

Incomplete Cervical Spinal Cord Injury In the Inpatient Rehabilitation Setting Assessment Toolbox

Assessment measures enable health care professionals to describe, quantify, predict, and evaluate patients' qualities, traits, or characteristics in order to provide benchmarks and summarize change in the care of individuals with incomplete cervical spinal cord injuries. Below is a "core set" (measures that are highlighted throughout) and additional assessment tools which are recommended for use in assessing incomplete cervical spinal cord injuries in the inpatient rehabilitation setting in conjunction with a thorough physical therapy examination. Due the excessive variety of clinical presentations that individuals with incomplete tetraplegia may exhibit, this assessment toolbox allows clinicians to select a variety of appropriate measures based on their patients' specific level and extent of injury, needs, and presentation. This toolbox narrows down to 1 or 2 measures most appropriate for each impairment or limitation in regards to this patient population and setting. The Core-Set includes the most feasible, comprehensive, and psychometrically supported assessments that would be applicable to the majority of individuals with incomplete tetraplegia in the inpatient rehabilitation setting.

CORE-SET TOOLBOX:

1. The "American Spinal Injury Association: International Standards for Neurological Classification of Spinal Cord Injury: [*Impairment*]
2. Ashworth/Modified Ashworth Scale [*Impairment*]
3. Functional Independence Measure (FIM) or Spinal Cord Independence Measure III (SCIM III) [*Activities*]
4. Capabilities of Upper Extremities Instrument (CUE) [*Activities*]
5. Life-Satisfaction Questionnaire- 9-11 [*Quality of Life*]

Body Structure and Function Assessments

The majority of measurements used in rehabilitation facilities fall under this ICF component. Though complex, these measures tend to be the most straight forward for this population compared to activity and participation components.

General: The “American Spinal Injury Association: International Standards for Neurological Classification of Spinal Cord Injury”:

A multidimensional approach to categorize motor and sensory impairment in individuals with SCI and identify motor and sensory levels and scores. This essential classification system assesses 28 dermatomes bilaterally through pinprick and light touch sensation as well as 10 key muscles through manual muscle testing. Classification is on an A-E scale with incomplete injuries noted B, C, and D (E= normal). These scores are shown to have predictive validity of later functional outcomes. A more accurate representation of motor function is demonstrated separating upper and lower extremity scores^{1,2}. Unfortunately, incomplete SCI sometimes have only moderate inter-rater reliability. Functional assessment measures should still be used in conjunction with the AIS impairment scale³.

- Available: http://sci.rutgers.edu/dynarticles/2001_Classif_worksheet.pdf

Fitness: Six-Minute Arm Test (6-MAT)

This tool immediately assesses cardiovascular fitness in individuals with SCI using 6 minutes of submaximal arm ergometry at a constant power output. It is simple and quick to administer clinically. Exercising heart rate and ratings of perceived exertion are taken during the final 30 seconds of the test. Equipment includes arm ergometer, heart rate monitor, and RPE scale found in most rehabilitations settings. This test has excellent reliability and concurrent validity for assessing cardiovascular fitness in people with SCI though function of an arm ergometer is necessary. Decrease in heart rate and/or RPE may indicate an increase in cardiovascular fitness over time while an increase in heart rate and/or RPE may indicate a decrease in cardiovascular fitness^{3,4}.

- Available: Guidelines and Instructions found in <http://www.ncbi.nlm.nih.gov/pubmed/17398251>⁴

Pain: Wheelchair Users Shoulder Pain Index (WUSPI)

A 15-item questionnaire to measure shoulder pain that limits functions in individuals who use wheelchairs. This assessment targets activity limitations due to shoulder pain on a 10cm VAS and includes subsections such as transfers, wheelchair mobility, self-care, and general activities. This tool is a simple and effective method to determine the degree of disturbance shoulder pain may have on typical ADLs in this patient population. Higher scores indicate more limitation due to pain but no norms or meaningful cut scores have been established for the incomplete tetraplegia population. This tool may allow for clinicians to consider more detailed assessment of shoulder pathology or intervention/equipment strategies in order to decrease pain^{3,5}.

