Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Research Summary – Functional Independence Measure (FIM) – Self Care and Daily Living

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
Espindula et al. (2023) Cross-sectional study of the Participation Scale (P-scale) SARAH Network of Rehabilitation Hospitals, Brazil.	N=100 Age: mean 38.9 ± 12.80 years Male: 74% Traumatic injury: 72%	The participation scale (P-scale) showed a low to fair relationship with the motor domain of the FIM scale ($r_s = -0.280$; $P = 0.005$), with the cognitive domain of the FIM Scale ($r_s = -0.520$; $P < 0.001$),		
Maritz et al. (2022) Rasch-based score equating based on a common person design to investigate the psychometric properties of FIM™ and SCIM	A total of 663 patients with SCI were assessed 1–6 times for 6 weeks, resulting in a total of 985 observations. Approximately 66% of the patients participated in one wave of data collection, 22.3% in two waves, 8.5% in three waves, and 2.5%	The findings of the Rasch analysis supported the use of SCIM motor scores over FIM™ motor scores because of the larger operational range of SCIM.		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
and to equate the 2 scales Swiss inpatient rehabilitation	in four waves of data collection.			
Vasilchenko et al. (2022) Psychometric study to conduct a cross-cultural adaptation of the Russian version Work Rehabilitation Questionnaire (WORQ) and test its psychometric properties in a sample of SCI Inpatient	N=304 247M, 57F Mean (SD) age 38 (11.3) years Mean (SD) time since injury 7.2 (7.1) years Paraplegia (n = 158), tetraplegia (n = 146) AIS A (n = 95), AIS B (n = 83), AIS C (n = 79), AIS D (n = 47)	The WORQ-R score showed a strong negative correlation with FIM (0.626, $p < 0.001$), meaning individuals with higher work functioning had higher levels of functional independence.		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
setting of the Department of Neurosurgery of the Federal Centre of Disability Rehabilitation of Novokuznetsk, Russia				
Tyner et al. 2022 Cross-sectional study to evaluate the psychometric properties of the Spinal Cord Injury-Functional Index (SCI-FI) instruments in a community-dwelling sample Six SCI Model Systems sites: Craig Hospital,	N=269 193M, 64F Mean (SD) age 43.8 (15.5) years Mean (SD) time since injury 6.8 (8.7) years Diagnosis: Paraplegia complete (n = 54), paraplegia incomplete (n = 72), tetraplegia complete (n = 30), tetraplegia incomplete (n = 89), unknown (n = 24)	**Convergent validity:** Positive correlations with the motor FIM scores were in the moderate to large range, with r values ranging from .44 to .64 (P<.01) See table 1 below.		
	Table 1. Pearson correlations (*r*) between SCI-FI instruments and clinical assessments			

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

<table>
<tr><th>Author Year Country Research Design Setting</th><th>Demographics and Injury Characteristics of Sample</th><th>Validity</th><th>Reliability</th><th>Responsiveness Interpretability</th></tr>
<tr><td>Kessler Foundation, Mount Sinai Medical Center, New England Regional SCI Center (Boston Medical Center and Gaylord Hospital), Rehabilitation Institute of Chicago (now the Shirley Ryan AbilityLab), and the University of Michigan.</td><td colspan="4">
<table>
<tr><th>SCI-FI Bank Domain</th><th>Mode</th><th>SRFM</th><th></th><th>FIM</th><th></th></tr>
<tr><th></th><th></th><th>r</th><th>n</th><th>r</th><th>n</th></tr>
<tr><td>Ambulation/C</td><td>CAT</td><td>.69</td><td>91</td><td>.52</td><td>77</td></tr>
<tr><td></td><td>Short Form (11a)</td><td>.69</td><td>90</td><td>.44</td><td>75</td></tr>
<tr><td>Basic Mobility/C</td><td>CAT</td><td>.86</td><td>263</td><td>.59</td><td>203</td></tr>
<tr><td></td><td>Short Form (11a)</td><td>.89</td><td>198</td><td>.64</td><td>260</td></tr>
<tr><td>Fine Motor/C</td><td>CAT</td><td>.79</td><td>203</td><td>.57</td><td>263</td></tr>
<tr><td></td><td>Short Form (9a)</td><td>.81</td><td>202</td><td>.57</td><td>262</td></tr>
<tr><td>Self-Care/C</td><td>CAT</td><td>.86</td><td>203</td><td>.6</td><td>263</td></tr>
<tr><td></td><td>Short Form (11a)</td><td>.88</td><td>203</td><td>.61</td><td>263</td></tr>
<tr><td>Wheelchair Mobility/AT</td><td>CAT</td><td>.83</td><td>163</td><td>.61</td><td>212</td></tr>
<tr><td>Manual Wheelchair/AT</td><td>Short Form (10a)</td><td>.73</td><td>102</td><td>.56</td><td>135</td></tr>
<tr><td>Powered Wheelchair/AT</td><td>Short Form (9a)</td><td>.81</td><td>80</td><td>.44</td><td>107</td></tr>
</table>
NOTE. All correlations were significant P<.01.
*SCI-FI/Capacity (C) banks (ie, Ambulation, Basic Mobility, Fine Motor, Self-Care) and SCI-FI/Assistive Technology (AT) bank (Wheelchair Mobility)
Self-Report Functional Measure (SRFM)
</td></tr>
<tr><td>Flett et al. (2019)</td><td>N=754 (244F, 510M) all participating in</td><td></td><td></td><td>Se: sensitivity, Sp: specificity, PPV: positive predictive</td></tr>
</table>

