _____

Life-Satisfaction Questionnaire -11 (LISAT-11)

Adapted from Fugl-Meyer AR, Branholm IB, and Fugl-Meyer KS, Life Satisfaction in 18- to 64-year old Swedes: In Relation to Gender, Age, Partner and Immigrant Status, J Rehabil Med, 34: 239 -46, 2002; Appendix A. Used with permission from Taylor & Francis.

Life-Satisfaction Questionnaire-11 (LISAT-11) Worksheet:

Patient Name: _____ Date: _____

How satisfactory are these different aspects of your life? Indicate the number which best suits your situation for each of these statements.

1 = very dissatisfying	4 = rather satisfying
2 = dissatisfying	5 = satisfying
3 = rather dissatisfying	6 = very satisfying

Score: (1-6)

Life as a whole is _____

My vocational situation is _____

My financial situation is _____

My leisure situation is _____

My contacts with friends and acquaintances are _____

My sexual life is _____

My ability to manage my self-care (dressing, hygiene, transfers, etc.) is _____

My family life is ☐ have no family _____

My partnership relation is ☐ have no steady partner relationship _____

My physical health is _____

My psychological health is _____

Sum: _____

Short Form 36 (SF-36)

Assessment Overview

Assessment Area

ICF Domain:
Quality of Life

You Will Need

Length:
36 items
Scoring:

- Raw score is transformed to 0-100 scoring system (Algorithm available in the manual, which must be purchased)
- Score is norm-based; the mean score for the general population is 50 with a standard deviation of 10
- Higher score indicates better health status
- The SF-36 can also be scored using two norm-based summary scores, a physical and a mental component score (PCS & MCS).

Summary

The Medical Outcomes Study Short Form 36 (SF-36) is a generic health status measure that was introduced in 1992 and has been translated into various languages. The SF-36 assesses health-related quality of life using 8 domains, regarding either physical or mental functioning, both of which can also be summarized into a composite score: the physical (PCS) and mental (MCS) component summary.

The SF-36 can be administered by interviewer or self-administered.

Availability

Available for free here: https://www.rand.org/health-care/surveys_tools/mos/36-item-short-form/survey-instrument.html
Languages: 50+ languages

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI
For a sample of patients with osteoarthritis:
Worsening:
Physical functioning = 5.3
Bodily pain = 7.2
PCS = 2.0
Improving:
Physical functioning = 3.3
Bodily pain = 7.8
PCS = 2.0

(Angst et al., 2001; N=122, 71% female, mean age 65)

Statistical Error

Minimal Detectable Change:
Physical functioning=21.4
Role physical=14.7
Bodily pain=7.4
General health=7.9
Vitality=4.6
Social functioning=5.9
Role emotional=4.1
Mental health=7.4

(Lin 2007; N=187, 151 male, traumatic SCI; mixed injury types, mean time since injury = 7.4 years)

Typical Values

Mean (SD) Scores:
Physical functioning: 61.2(39.8)
Role physical: 62.7(44.4)
Bodily pain: 67.5(20.6)
General health: 52.5(20.3)
Vitality: 57.0(17.3)
Social functioning: 71.8(22.2)
Role emotional: 71.8(40.9)
Mental health: 63.5(15.5)

(Lin 2007; N=187, 151 male, traumatic SCI; mixed injury types, mean time since injury = 7.4 years)

Threshold Values:

		Not established in SCI. But in the general population: Mental health (MH) score of ≤ 52 is "indicative of emotional problems probably of any psychiatric disorder". MCS of ≤ 42 is "indicative of clinical depression". (Ware et al 1994) (Silveira et al 2005; N=545-555; Swedish women, aged 70-84; MH cut-off: sensitivity=58%, specificity=92%; MCS cut-off: sensitivity=71%, specificity=82%)

Measurement Properties

Validity – Low to High

Moderate **correlation with Life Satisfaction Questionnaire 9 (LISAT-9):**
ρ = 0.531