- Available through author: Kathleen Curtis, PT, PhD (email: kacurtis@utep.edu)⁵

Skin: Spinal Cord Injury Pressure Ulcer Scale (SCIPUS) Measure:

The SCIPUS was developed to measure the risk for pressure ulcer development in individuals with SCI in a rehabilitation center. Patients are evaluated with 15 items including level of activity, mobility, injury, previous medical history, etc.. This measure has high content validity for SCI demonstrating a statistical association with pressure ulcer development and prediction. This test takes 10-15 minutes with laboratory data readily available and is easy to administer. Scores range from 0 (best prognosis) to 25 (worst prognosis) with a cutoff score of 6 to indicate clients at risk for pressure ulcer development.^{3, 6.}

- Available: <http://ovidsp.tx.ovid.com.libproxy.lib.unc.edu/sp-3.8.1a/ovidweb.cgi?S=HEDNFPMJPFDDMKPINCOKBAGCGGMLAA00&Graphic=00002060-199603000-00004%7cFF1%7cL%7ctiff>⁶

Self-Efficacy: Moorong Self-Efficacy Scale (MSES)

This 16-item self-report scale was developed to measure self-efficacy in performing basic ADLs and social functions specifically in individuals with SCI. Participants rate their ability to complete each task on a 7-point scale (1= very uncertain, 7= very certain). Total score is summed ranging from 16 to 112. Validity, reliability, internal consistency, and ability to detect change over short periods of time have been preliminarily demonstrated⁷. Higher scores indicate higher perceived self-efficacy with a mean change of 8 points over 6 months in sub-acute rehabilitation following SCI. Patients with strong self-efficacy are associated with setting higher goals and expectations and may positively influence rehabilitation. This tool may help clinicians to identify areas that the individual has low-self efficacy for areas of focus, education, and modification^{3, 7}.

- Available: Scale items are available through the original publication⁷

Spasticity: Ashworth/Modified Ashworth Scale:

This subjective clinical measure is the clinical gold standard for assessing spasticity in individuals with SCI. Well known and well tolerated by patients, this tool is measured on a 0-4 nominal scale and correlates well with the Spinal Cord Assessment Tool for Spastic Reflexes (SCATs)⁸. However, this measure does not address the frequency, severity and differentiating of spasticity components. Therefore, alternative measures or a battery of spasticity tests should be used to quantify spasticity in individuals with SCI.

- Available:
<http://www.rehabmeasures.org/PDF%20Library/Modified%20Ashworth%20Scale%20Instructions.pdf>

Spasticity: Spinal Cord Assessment Tool for Spastic Reflexes (SCAT):

This physiologically based spasticity measure was developed specifically for use in individuals with SCI. This scale assesses three distinct types of spastic motor behaviors seen in SCI, each with a different reflex pathway (clonus, flexor spasms, and extensor spasms) on a 0-3 rating scale. This scale provides a simple, fast, objective clinical measure however it does not consider patient perspective and should be used with a self-report measure such as the Ashworth Scale^{3,8}.

- Available:
<http://www4.fct.unesp.br/docentes/fisio/augusto/artigos%20cient%EDficos/2005%20-%20A%20physiologically%20based%20clinical%20measure%20for%20spastic%20reflexes%20in%20spinal%20cord%20injury.pdf>

Activity Assessments

General: **Functional Independence Measure (FIM):**

Though originally developed to assess the burden of care in the stroke population, the FIM is now the gold standard for assessment of basic function (e.g. transfers, mobility, dressing, grooming, bowel and bladder). Though not always the best at assessing SCI, it is often a requirement and included in the minimum data set in many inpatient rehabilitation databases⁹ thereby necessitating its use in the facility. It is internationally known and accepted and is able to predict the amount of assistance needed indicating the cost of living in the community with SCI³. However, the FIM is not SCI specific and is not able to discriminate between subtle, yet important changes in functional skills in tetraplegics. It is suggested that the cognitive subscale is only used as a screen in this population due to its high ceiling effects³.