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
Retrospective cohort Two tertiary rehabilitation centers	inpatient SCI rehabilitation Mean age at injury = 53.9 ± 18.5 SCI 303 Traumatic 451 Non-traumatic 325 Tetraplegia 376 Paraplegia 53 Unknown 111 Complete Injury 582 Incomplete Injury 61 unknown			value, NPV: negative predictive value Sensitivity and specificity analysis for FIM subscales, scales, and items with AUC ≥ 0.70 Braden Scale Se: 0.82, Sp:0.59, PPV:0.35, NPV: 0.93 SCIPUS Scale Se:0.85, Sp:0.37, PPV:0.38, NPV:0.85 FIM Scale Se:0.89, Sp:0.57, PPV:0.35, NPV:0.95 Subscales: FIM Self-care subscale, Se:0.86, Sp:0.54, PPV:0.33, NPV:0.94 FIM transfers subscale, Se:0.89, Sp:0.65, PPV:0.36, NPV:0.96 FIM Motor subscale, Se:0.89, Sp:0.58, PPV:0.35, NPV:0.95

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
				Scale Items: FIM bathing, Se:0.98, Sp:0.33, PPV:0.42, NPV:0.97 FIM bladder, Se:0.79, Sp:0.57, PPV:0.30, NPV:0.92 FIM bowel, Se:0.84, Sp:0.58, PPV:0.32, NPV:0.94 FIM dressing lower body, Se:0.91, Sp:0.45, PPV:0.35, NPV:0.94 FIM toileting, Se:0.97, Sp:0.45, PPV:0.38, NPV:0.97 FIM bed/chair transfer, Se:0.83, Sp:0.63, PPV:0.34, NPV:0.95 FIM tub/shower transfer, Se:0.89, Sp:0.56, PPV:0.34, NPV:0.95 FIM toilet transfer, Se:0.89, Sp:0.61, PPV:0.35, NPV:0.96

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
Almeida et al (2016) Cross-sectional validation, using Brazilian SCIM-III & FIM Neurology and Rehabilitation Clinics of the Ribeirão Preto Medical School of the University of São Paulo	N=30 (10M, 20F) nontraumatic SCI individuals N=17 ambulates without assistance, N=9 used mobility aids, N=2 cannot walk independently Etiologies: N=15 familial N=5 infectious disease N=6 under investigation N=4 other myelitis	Spearman's rho between: SCIM-III and motor FIM: .6, p<.01 SCIM-III Grooming and FIM self-care: .8, p=.001 SCIM-III respiration & sphincter and FIM sphincter: .6, p=.0005 SCIM-III mobility indoor & outdoors and FIM locomotion: .6, p=.0006		
Graham et al. (2014) Analysis of secondary data 300+ US inpatient rehabilitation facilities that contributed data to the	N=6663, 29.3%F 70.7%M Age breakdown: <45: 44.6% 45-64: 30.2% 65-74: 12.8% >= 75: 12.4% Admission: Living alone: 17.6% Living in community: 98.6% Discharge:			Mean scores (mean, mean(SD) or percentage; N=6663): Admission: FIM motor: 30.3(14.0) Sphincter domain: 2.4 Self-care domain: 2.7 Transfer domain: 2.0 Locomotion domain: 1.6 FIM cognition: 29.9(5.6)

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
UDSMR; Jan 2002 ~ Dec 2010	Living alone: 7.2% Living in community: 82.5% Follow-up: Living alone: 12.1% Living in community: 92.5% Employed: 8.0% Unemployed: 42.0% Retired: 45.1%			Communication domain: 6.2 Social cognition domain: 5.9 FIM total: 60.2(16.1) Living alone: 17.6% Living in community: 98.6% Discharge: FIM motor: 55.0(20.0) Sphincter domain: 4.0 Self-care domain: 4.6 Transfer domain: 4.1 Locomotion domain: 3.8 FIM cognition: 32.3(4.1) Communication domain: 6.6 Social cognition domain: 6.4 FIM total: 87.3(21.4) Living alone: 7.2% Living in community: 82.5% Follow-up*: FIM motor: 66.6(23.2) Sphincter domain: 5.3 Self-care domain: 5.4

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
				Transfer domain: 5.0 Locomotion domain: 4.2 FIM cognition: 33.6(3.0) Communication domain: 6.8 Social cognition domain: 6.7 FIM total: 100.2(24.3) Living alone: 12.1% Living in community: 92.5% Admission - discharge change: FIM total: 27.8(15.5) Discharge – follow-up* change: FIM total: 12.8(16.5) *80~180 days after discharge (mean 104, SD 23, median 95, IQR 87-114)
Barbetta et al. (2014) Retrospective cohort study , Brazil	N=218, 176 male Mean age 30.9 yrs SCI patients hospitalized in 2006	Regarding the validity of the FIM scale, we observed a good correlation between the level of injury and the total FIM score,		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
SARAH Network of Rehabilitation Hospitals, Brasília, Brazil.	Excluded patients with injury @ C4 or above AIS-A=130; B=30; C=20; D=20	the motor score (*r*=0.64) and each of the 13 items of motor scores, when evaluated separately which ranged from 0.13 to 0.74. The item 'stairs' showed the lowest correlation index and 'eating' the highest correlation. The cognitive FIM score and assessment of its five items separately showed no correlation with the level of injury.		
Oleson & Marino (2014) Longitudinal, with convenience sample Studying the revised CUE-Questionnaire	N=46, 42 male Median age 44±21 yrs AIS-A = 14, B = 5, C = 8, D = 19 Right motor lvl: C1-C4 = 11, C5 = 25, C6 = 7, C7-C8 = 3 Left motor lvl: C1-C4 = 9, C5 = 27, C6 = 5, C7-C8 = 5 28 Caucasian, 18 African-American	Spearman Correlations of: Modified CUE-Q total score at: Admission: With FIM-Self Care: r=.73 Discharge: With FIM-Self Care: r=.80		Effect Size of change (FIM selfcare subscale): 1.38