Low **correlation with Functional Independence Measure (FIM):**
ρ = 0.094

(van Leeuwen et al. 2012; N=145, 104 male, mixed injury types, 5 years post-discharge from inpatient rehabilitation)

Low **to** ***High*** **correlation with WHO Quality of Life – BREF (WHOQOL-BREF):**
ρ = 0.24-0.78

(Lin 2007; N=187, 151 male, traumatic SCI; mixed injury types, mean time since injury = 7.4 years)

Moderate **correlation with Spinal Cord Independence Measure (SCIM):**
r = 0.339

(SCIM Turkish ver.; Unalan et al. 2015; N=204, 144 male, mixed injury types, mean time since injury = 75.4 months)

Low **to** ***Moderate*** **correlation with Beck Depression Inventory (BDI):**
r = 0.229-0.329

(Ataoglu et al. 2013; N=140, 104 male, mixed injury types, inpatient, mean time since injury = 25.2 months)

Number of studies reporting validity data: 13

Reliability – Moderate to High

Moderate **to** ***High*** **Inter-rater Reliability:**
ICC = 0.52-0.98

Moderate **to** ***High*** **Intra-rater Reliability:**
ICC = 0.71-0.99

Moderate **to** ***High*** **Internal Consistency:**
α = 0.72-0.98

(Lin 2007; N=187, 151 male, traumatic SCI; mixed injury types, mean time since injury = 7.4 years)

Number of studies reporting reliability data: 5

Responsiveness

Floor/Ceiling Effect:

Percentage of patients at lowest score:

Items 3a-3j: 29%

Items 3g, 3h, 3i: >90%

(Lee et al., 2009; N=305, 83% male, SCI patients with neuropathic bladder, mixed injury types, mean 14 years post-SCI)

2 subscales >20%

Percentage of patients at highest score:

3 subscales >20%

(Lin 2007; N=187, 151 male, traumatic SCI; mixed injury types, mean time since injury = 7.4 years)

Effect Size:

Physical Functioning Domain: 0.36

Physical Composite Score: 0.58

Mental Composite Score: 0.71

(Lee et al., 2009; N=305, 83% male, SCI patients with neuropathic bladder, mixed injury types, mean 14 years post-SCI)

Number of studies reporting responsiveness data: 7

World Health Organization Quality of Life – BREF (WHOQOL-BREF)

Assessment Overview

Assessment Area

ICF Domain:
Quality of Life
Subscales (domains):
Physical Health (7 items)
Psychological Health (6 items)
Social Relationships (3 items)
Environment (8 items)

You Will Need

Length:
10-15 minutes, 24+2 items
Scoring:
Items scored 1-5. Raw domain score is the sum of respective item scores. All domain scores are then normalized to a range of 0-100. Refer to user manual for scoring algorithm.
SPSS algorithm available for automatic scoring.

Summary

The World Health Organization Quality of Life – BREF (WHOQOL-BREF) is a self-report questionnaire which assesses 4 domains of quality of life (QOL): physical health, psychological health, social relationships, and environment. In addition, there are 2 items that measure overall QOL and general health. The assessment conceptually fits with the WHO definition of QOL.

The WHOQOL-BREF was developed by extracting 1 item from each of the 24 facets and 2 of the 4 general items from WHOQOL-100. WHOQOL-BREF can provide data for both research and clinical purposes. Although it is a relatively brief instrument, its structure allows one to acquire specific information covering many aspects of life.

This scale was not developed for people with SCI, therefore, it is possible that there are some questions in the scale that are not relevant.