- Available: <http://www.udsmr.org/WebModules/FIM/FimAbout.aspx>
- Contains 18 items (13 motor tasks, 5 cognitive tasks) rated on a 7-point ordinal scale from total assistance to complete independence.
- Normative scores following SCI are available based on cervical injury level and completeness for AIS grades A, B, C at admission and discharge (<http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=889>)¹⁰
- Excellent inter-rater reliability for the total FIM scores across acute care and subacute rehabilitation, though only adequate inter-rater reliability for patients with incomplete tetraplegia¹¹. It is suggested that a four category-rating scale increases reliability in this population compared to the original 7-category scale.¹² It also has excellent internal consistency for both traumatic and non-traumatic spinal cord diagnosis. Displays excellent correlation with the ASIA motor and Quadriplegia Index of Function in the subacute setting with adequate correlation of ASIA light touch and ASIA pinprick in this setting.

OR

General: **Spinal Cord Independence Measure III (SCIM):**

Created in response to deficiencies and inadequacies of the FIM to categorize functional changes in ADLs during SCI rehabilitation. The SCIM was specifically developed for the SCI population and demonstrates a higher responsiveness and ability to detect change than the FIM in this population. The SCIM III is now gaining international acceptance as the measure to assess function following SCI and should be used for this population as an alternative where the FIM is not required.¹³

- Available:
<http://www.rehab.research.va.gov/jour/07/44/1/pdf/catzappend.pdf>
- Contains 19 items assessed the 3 domains of self-care, respiration/sphincter management, and mobility. 35-45 minutes to score.

- The SCIMIII has established normative data for this population; excellent adequate to excellent interrater reliability for total agreement, total score, subscale scores, and individual tasks; excellent internal consistency in the subacute setting; and excellent correlation between the WISCI, RMI, FIM, walking speed, and Barthel index in the acute and subacute settings; strong validity and sensitivity. It is important to note however that a flooring effect may be observed for individuals with C1-c4 injuries for items that require greater upper extremity musculature^{3, 13, and 14}.

OR

General: Quadriplegia Index of Function (QIF)-Short Form

This global functional scale is specifically sensitive for measuring the gain of individuals with tetraplegia during rehabilitation. This 6 item assessment covering wash/dry hair, turn supine to side in bed, lower extremity dressing, open carton/jar, and transfers from bed to wheel chair and lock chair is a shorter and more practical version of the original 37 item QIF. Items are scored from 0 (dependent) to 4 (independent) with a total score ranging from 0-24. Though this measure has very good psychometrics and is primarily used to test the gains of those with tetraplegia from admission to discharge of inpatient rehabilitation, it is not comprehensive measure of upper extremity function or predictor of independence in ADLs upon discharge. The item scoring of the QIF compared to the category scoring of the FIM allows individual scores for individual tasks that are clumped as “set up” in the FIM, allowing appropriate credit for each task the individual can complete^{3, 15, 16}.

- Available: See guidelines and scoring in article¹⁶

Balance: Berg Balance Scale (BBS)

This performance-based measure is applicable for those patients with incomplete injuries who have some form of standing and/or ambulatory capacity. The assessment consists of 14 observable tasks on a 0-4 scale rated and include functional activities related to balance, bending, transferring, and standing. Scores below 41 are suggested to indicated falls risk and change in score >7 is said to be clinically relevant though these values have not been validated in the SCI population yet. Results may be useful in developing treatments to restore mobility and balance. The BBS has been found to be an appropriate assessment of standing balance for incomplete SCI due to strong associations with various walking evaluations (WISCI, SCI-FAI, 10MWT, 2MWT) and relates well to mobility measures, fear of falling, muscle strength, and discriminating SCI fallers and nonfallers.^{3, 17, 18}

- Available: www.aahf.info/pdf/Berg_Balance_Scale.pdf.