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	**Demographics and Injury Characteristics of Sample**	**Validity**	**Reliability**	**Responsiveness Interpretability**
(5pt instead of 7pt scale) "Data were obtained at admission and discharge from acute inpatient rehabilitation"	Etiology: fall = 18, MVA = 17, sports = 8	Modified CUE-Q score change between admission and discharge: With FIM-Self Care: r=.51		
Koca et al. (2014) Physical Medicine and Rehabilitation Outpatients Clinic of Gaziantep University, Gaziantep, Turkey	N=44 (15F, 29M) Age: 34.25 ± 4.42 Time since SCI (months): 31.2 ± 4.7 AIS A: 14 AIS B: 9 AIS C: 10 AIS D: 11	With BDI (Beck Depression Index) score (Pearson r= -.674, p < .001)		
Horn et al. (2013) Prospective observational cohort study	N=1376, 81.2% male Mean age 37.7, SD=16.7 Patients >= 12 yrs of age Lvl C1-4 & AIS-A/B/C = 28.4%	The only independent variables that were highly correlated (*r*>.75) were admission motor FIM and the CMG tier weight with a correlation of *r*=−.86.		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	**Demographics and Injury Characteristics of Sample**	**Validity**	**Reliability**	**Responsiveness Interpretability**
Inpatient rehabilitation and community followup at 6 US SCI treatment centers	Lvl C5-8 & AIS-A/B/C = 19.8% Paraplegia & AIS-A/B/C = 36.2% AIS-D = 15.6%			
Kozlowski & Heinemann (2013) Observational longitudinal secondary analysis Six rehabilitation facilities participating in the SCIRehab project	N=1146 81.2%M 18.8%F Mean age 37, SD=16.5 Level and completeness of injury: C1~C4 AIS-A~C: N=314 C5~C8 AIS-A~C: N=229 Paraplegia AIS-A~C: N=422 AIS-D: N=181 Days from injury to admission: mean 30.0, median 22.0, SD 26.0 Rehab length of stay (days): mean 55.0, median 44.0, SD 42.0 Days from admission to discharge: mean 57.0, median 46.0, SD 44.0			Mean FIM subscores (mean median (SD); N=1146): Admission: motor (13-item): 18 21 (28) motor (11-item*): 17 20 (27) transfer (3-item): 6 0 (9) self-care (6-item): 26 32 (44) upper (3-item): 34 38 (56) lower (3-item): 11 0 (23) Discharge**: motor (13-item): 37 39 (19) motor (11-item*): 37 39 (20) transfer (3-item): 34 34 (55) self-care (6-item): 51 56 (24)

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
	Days from admission to follow-up: mean 444.0, median 407.0, SD 134.0			upper (3-item): 65 70 (39) lower (3-item): 42 47 (37) Follow-up***: motor (13-item): 47 47 (29) motor (11-item*): 47 49 (28) transfer (3-item): 56 66 (100) self-care (6-item): 65 68 (55) upper (3-item): 74 100 (47) lower (3-item): 59 66 (77) *13-item motor subscale without 2 sphincter items **Days from admission to discharge: mean 57.0, median 46.0, SD 44.0 *** Days from admission to follow-up: mean 444.0,

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
				median 407.0, SD 134.0
Soler et al. (2013) Postal surveys; Validation of Spanish MPI-SCI (MPI-SCI-S) Guttmann Institute, Barcelona, Spain	N=126, 78M 48F Mean age 49.0±13.8 Mean time since injury 11.8±10.8 yrs AIS-A/B/C = 78/20/28 43 traumatic, 83 nontraumatic Chronic pain (>1yr) & SCI (>2yr) & pain rating of >=3 on Numerical Rating Scale	Pearson's r btwn: MPI-SCI general activity subscale and FIM: .35, p<.05	**Internal consistency** Cronbach's alpha: 0.88	
Poncumhak et al. (2013) Tertiary referral hospital in Thailand	Validity Test: N=66 (46M, 20 F) FIM-L 6: n=33 Age: 50.9 ±13.4 FIM-L 7: n=33 Age: 50.2 ±9.5 Reliability Test: N=16 (11M, 5F) Age: 50.8 ±10.3	FIM-L (FIM locomotion subscale) with 10mWT Point biserial coefficient r_{pb}=.778 (p<.001)		
Ovechkin et al. (2013)	N= 11 (3F, 8M) Age: 48 ± 19 AIS A: 4 AIS C: 1	FIM motor score correlated (Spearman) with the following:		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
Prospective cohort study University of Louisville	AIS D: 6	AIS: r= .57 (not significant) SCIM III total: r=.88 (p< .01) SCIM III Self-care: r=.88 (p< .01) SCIM III Mobility: r=.86 (p< .01) WISCI: r= .69 (p<.01)		
Anderson et al. (2011) Multi-center, prospective, cohort study Inpatient rehabilitation hospitals in the US	N= 390 (294 M, 96 F) Mean age at injury= 45.3 ± 17.9 SCI 270 Traumatic 120 Non-traumatic 187 Tetraplegia 203 Paraplegia AIS A = 135 AIS B = 54 AIS C = 80 AIS D = 121	The Pearson correlation coefficients for the FIM and the Spinal Cord Independence Measure III (SCIM III) first rater or the SCIM III second rater were both .80 (P<.001). For all subscales, the SCIM III was in agreement with the FIM in responding to functional change (P<.0001)		For all subscales, the Spinal Cord Independence Measure III (SCIM III) was in agreement with the FIM in responding to functional change (P<.0001). For the respiration and sphincter management subscale, the SCIM III was more responsive to change than the FIM (P<.0001)