Availability

Available for free here:
http://www.who.int/mental_health/publications/whoqol/en/
http://www.who.int/substance_abuse/research_tools/whoqolbref/en/
Languages: English

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Standard Error of Measurement:
Overall QOL/General Health: 7.8
Physical Health: 5.2
Psychological: 2.4
Social Relationships: 6.4
Environment: 5.1

Minimal Detectable Change:
General Health: 21.5
Physical Health: 14.4
Psychological: 6.6
Social Relationships: 17.9
Environment: 14.1

(Lin, 2007; N=187, 151 male, mixed injury type, mean time since injury = 7.4 years)

Typical Values

Mean (SD) Scores:
Overall QOL/General Health: 52.4 (19.4)
Physical Health: 56.1 (19.6)
Psychological: 53.7 (16.9)
Social Relationships: 58.9 (16.1)
Environment: 53.1 (15.3)

(Lin, 2007; N=187, 151 male, mixed injury type, mean time since injury = 7.4 years)

Measurement Properties

Validity – Low to High

Moderate **or higher correlation between WHOQOL-BREF subscales and the Short Form-36 (SF-36) subscales measuring similar constructs:**
r > 0.4

(Lin, 2007; N=187, 151 male, mixed injury type, mean time since injury = 7.4 years)

Low **to** ***High*** **correlation between WHOQOL-BREF subscales and the Impact of Participation and Autonomy Questionnaire (IPAQ) subscales:**
r = -0.30 to -0.65

(Suttiwong et al., 2013; N=161, 77% male, mixed injury types, mean (SD) time since injury = 10.6 (7.1) years)

Number of studies reporting validity data: 6

Reliability – Moderate to High

Moderate **to** ***High*** **Inter-rater Reliability:**
ICC = 0.56-0.95

High **Intra-rater Reliability:**
ICC = 0.84-0.93

(Lin, 2007; N=187, 151 male, mixed injury type, mean time since injury = 7.4 years)

(Salvador-De La Barrera et al. 2018, N=54 (44M); Mean age (SD): 45.5 (13.2); 20 CSCI, 28 TSCI, 6 LSCI)

Low **to** ***High*** **Internal Consistency:**
Overall α = 0.73-0.89
Physical Health Domain α = 0.73-0.87
Psychological Domain α = 0.74-0.86
Social Relationship Domain α = 0.54-0.75
Environment Domain α = 0.65-0.86

(Lin, 2007; N=187, 151 male, mixed injury type, mean time since injury = 7.4 years)

(Salvador-De La Barrera et al. 2018, N=54 (44M); Mean age (SD): 45.5 (13.2); 20 CSCI, 28 TSCI, 6 LSCI)

(Xavier de Franca et al. 2011, N=47 (91.5% Male); Mean age (SD): 42.95 (14.12))

(Jang 2004, N=111; Mean age (SD): 40 (13); Complete tetraplegia=23, Incomplete tetraplegia=28, Complete paraplegia=43, Incomplete paraplegia=17)

(Miller et al. 2008, N=161 (77% Male); Mean age (SD): 46.88 (15.52))

Number of studies reporting reliability data: 5

Responsiveness

Floor/Ceiling Effect:
0.0%-1.3% at floor
0.0%-0.4% at ceiling

(Subscale values; Lin, 2007; N=187, 151 male, mixed injury type, mean time since injury = 7.4 years)

Effect Size:
Overall QOL & general health domain (combined): 1.01
Physical Health: 1.83
Psychological Health: 0.78
Social Relationship: 1.16
Environment: 0.78

(Lin, 2007; N=187, 151 male, mixed injury type, mean time since injury = 7.4 years)

Number of studies reporting responsiveness data: 2

Assistive Technology Device Predisposition Assessment (ATD-PA)

Assessment Overview

Assessment Area

ICF Domain:

Environment

Subscales:

Person Domain (53 items)
Device Domain (10 items)

You Will Need

Length:

63 items – approximately 30 minutes

Scoring:

5-point scale for items

Summary

The Assistive Technology Device Predisposition Assessment (ATD-PA) examines a user's subjective satisfaction with achievements in a variety of functional areas and with assistive technology. The ATD-PA encourages user participation in developing and setting goals and helps them to understand their own needs and interests. The ATD-PA can be used for complicated cases and for assessing a client's 'story' with assistive technology. For people with new spinal cord injuries who indicate previous problems with assistive technology use, the ATD-PA can be used to identify obstacles to AT use early on in the course of rehabilitation.