Mobility: Walking Index for Spinal Cord Injury II (WISCI II)

An ambulation measure designed specifically for individuals with SCI which evaluates not only functional capacity, but amount of physical assistance, braces, and devices required to walk 10m (household ambulation). A score of 0 to 20

assigned covering the whole walking ability spectrum (0= unable to stand and/or participate in walking” to 20= “ambulates with no devices, no brace, and no assistance”). It covers all levels of walking ability for these patients unlike general mobility measures such as the TUG. This test was chosen over the Spinal Cord Injury Functional Ambulation Inventory (SCI-FAI) as that test requires patients to be able to ambulate independently or with an assistive device for at least 2 minutes and may not be as applicable to as many individuals with incomplete cervical SCI in the subacute stage³. This test demonstrates excellent interrater reliability, construct criterion, and construct validity with RMI, Barthel Index, SCIM, and FIM as well as with adequate responsiveness. Additional tests such as the 10MWT or 6MWT may be necessary to assess walking speed and endurance in individuals with greater walking capacity^{3,19}.

- Available in Article:
http://www.spinalcordcenter.org/research/wisci_ii_scale_revision.pdf

Mobility: Wheelchair Skills Test 4.1 (WST 4.1)

This comprehensive measure is appropriate to evaluate individuals who use manual wheelchairs in assessing skills required for daily functioning. This assessment includes 32 skills with scoring based on a pass/fail basis in the subcategories of safety and performance. This test was partially developed using inpatient samples and can be used early in rehabilitation to diagnostically assess which skills need to be addressed during the rehabilitation process. A wheelchair skills test has also recently been developed for power chair users though there is limited psychometric data available for its use. These tests may also be used as an outcome measure or supplement to discharge at the completion of rehab. They ensure that users have been adequately training in the safe and effective use of their chair. The manual test has excellent test-retest reliability, interrater reliability, and predictive validity of CHART score, Satisfaction with Life Scale score, and self-perceived health status on multiple linear regression^{3,20}.

- Available: <http://www.wheelchairskillsprogram.ca/eng/wspforms.php>
- Tetraplegia normative data: (C4-C8)=72.1±7.9²⁰
- In the chronic population: scores ≥80% = advanced

Skin Management: Skin Management Needs Assessment Checklist (SMNAC)

This self-report assessment provides SCI specific information related to skin management needs and may be particularly helpful in the inpatient rehabilitation setting to preventatively identify individuals at risk for skin breakdown and enable education prior to discharge. This tool assesses patients’ knowledge and ability to perform skin checks, pressure relief, and prevention of skin breakdown. Each item received a 0-3 score (0=complete dependence and 3= complete independence). It is applicable to individuals with high cervical injuries as well as they must verbally instruct personal care attendants to perform activities. This tool also assesses patient’s attitudinal and behavior factors toward skin management and complex variables that impact an individual’s actual skin protection performance. This test is both strong in internal consistency and responsiveness in this population^{3,21}.

- Available: through author²¹

Upper Extremity: Capabilities of Upper Extremity Instrument (CUE)

A 32-item measure of functional limitation that assesses the amount of difficulty in performing certain actions with one or both upper extremities (not just hands) in individuals with tetraplegia. Items cover ability to reach or lift; push or pull with arms; move and position arms/wrist; use hand and fingers; and press with the tip of index finger. Score represent a self-perceived difficulty on a 7-point scale. Left and right arm/hand functional can be calculated and interpreted separately which is especially appealing when evaluating those with incomplete injuries. This assessment tool covers the full spectrum of hand/arm function as well as a comprehensive clinical picture of function.³

- Available: www.cebp.nl/vault_public/filesystem/?ID=1269
- The algorithm $((\text{Total score}-32)/192*100\%)$ can be used to determine a percent of normal function score.