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
Jackson et al. (2008) A subcommittee of international experts evaluated locomotion measures	N=54 expert raters	FIM – Locomotion item was rated as Valid/Useful by 6%, Useful But Requires Validation or Changes by36% , and Not Useful or Valid for Research in SCI by 58%		
Itzkovich et al. (2007) Cohort study 13 spinal cord units in six countries from North America, Europe and the Middle East.	N=425 (309M, 116F) Mean age = 46.93 Tetraplegia = 188 Paraplegia = 237 Inclusion criteria included: age ≥ 18 and no concomitant impairments that might influence everyday function. Traumatic SCL participants = 261	Pearson correlation w/ Functional Independence Measure (FIM): 1st rater: r = .790 (P<.01) 2nd rater: r = .779 (P<.01) McNemar test comparing SCIM III subscale scores to FIM tasks that match those subscales: The responsiveness of the SCIM III was better		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
	Non-traumatic SCL participants = 164, including: Spinal stenosis = 23; benign tumor = 27, disc protrusion = 25; myelopathy unknown = 16; syringomyelia = 5; decompression sickness = 3; multiple sclerosis = 2; congenital anomaly = 2 spinal abscess = 2; metastatic disease = 2; other = 41.	than that of the FIM in the Respiration and sphincter management and Mobility indoors and outdoors subscales. In the Self care and Mobility in the room and toilet subscales, differences between the two scales were statistically non significant: Self care: 1st rater: P<.360 2nd rater: P<.533 Respiration and sphincter mgmt: 1st rater: P<.001 2nd rater: P<.001 Mobility in the room and toilet: 1st rater: P<.341 2nd rater: P<.784		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		Mobility indoors and outdoors: 1st rater: P<.001 2nd rater: P<.001		
Ditunno et al. (2007) Single-blinded, parallelgroup, multicenter randomized clinical trial 6 regional SCI inpatient rehab. centres	N= 146 (114M, 32F) Mean age = 32 years (range 16 – 69 years) Duration of SCI <= 8 weeks Incomplete spinal cord injury patients who had a Functional Independence Measure locomotor score for walking of < 4 on entry.	**Spearman correlation w/Walking Index for SCI** At 3 months: r = .73 At 6 months: r = .77 At 12 months: r = .74 All P<.001 **Spearman correlation w/Berg Balance Scale** At 3 months: r = .76 At 6 months: r = .72 At 12 months: r = .77 All P<.001 **Spearman correlation w/50-Foot Walking Speed** At 3 months: r = .57 P<.001		
Lawton et al. (2006)	N=647 (408M, 239F; Denmark = 168; Israel = 153;	The present scoring system for the FIM motor and cognitive		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
Cross-sectional study 19 rehabilitation facilities from four countries in Europe	Italy = 226; UK = 100) Mean age = 46 (range: 11-93 yrs)	scales, that is a seven category scale, was found to be invalid, necessitating extensive rescoring. Following this, differential item functioning was found in a number of items within the motor scale, requiring a complex solution of splitting items by country to allow for the valid pooling of data. The FIM cognitive scale fitted the Rasch model after rescoring, but there was a substantial ceiling effect. Only after refitting to the Rasch model could data from the FIM motor score scale be pooled, or compared from		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		country to country. The FIM cognitive scale works well following rescoring, and data may be pooled, but many patients were at the maximum score.		
Lundgren-Nilsson et al. (2006) Cross-sectional study 9 rehabilitation facilities in Scandinavia	N=471 Stroke=157 SCI=157 TBI=157 Age range=11-90 Male=70%		**Internal consistency** The SCI data had a significant item-trait interaction. The person separation index was between .94 and .96. A Person Separation Index is calculated as the base for estimating internal consistency reliability, where the estimates on the logit scale for each person are used to calculate reliability. The interpretation is similar to Cronbach's alpha. The PSI	

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
			indicates the degree to which the scale can separate patients into discrete groups. A value of .7 is the minimum required to discern two groups.	
Graves et al. (2006) Secondary analysis. Review of reports, investigating the ASIA motor scores (AMS) and the FIM. National Spinal Cord Injury Statistical Center Database.	440-de-identified records were extracted from a clinical database with complete data from the discharge evaluation on the AMS and the FIM motor scores. First factor of FIM: functional abilities. Second factor of FIM: motor function.	r = .642 between FIM factors (upper extremity and lower extremity) The two FIM factors accounted for 81% of variance in ASIA (AMS) scores; first factor (70%), second factor (11%). The two American Spinal Cord Injury Association motor score (AMS) factors (upper extremity and lower extremity) predict 73% of the variance in the first		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		factor and 56% of the second factor of FIM.		
Spooren et al. (2006) Longitudinal cohort study SCI Units in 8 rehabilitation centres in the Netherlands	N=60 (46M, 14F) Mean age = 38.9 Acute SCI C3-C6 = 42 C7-T1 = 18 AIS A-B = 34 AIS C-D = 26			t1-t3 = from start of rehab to discharge t1-t2 = from start of rehab to 3 months later t2-t3 = from 3 months after the start of rehab to discharge. For the interpretation of SRM and ES, a value of 0.20 was considered small, a value between 0.50 and 0.80 was moderate and > 0.80 was large degree of responsiveness. **Total FIM**: there was a significant difference in the FIM scores across the three measurements (Friedman, P<.001). There was a significant difference between all time

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
				intervals (Wilcoxon; P<.001) SRMFIM3-1 = 1.47 SRMFIM2-1 = 1.16 SRMFIM3-2 = 0.85 ESFIM3-1 = 2.08 ESFIM2-1 = 1.36 ESFIM3-2 = 0.42 **Groups A-B and C-D:** There was a significant difference across the three measurements for both groups (Friedman, P<.001). There were significant differences between all time intervals (Wilcoxon, P<.001) **Group A-B** SRMFIM3-1 = 1.23 SRMFIM2-1 = 1.40 SRMFIM3-2 = 0.77 ESFIM3-1 = 2.01 ESFIM2-1 = 1.08 ESFIM3-2 = 0.79

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
				Group C-D SRMFIM3-1 = 1.94 SRMFIM2-1 = 1.46 SRMFIM3-2 = 0.99 ESFIM3-1 = 2.47 ESFIM2-1 = 1.83 ESFIM3-2 = 0.37 **Groups C3-C6 and C7-T1:** There was a significant difference across the three measurements for both groups (Friedman, P<.001). There were significant differences between all time intervals (Wilcoxon, P<.002) **Group C3-C6** SRMFIM3-1 = 1.35 SRMFIM2-1 = 1.07 SRMFIM3-2 = 0.84 ESFIM3-1 = 2.12 ESFIM2-1 = 1.45 ESFIM3-2 = 0.34 **Group C7-T1** SRMFIM3-1 = 1.86