The ATD-PA is divided into 2 domains – Person and Device. People are asked to characterize aspects of functioning, temperament, lifestyle, and views of a particular assistive device. The ATD-PA has been shown to be a reliable measure and to have adequate content and criterion-related validity in the SCI population.

Availability

Available for purchase here:
http://www.matchingpersonandtechnology.com/orderform.html

Available at the above link in 8 translations: Brazilian Portuguese, French, German, Greek, Italian, Hungarian, Korean and Spanish (Spain).

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Mean Scores (Person Domain Sections B & C only):
1.75-4.10

(Scherer & Cushman 2001; n=20, 10 males, mixed injury types; acute SCI)

Measurement Properties

Validity – **High**

High **correlation between the ATD-PA Quality of Life subscale and the Brief Symptom Inventory (BSI):**
Correlation = -0.71
(Scherer & Cushman 2001; n=20, 10 males, mixed injury types; acute SCI)

High **correlation between the ATD-PA Quality of Life subscale and the Satisfaction with Life Scale (LISAT-9):**
Correlation = 0.89
(Scherer & Cushman 2001; n=20, 10 males, mixed injury types; acute SCI)

Number of studies reporting validity data: 1

Reliability – **High**

High **Internal Consistency:**
α = 0.80
(Scherer & Cushman 2001; n=20, 10 males, mixed injury types; acute SCI)

Number of studies reporting reliability data: 1

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Québec User Evaluation of Satisfaction with Assistive Technology (QUEST)

Assessment Overview

Assessment Area

ICF Domain:
Environmental Factors
Subcategory:
Products and Technology

You Will Need

Length:
10-15 minutes, 12 items
Scoring:
Items scored 1-5. 3 scores (devices, services, total) are calculated using means of certain items

Summary

The Québec User Evaluation of Satisfaction with Assistive Technology (QUEST) is a self-report or interview-based scale, designed to evaluate a person's satisfaction with a wide range of assistive technology. The current version (ver. 2.0) covers satisfaction with both the device, and with the service from the vendor/manufacturer.

Availability

http://www.midss.org/sites/default/files/questeng.scoring_sheet pdf_0.pdf
Languages: English

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Not established in SCI

Typical Values

Mean (SD) Scores:
Device Total: 4.1 (0.9)
Services Total: 3.8 (1.1)
Total: 3.99 (1.0)

(Bergstrom & Samuelsson 2006; N=124, 89 male, mixed injury types, community living, manual wheelchair users)

Measurement Properties

Validity – Moderate

Moderate **correlation between QUEST-Device subscale and Hong Kong WHO Quality of Life – BREF:**

Correlation = 0.344-0.567

(Chinese QUEST; Chan & Chan 2006; N=31, 25 male, mixed injury types, mean (SD) time since injury = 3.79 (3.72) years, manual and power wheelchair users)

High **intercorrelations for all subscale item pairings**

Safe Use: 0.691-0.794
Fit to Use: 0.615-0.829
Endurance: 0.635-0.909

(Koumpouros et al. 2016, N=115, 51 male, mean age: 62.45 ± 19.29 years, Injury not specified)

Number of studies reporting validity data: 4

Reliability – Moderate to High

High **Intra-rater Reliability:**

ICC = 0.855

(Korean QUEST; Hwang et al., 2015; N=70, 55 male, mixed injury types, mean (SD) time since injury = 31.1 (58.6) years, mixed assistive devices)

High **Test-Retest Reliability:**

ICC=0.949

(Koumpouros et al. 2016, N=115, 51 Male, Mean age: 62.45 ± 19.29 years, Injury not specified)

Moderate **to** ***High*** **Internal Consistency:**

α = 0.754
(Koumpouros et al. 2016, N=115, 51 Male, Mean age: 62.45 ± 19.29 years, Injury not specified)

α = 0.90

(Taiwanese QUEST; Mao et al., 2015; N=105, 79 male, 73 SCI, mean (SD) device use duration: 3.3 (2.2) years, mixed assistive devices)