Participation Assessments

Objective participation measures such as the Craig Handicap Assessment and Reporting Technique (CHART) or The Physical Activity Recall Assessment for People with Spinal Cord Injury (PARA-SCI) are primarily useful for research purposes³. Though the CHART is one of the most widely used participation measures for individuals with SCI, it lacks the individual's perspective as well as what is important to them which is a significant limitation in a participation. Therefore, a subjective measure of participation was chosen for this core-set. Though new and conceptually compatible with the WHO ICF model, the IPAQ was not chosen as it was developed for and contains items most suitable for an outpatient environment. It is also important to recognize that many of the assessment tools listed under activities also contain participation items but are listed under "Activity" due to the majority of items falling under that category.

Assessment of the Life Habits Scale (Life-H)

This tool assesses the life habits, or "those habits that ensure the survival and development of a person in society throughout his or her life" and handicap situations, including ADLs and social roles. The Life-H includes 12 categories (nutrition, fitness, personal care, communication, housing, mobility, responsibilities, interpersonal relationships, community life, education, employment, and recreation). This measure incorporates the interaction of the individual and their environment and may be difficult for patients to respond to prior to community integration while in inpatient rehab. However, participation is based on the individual's perspective of performance and satisfaction information may help to guide clinical interventions, as social participation is a significantly meaningful rehabilitation outcome.³

- Available: <http://www.ripph.qc.ca/>

Quality of Life

Similar to participation measure, assessing the quality of life in the inpatient rehabilitation setting can be challenging to a patient as this is prior to community integration. Multiple instruments exist for utilization in this population however their testing in the SCI population has been limited. For example, though the WHOQOL-BREF is a promising instrument, its psychometric testing in this population and setting is very limited. For that reason, the LISAT was chosen for inclusion in this core set.

Life Satisfaction Questionnaire (LISAT-9-11)

This global QOL assessment is comprised of 1 general question regarding satisfaction with life and 8 questions of other domains (vocational, financial and leisure, contacts with friends, sexual life, self-care management, family life, and partnership relationships). Physical and psychological health were then added to a

more updated version LISAT-11. A 6 point scale from very dissatisfied (1) to very satisfied (6) is used. Though item scores can be summed for a total score, keeping mean item scores may be more beneficial in order to specify QOL in each domain. This relatively short questionnaire covers multiple domains and can provide the necessary information to identify best clinical interventions. It has been used frequently in patients with SCI.^{3, 22}
Available: A copy of the tool can be obtained from the original article²²

Incontinence Quality of Life Questionnaire (I-QOL)

This QOL measure specifically focuses on the impact urinary incontinence has on the individuals QOL. This assessment is divided into the subscales of avoidance and limiting behavior, psychosocial impact, and social embarrassment. Due to the high prevalence of bladder dysfunction in this SCI population, this quick and easy to administer tool is highly used and widely recommended. It has shown to be reliable, valid, and responsive to change in incontinence-related quality of life and may be used pre and post treatment intervention for urinary incontinence or training to reflect subjective efficacy of treatment^{3, 23}.

- Available: The measure can be found in original article²³

References:

- 1.Graves DE, Frankieqics RG, Donovan WH. Construct validity and dimensional structure of the ASIA motor scale. *J Spinal Cord Med.* 2006; 29:39-45.
- 2.Marino RJ, Graves DE. Metric properties of the ASIA motor score: subscales improve correlation with functional activities. *Arch Phys Med Rehabil.* 2004; 85:1804-18010.
- 3.Miller W, Sakakibara B, Noonan V, Tawashy A, Aubut J, Curt A. Outcome Measure Review. SCIRE. 2010. Version 3.0.
- 4.Hol AT, Eng JJ, Miller WC, Sproule S, Krassioukov AV. Reliability and validity of the six-minute arm test for the evaluation of cardiovascular fitness in people with spinal cord injury. *Arch Phys Med Rehabil.* 2007; 88:489-495.
- 5.Curtis KA, Roach KE, Applegate EB, Amar T, Benbow CS, Genecco TD, Gualano J. Development of the Wheelchair User's Shoulder Pain Index (WUSPI). *Paraplegia* 1995;33:290-293.
- 6.Salzberg C A, Byrne DW, Cayten CG, van Niewerburgh P, Murphy JG, Viehbeck M. A new pressure ulcer risk assessment scale for individuals with spinal cord injury. *Am J Phys Med Rehabil* 1996;75:96-104.
- 7.Middleton JW, Tate RL, Geraghty TJ. Self-efficacy and spinal cord injury: psychometric properties of a new scale. *Rehabilitation Psychology* 2003, 48(4): 281-288.
- 8.Benz, E. N., Hornby, T. G., et al. (2005). "A physiologically based clinical measure for spastic reflexes in spinal cord injury." *Arch Phys Med Rehabil* 86(1): 52-59
- 9.Anderson K, Aito S, Atkins M, Biering-Sorensen F, Charlifue S, Curt A, et al. Functional recovery measures for spinal cord injury: An evidence-based review for clinical practice and research. *J Spinal Cord Med.* 2008; 31: 133-144.
10. Functional Independence Measure. Rehabilitation Measures Database-NIDRR. Updated Jan 2013.
<http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=889>. Accessed March 27, 2013.
11. Segal, M., Ditunno, J., et al. (1993). "Interinstitutional agreement of individual Functional Independence Measure (FIM) items measured at two sites on one sample of SCI patients." *Spinal Cord* 31(10): 622-631.
12. Nilsson, Å. L., Sunnerhagen, K. S., et al. (2005). "Scoring alternatives for FIM in neurological disorders applying Rasch analysis." *Acta neurologica scandinavica* 111(4): 264-273.
13. Catz A, Itzkovich M, Tesio L, Biering-Sorensen F, Weeks C, Laramée MT, et al. A multi-center international study on the spinal cord independence measure, version III: Rasch psychometric validation. *Spinal Cord* 2006;44:(in press).
14. Spinal Cord Independence Measure. Rehabilitation Measures Database-NIDRR. Updated Jan 2013.
<http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=967>. Accessed Mar 27, 2013.

15. Quadriplegia Index of Function- Short Form. Rehabilitation Measures Database. Updated Nov 2012.
<http://www.rehabmeasures.org/Lists/RehabMeasures/DispForm.aspx?ID=1074>. Accessed Mar 27, 2013.
16. Marino RJ, Goin JE. Development of a short-form Quadriplegia Index of Function scale. *Spinal Cord* 1999;37:289-296.
17. Lemay JF, Nadeau S. Standing balance assessment in ASIA D paraplegic and tetraplegic participants: concurrent validity of the Berg Balance Scale. *Spinal Cord* advance online publication, 22 September 2009; doi: 10.1038/sc.2009.119.
18. Wirz M, Muller R, Bastiaenen C. Falls in persons with spinal cord injury: Validity and reliability of the Berg Balance Scale. *Neurorehabil Neural Repair* 2010;24: 70-77.
19. Walking Index for Spinal Cord Injury. Rehabilitation Measures Database. Updated Jan 2013.
<http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=957>. Accessed Mar 27, 2013.
20. Wheelchair Skills Test 4.1. Rehabilitation Measures Database. Updated Dec 2012.
<http://rehabmeasures.org/Lists/RehabMeasures/DispForm.aspx?ID=1065> . Accessed Mar 27, 2013.
21. Berry C, Kennedy P, Hindson L. Internal consistency and responsiveness of the skin management needs assessment checklist post spinal cord injury. *J Spinal Cord Med* 2004;27:63-71.
22. Fugl-Meyer A, Branholm IB, Fugl-Meyer K. Happiness and domain specific life satisfaction in a north northern Swedes. *Clin Rehabil*. 1991; 5:25-33.
23. Schurch et al. "Reliability and validity of the incontinence quality of life questionnaire in patients with neurogenic urinary incontinence." *Archives of Physical Medicine and Rehabilitation* 2007; 88: 646-52.