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
				SRMFIM2-1 = 1.39 SRMFIM3-2 = 0.95 ESFIM3-1 = 2.08 ESFIM2-1 = 1.25 ESFIM3-2 = 0.63
Middleton et al. (2006) Repeated-measures design to assess the validity and responsiveness of 5 additional mobility and locomotor items when used in conjunction with the FIM Specialized acute spinal and rehabilitation units in Sydney, Australia.	N = 39 (32M, 7F) Paraplegic = 28 Tetraplegic = 11 Median age = 28 Paraplegic: ASIA motor: Initial = 50 (50-50) 6 months = 50 (50–56) ASIA sensory: Initial = 137 (100-146) 6 months = 130 (104-149) Tetraplegic: ASIA motor: Initial = 17 (13-23) 6 months = 24 (18–31) ASIA sensory: Initial = 44 (31-84)	Construct of the 5-AML was assessed by testing ability of items to discriminate between different impairment groups (tetraplegia and paraplegia **All locomotor items failed to discriminate between the paraplegic and tetraplegic groups.**		Responsiveness was assessed by analysing ability to detect changes in mobility and locomotor function over time Mobility items: Bed transfer: reasonable responsiveness over time for the paraplegic group but less so for the tetraplegic group. Toilet transfer: similar to bed transfer Bath transfer: similar to bed transfer

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	**Demographics and Injury Characteristics of Sample**	**Validity**	**Reliability**	**Responsiveness Interpretability**
	6 months = 68 (42-122)			Locomotor items: Push/walk: not responsive Stair item: not responsive **Floor/ Ceiling Effects:** Mobility items: Bed transfer: ceiling effect for paraplegic group; floor effect for the tetraplegic group. Toilet transfer: similar to bed transfer Bath transfer: similar to bed transfer Locomotor items: Push/walk: ceiling effect Stair item: floor effect
Nilsson (2005) Cross-sectional study	N=358 (64% male) Median age = 48, range; 16-90	Rasch analysis: Motor scale items: Misfit – Infit mean square values: Bladder =1.59, Walk/Wheelchair=1.29, Stairs=3.56 Misfit	**Internal consistency** In the Rasch model; reliability of a measure is evaluated in terms of separation;	

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
Rehabilitation centres in Scandinavia.		Outfit: Bladder =2.10, Bowel=1.42, Walk/Wheelchair=1.53, Stairs=4.70 No misfits within Social-cognitive items.	3 category FIM was found to be the best model for motor items: Real person separation = 2.28 Real person reliability = .84 Item reliability = .99 4 category FIM was found to be the best model for social/cognitive items: Real person separation =0.67 Real person reliability = .31 Item reliability = .90 (reliability can be interpreted as Chronbach's alpha; separations of 2 and	

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
			below are considered low)	
Morganti et al. (2005) Retrospective Analysis Rehab Hospital in Italy	Total sample: N=284 patients (184M, 100F) Mean age: 50.4±19.3 years WISCI 0 to 20 Validity sample: N=76 WISCI 1 to 19 Traumatic or non traumatic SCLs admitted between 1997-2001. Non-traumatic etiology was present in the majority of the patients (177/284): inflammatory (4), vascular (36), neoplastic (39), degenerative (62); traumatic lesions (107/284): car accident (38), motorcycle	Walking Index for Spinal Cord Injury: ρ= .70 Rivermead Mobility Index: ρ=.9 Barthel Index: ρ=.7 Spinal Cord Independent Measure: ρ=.8 All P<.001	**Inter-rater reliability:** r=.90 (P<.001)	