α = 0.855

(Korean QUEST; Hwang et al., 2015; N=70, 55 male, mixed injury types, mean (SD) time since injury = 31.1 (58.6) years, mixed assistive devices)

Number of studies reporting reliability data: 4

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Not established in SCI

Number of studies reporting responsiveness data: 0

Quebec User Evaluation of Satisfaction with assistive Technology

QUEST (Version 2.0)

Technology device: _____

User name: _____

Date of assessment:_____

The purpose of the **QUEST** questionnaire is to evaluate how satisfied you are with your assistive device and the related services you experienced. The questionnaire consists of 12 satisfaction items.

- For each of the 12 items, rate your satisfaction with your assistive device and the related services you experienced by using the following scale of 1 to 5.

1	**2**	**3**	**4**	**5**
not satisfied at all	not very satisfied	more or less satisfied	quite satisfied	very satisfied

- Please circle or mark the **one number** that best describes your degree of satisfaction with each of the 12 items.
- D**o not** leave any question unanswered.
- For any item that you were not "very satisfied", please comment in the section ***comments***.

Thank you for completing the QUEST questionnaire.

1	2	3	4	5
not satisfied at all	not very satisfied	more or less satisfied	quite satisfied	very satisfied

ASSISTIVE DEVICE ***How satisfied are you with***	
1. the **dimensions** (size, height, length, width) of your assistive device? *Comments*:	1 2 3 4 5
2. the **weight** of your assistive device? *Comments*:	1 2 3 4 5
3. the **ease in adjusting** (fixing, fastening) the parts of your assistive device? *Comments*:	1 2 3 4 5
4. how **safe and secure** your assistive device is? *Comments*:	1 2 3 4 5
5. the **durability** (endurance, resistance to wear) of your assistive device? *Comments*:	1 2 3 4 5
6. how **easy** it is to use your assistive device? *Comments*:	1 2 3 4 5
7. how **comfortable** your assistive device is? *Comments*:	1 2 3 4 5
8. how **effective** your assistive device is (the degree to which your device meets your needs)? *Comments*:	1 2 3 4 5

1	2	3	4	5
not satisfied at all	not very satisfied	more or less satisfied	quite satisfied	very satisfied

SERVICES ***How satisfied are you with***	
• the **service delivery** program (procedures, length of time) in which you obtained your assistive device? *Comments*:	12345
• the **repairs and servicing** (maintenance) provided for your assistive device? *Comments*:	12345
• the quality of the **professional services** (information, attention) you received for using your assistive device? *Comments*:	12345
• the **follow-up services** (continuing support services) received for your assistive device? *Comments*:	12345

r Below is the list of the same 12 satisfaction items. PLEASE **SELECT THE THREE ITEMS** that you consider to be **the most important to you**. Please put an X in the **3 boxes** of your choice.

☐	1. Dimensions	☐	7. Comfort
☐	2. Weight	☐	8. Effectiveness
☐	3. Adjustments	☐	9. Service delivery
☐	4. Safety	☐	10. Repairs/servicing
☐	5. Durability	☐	11. Professional service
☐	6. Easy to use	☐	12. Follow-up services

QUEST
Scoring Sheet

This page is for scoring the answers to your questions.

DO NOT WRITE ON THIS PAGE.

- Number of non-valid responses _____ ☐

- **Device** subscale score _____ ☐

  For items 1 to 8, add the ratings of the valid responses and divide this sum by the number of valid items in this scale.

- **Services** subscale score _____ ☐

  For items 9 to 12, add the ratings of the valid responses and divide this sum by the number of valid items in this scale.

- Total QUEST score _____ ☐

  For items 1 to 12, add the ratings of the valid responses and divide this sum by the number of valid items.

- The 3 most important satisfaction items:

  _____

  _____

  _____

QUEST
(version 2.0)

1	2	3	4	5
not satisfied at all	not very satisfied	more or less satisfied	quite satisfied	very satisfied