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
	accident (15), sport accident (&), act of violence (6), suicide attempts (6), and accidental falls (31).			
Marino & Graves (2004) Secondary analysis of prospectively collected data Model Spinal Cord Injury Systems centers	N=4338 SCI patients (3443M, 895F) Median age = 33 years AIS grade: A: N= 2049 B: N= 511 C: N= 655 D: N= 1123		Use of separate ASIA upper-extremity and lower-extremity motor scores improved prediction of motor FIM scores over that of total ASIA motor score (R^2 for motor FIM score, .71 vs .59).	
Donnelly et al. (2004) Retrospective analysis Spinal cord injury unit at GF strong in Vancouver BC	N=41 (29M, 9F, 3 individuals' demographics were not reported) Mean age=49±18.1 years 3 individuals demographics were not reported Paraplegia = 18 Tetraplegia = 20	Relationship between COPM & Functional Independence measure (FIM) motor scores Admission FIM motor & COPM Performance r=.452, (P<.001) Admission FIM motor & COPM Satisfaction r=.514, (P<.001)		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
	Incomplete = 27 Complete = 11 Mean time since injury (days) = 52±73.1	Discharge FIM motor & COPM Performance r=.388, (P<.05) Discharge FIM motor & COPM Satisfaction r=.513, (P<.05) Change FIM motor & COPM Performance r=.351, (P<.05) Change FIM motor & COPM Satisfaction r=.475, (P<.05)		
Beninato et al. (2004) Retrospective review Acute rehabilitation hospitals, Boston, MA, USA	N=20 (16M, 4F) Mean age 36.8±13.4yrs (range 18-62yrs Inpatients at one of 2 acute rehab hospitals in Boston, MA. 7 C5, 11 C6, 2 C7 13 AIS A, 6 AIS B, 1 anterior cord syndrome Admitted to rehabilitation within 1 year of injury	*MMT scores were compared to FIM scores (all data taken from time of discharge).* **Spearman's rank correlations.** Manual Muscle Test: Elbow flexion and 10 of 12 FIM tasks: ρ=.48-.75 Shoulder flexion and 8 of 12 FIM tasks: ρ=.45-.72		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
	Excluded incomplete individuals with abdominal or lower extremity MMT scores of ≥2.	Wrist extension and 7 of 12 FIM tasks: ρ=.52-.64 Elbow extension and 6 of 12 FIM tasks: ρ=.57-.69 Wrist flexion and 5 of 12 FIM tasks: ρ=.56-.73 Shoulder extension and 2 of 12 FIM tasks: ρ=.59-.76 Significance at p<.05 for all. The strongest correlations existed between left shoulder extension and bladder management (.76), elbow flexion to toileting (.75), wrist flexion to toilet/tub/shower transfers (.73), and shoulder flexion and right shoulder extension to dressing		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		upper body (.71 and .72, respectively). No significant correlations were found between any MMT muscle group and the FIM task of locomotion (wheelchair).		
Mulcahey et al. (2004) Methodological study Shriners Hospitals for Children, Philadelphia, Pennsylvania	N=16 Age range: 7-20 years All had cervical level SCI. 3 had strong C6 or C7 function and underwent bilateral surgical tendon transfers, 16 had C5 or weak C6 level SCI and underwent unilateral surgical implantation of the Freehand System.	Relationship between GRT objects at post-rehabilitation and 12 month Functional Independence Measure (FIM) Scores Fork from Grasp and Release Test (GRT) & 12-month FIM: $\rho = .624$ ($P<.01$) Can from GRT & 12-month FIM: $\rho = .700$ ($P<.01$) Videotape from GRT & 12-month FIM: $\rho = .503$ ($P<.05$)		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		Non-significant items from GRT and 12-month FIM were: peg, block, paperweight, and total number of objects		
Middleton et al. (2003) Descriptive, correlational study, validation study of a new instrument Moorong Spinal Unit of the Royal Rehabilitation Centre Sydney, Sydney, New South Wales, Australia.	Sample 1: People with SCI living in the community who previously were at in-patient rehabilitation N=36, 28 male Mean age 36.33 (SD = 9.52) Mean time post-trauma 11.23 (SD = 9.67) years 11 paraplegia, 25 tetraplegia 15 incomplete, 21 complete Sample 2: People who had recently sustained a SCI and were currently enrolled at in-patient rehabilitation	Spearman correlations with Moorong Self-Efficacy Scale (Sample 1 only, N=36): Functional Independence Measure (FIM) motor (N=34): .04 (P>.05) FIM cognitive: -.39 (P<.05)		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	**Demographics and Injury Characteristics of Sample**	**Validity**	**Reliability**	**Responsiveness Interpretability**
	N=31, 23 male Mean age 31.48 (SD = 10.46) Mean time post-trauma 2.01 (SD = 2.50) months 21 paraplegia, 10 tetraplegia 13 incomplete, 18 complete Sample 3: People with SCI living in the community who previously were at in-patient rehabilitation N=108, 30 male Mean age 45.26 (SD = 15.99) Mean time post-trauma 7.92 (SD = 9.83) years 66 paraplegia, 42 tetraplegia 58 incomplete, 49 complete			
Kucukdeveci et al. (2001)	N=62 (27M, 35F) Mean age 32.7yrs	*Total and subscale scores of FIM were*	**Internal consistency** Cronbach's alpha.	

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	**Demographics and Injury Characteristics of Sample**	**Validity**	**Reliability**	**Responsiveness Interpretability**
Longitudinal study to adapt the FIM in Turkey Inpatient rehab centre, Turkey	Mean DOI 16.4mo (range 1-210mo). 21% cervical, 42% thoracic, 37% lumbar.	*correlated to ASIA motor impairment scale at admission and discharge.* **Kruskall-Wallis test and Spearman's Rho.** FIM total motor scores were more strongly correlated to ASIA motor scores (admission: r=.58, P<.01; discharge: r=.76, P<.01) compared to ASIA sensory scores (admission: r=.40, P<.01; discharge: r=.49, P<.01). (There was medium to high correlation between most of the FIM motor subscale scores and ASIA motor/sensory scores.) ASIA scores were not correlated with FIM cognitive scores.	Admission: Motor subscale α=.934 Cognitive subscale α=.983 Discharge: Motor subscale α=.953 Cognitive subscale α=.930 **Test-retest, Inter-rater, Intra-rater** Intraclass correlation coefficient. Mean ICC=.90 (motor) and .98 (cognitive) Kappa statistic. Range K=.48 – 1.00	

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		FIM data were fitted to the Rasch Model (one-parameter Item Response Theory) to test for unidimensionality of the scales. Bladder and bowel management scores show a considerable level of misfit, which compromises the unidimensionality of the motor scale. Grooming showed higher than acceptable variability.		
Dijkers & Yavuzer (1999) Secondary analysis National Spinal Cord Injury Database	N=4,128 (3323M, 805F) Mean age = 37.5 Complete tetraplegia = 23.7% Incomplete tetraplegia = 28.1% Complete paraplegia = 31.1%	*Satisfaction With Life Scale (SWLS) scores were correlated to those for the Functional Independence Measure (FIM) and the Craig Handicap Assessment and*		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
	Incomplete paraplegia = 17.0%	*Reporting Technique (CHART).* **ANOVA and Eta².** Both FIM subscales (motor and socio-cognitive) and all four CHART subscales (physical independence, mobility, social integration and occupation) were significantly correlated to SLWS scores (P<.001). Effect size (Eta²): <u>FIM</u> Motor score: F=22.26, df=5 (P<.001); η^2=0.05 Sociocognitive score: F=19.98, df=2 (P<.001); η^2=.02 **Stepwise Regression Analysis.**		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		(Beta weights and significance level indicated in brackets.) Adding the FIM motor (0.21, P<.0001) and sociocognitive (0.10, P<.0001) variables into the regression produced an R^2 value of .14. Adding the CHART subscales of physical independence, mobility (0.26, P<.0001), occupation (0.10, P<.001) and social integration (0.11, P<.0001) produced an R^2 value of .23.		
Hall et al. (1999) Descriptive study of FIM raw data collected at 1,2 and 5 years after injury	Persons with SCI, age 16 and over Data were available for: N=3971 at rehab admission (≤60 days post-SCI) N=4033 at discharge		**Internal consistency** Motor items were highly inter correlated (r=.58-.92).	Mean (SD) Motor FIM scores at rehabilitation admission, discharge, and 1, 2, and 5 years post injury. (AIS

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	**Demographics and Injury Characteristics of Sample**	**Validity**	**Reliability**	**Responsiveness Interpretability**
National Database of the 18 Spinal Cord Injury Model System	N= 903 at 1-yr post injury N=712 at 2-yrs post injury N=570 at 5-yrs post injury			Grades A, B, C individuals) See table 2 below Mean (SD) Cognitive FIM scores at rehabilitation admission, discharge, and 1, 2, and 5 years post-injury (AIS A, B, and C individuals) See table 3 below Mean Motor FIM scores at rehabilitation, admission and discharge by level and completeness of injury: See table 4 below **Floor/ Ceiling Effects:** Ceiling effects of the FIM cognition items.

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
				80-90% of the cases avg. 6 or 7 (on a 7point scale) across the 5 FIM cognition items. High tetraplegia- Floor - Motor score Admisssion=86% Discharge=14-21% 1 Years=28-30% 2 Years=25% 5 Years=13% High tetraplegia – Ceiling - Cognition score Admission=59-61% Discharge=80-81% I Year=89-90% 2 Years=96% 5 Years=98% Low tetraplegia – Floor - Motor score Admission=58-61% Discharge=1-3% I Year=5-6% 2 Years=4%

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
				5 Years=3% Low tetraplegia – Ceiling - Motor score Admission=0% Discharge=2-4% I Year=15-18% 2 Years=18% 5 Years=16% Low tetraplegia – Ceiling - Cognition score Admission=67-69% Discharge=84-86% I Year=94-95% 2 Years=99% 5 Years=96% Paraplegia - Ceiling – Motor score Admission=0% Discharge=23-36% I Year=55-57% 2 Years=66% 5 Years=75%

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

<table>
<tr><th>Author Year Country Research Design Setting</th><th>Demographics and Injury Characteristics of Sample</th><th>Validity</th><th>Reliability</th><th>Responsiveness Interpretability</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Paraplegia – Ceiling – Cognitive score
Admission=75-76%
Discharge=90-93%
I Year=97-98%
2 Years=98%
5 Years=99%</td></tr>
<tr><td></td><td colspan="4">Table 2
<table>
<tr><th>FIM Motor</th><th>Admission</th><th>Discharge</th><th>1 yr status post</th><th>2 yr status post</th><th>5 yr status post</th></tr>
<tr><td>C1-C3</td><td>14.1(4.7) n = 156</td><td>18.6 (7.8) n = 115</td><td>25.4 (22.2) n = 29</td><td>26.5 (26) n = 17</td><td>22.1 (15.0) n = 18</td></tr>
<tr><td>C4</td><td>14.9 (6.1) n = 517</td><td>23.1 (11.6) n = 458</td><td>26.9 (19.6) n = 118</td><td>25.4 (17.0) n = 87</td><td>24.9 (14.9) n = 52</td></tr>
<tr><td>C5</td><td>16.0 (7.9) n = 578</td><td>31.3 (15.0) n = 433</td><td>35.6 (20.7) n = 91</td><td>37.5 (22.7) n = 81</td><td>38.5 (22.6) n = 67</td></tr>
<tr><td>C6</td><td>16.9 (7.8) n = 313</td><td>37.4 (14.3) n = 394</td><td>39.7 (19.6) n = 89</td><td>46.7 (21.9) n = 75</td><td>42.2 (20.2) n = 63</td></tr>
<tr><td>C7</td><td>19.6 (9.0) n = 177</td><td>50.2 (15.8) n = 236</td><td>59.6 (22.3) n = 56</td><td>58.3 (22.6) n = 46</td><td>56.9 (20.5) n = 42</td></tr>
<tr><td>C8</td><td>22.6 (8.2) n = 55</td><td>61.9 (16.4) n = 76</td><td>68.7 (18.7) n = 21</td><td>68.4 (16.4) n = 14</td><td>73.3 (17.2) n = 14</td></tr>
<tr><td>Thoracic</td><td>32.5 (12.0) n = 1718</td><td>69.3 (13.1) n = 1869</td><td>72.2 (14.4) n = 402</td><td>74.7 (12.8) n = 320</td><td>77.4 (10.0) n = 256</td></tr>
<tr><td>Lumbar / sacral Sacral</td><td>36.7 (12.6) n = 457</td><td>73.2 (11.9) n = 452</td><td>79.8 (12.4) n = 97</td><td>83.2 (5.9) n = 72</td><td>82.4 (5.5) n = 58</td></tr>
</table></td></tr>
</table>

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

<table>
<tr><th>Author Year Country Research Design Setting</th><th>Demographics and Injury Characteristics of Sample</th><th>Validity</th><th>Reliability</th><th>Responsiveness Interpretability</th></tr>
<tr><td></td><td colspan="4">
Table 3
<table>
<tr><td>FIM Motor</td><td>Admission</td><td>Discharge</td><td>1 yr status post</td><td>2 yr status post</td><td>5 yr status post</td></tr>
<tr><td>C1-C3</td><td>26.8(9.7) n = 131</td><td>29.8 (8.2) n = 95</td><td>33.8 (2.4) n = 17</td><td>33.4 (2.1) n = 10</td><td>34.5 (1.2) n = 12</td></tr>
<tr><td>C4</td><td>29.0 (7.2) n = 456</td><td>32.2 (4.8) n = 380</td><td>33.2 (5.2) n = 67</td><td>34.3 (1.7) n = 47</td><td>34.3 (1.4) n = 37</td></tr>
<tr><td>C5</td><td>29.5 (7.3) n = 541</td><td>32.5 (4.9) n = 371</td><td>33.8 (4.2) n = 55</td><td>34.4 (1.7) n = 55</td><td>34.1 (2.1) n = 55</td></tr>
<tr><td>C6</td><td>29.4 (7.1) n = 290</td><td>32.9 (3.5) n = 351</td><td>33.5 (3.5) n = 56</td><td>34.2 (3.3) n = 53</td><td>34.6 (1.3) n = 48</td></tr>
<tr><td>C7</td><td>30.1 (7.1) n = 165</td><td>32.9 (4.4) n = 212</td><td>34.7 (0.8) n = 40</td><td>34.9 (0.3) n = 27</td><td>34.6 (0.8) n = 30</td></tr>
<tr><td>C8</td><td>30.5 (6.8) n = 52</td><td>32.3 (4.5) n = 70</td><td>34.5 (0.9) n = 14</td><td>35.0 (0.0) n = 6</td><td>35.0 (0.0) n =7</td></tr>
<tr><td>Thoracic</td><td>31.2 (5.9) n = 1594</td><td>33.3 (3.5) n = 1644</td><td>34.4 (2.0) n = 249</td><td>34.5 (1.5) n = 199</td><td>34.8 (0.9) n = 180</td></tr>
<tr><td>Lumbar/ Sacral</td><td>32.1 (5.2) n = 431</td><td>33.5 (3.4) n = 405</td><td>34.6 (1.5) n = 59</td><td>35.0 (0.2) n = 41</td><td>34.1 (4.2) n = 38</td></tr>
</table>
Table 4
<table>
<tr><td></td><td colspan="3">Admission*</td><td colspan="3">Discharge*</td></tr>
<tr><td>Level</td><td>AIS A</td><td>AIS B</td><td>AIS C</td><td>AIS A</td><td>AIS B</td><td>AIS C</td></tr>
</table>
</td></tr>
</table>

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample		Validity		Reliability		Responsiveness Interpretability
	C1-C3	13.2 (n=88)	13.0 (n=14)	15.8 (n=54)	17.7 (n=75)	21.0 (n=13)	20.0 (n=27)
	C4	13.6 (n=288)	14.5 (n=73)	17.5 (n=156)	20.9 (n=288)	24.8 (n=54)	27.8 (n=116)
	C5	14.3 (n=310)	16.2 (n=127)	19.7 (n=141)	28.3 (n=236)	31.1 (n=96)	38.4 (n=101)
	C6	15.3 (n=173)	17.8 (n=89)	21.1 (n=51)	35.6 (n=238)	37.6 (n=93)	43.9 (n=63)
	C7	18.5 (n=90)	18.8 (n=52)	23.6 (n=35)	49.4 (n=123)	48.7 (n=56)	53.5 (n=57)
	C8	22.3 (n=27)	22.4 (n=17)	23.3 (n=11)	64.1 (n=34)	58.6 (n=27)	63.0 (n=15)
	Thoracic	32.2 (n=1324)	31.5 (n=202)	35.5 (n=192)	69.1 (n=1482)	67.2 (n=163)	71.7 (n=224)
	Lumbar/ Sacral	35.8 (n=147)	36.6 (n=105)	37.3 (n=205)	71.5 (n=161)	74.8 (n=74)	74.0 (n=217)
	* Including only those with level of injury and completeness data available						

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

<table>
<tr><th>Author Year Country Research Design Setting</th><th>Demographics and Injury Characteristics of Sample</th><th>Validity</th><th>Reliability</th><th>Responsiveness Interpretability</th></tr>
<tr><td rowspan="2">Dijkers (1999)

Secondary analysis

A Model SCI centre database</td><td>N=2183 (1766M, 417F)
Age range <19 to >60yrs
Records from the National SCI database, containing entries since 1973.</td><td>SWLS total mean (SD) score by FIM-motor and FIM-sociocognitive score categories: See table 5 below</td><td></td><td></td></tr>
<tr><td colspan="4">Table 5
<table>
<tr><th>FIM-motor component score</th><th>Mean (SD) SWLS score:</th><th></th></tr>
<tr><td>14-28 (low)</td><td>17.0 (8.0)</td><td rowspan="6">F=22.26, df=5, P<.001, eta^2=.05</td></tr>
<tr><td>29-55</td><td>18.1 (7.4)</td></tr>
<tr><td>56-76</td><td>18.6 (8.0)</td></tr>
<tr><td>77-80</td><td>20.4 (8.0)</td></tr>
<tr><td>81-87</td><td>20.3 (7.8)</td></tr>
<tr><td>88-91 (high)</td><td>23.1 (7.1)</td></tr>
<tr><td>FIM-sociocognitive component score</td><td>--</td><td></td></tr>
<tr><td>6-32 (low)</td><td>15.3 (8.0)</td><td rowspan="3">F=18.98, df=2, P<.001, eta^2=.02</td></tr>
<tr><td>33-34</td><td>18.8 (7.8)</td></tr>
<tr><td>35 (high)</td><td>19.8 (7.9)</td></tr>
</table></td></tr>
</table>

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
Hamilton et al. (1999) Cross-sectional study Discharged patients from medical centers in New York	N=109 SCI patients (90M, 19F) Incomplete paraplegia (N=26) Complete paraplegia (N=29) Incomplete tetraplegia (N=28) Complete tetraplegia (N=26)	FIM-18 and square root of minutes of assistance: r = -.92 FIM-18 and square root of cost of durable goods: r = -.496 FIM-18 and square root of hours of paid help/day: r = -.76 FIM-motor domain and square root of minutes of assistance: r = -.878 to -.92 FIM- motor domain and square root of cost of durable goods: r = -.492 to -.537 FIM-motor domain and square root of hours of paid help/day: r = -.737 to -.76 FIM-subscales and square root of minutes of assistance: r = -.593 to -.916 FIM- subscales and square root of cost of	**Test-retest, Inter-rater, Intra-rater** r = .90 or higher (no details given on range, actual values)	Mean (SD) FIM scores: FIM-18: 98.22 (26.00) FIM-Motor score: 63.39 (25.72) FIM-Cognitive score: 34.83 (1.37) FIM-subscales: Self-care: 31.90 (12.81) Sphincter control: 8.79 (4.79) Transfer: 14.61 (7.29) Locomotion: 8.10 (2.79) Communication: 13.94 (0.58) Social cognition: 20.89 (0.80)

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		durable goods: r = -.405 to -.480 FIM-motor domain and square root of hours of paid help/day: r = -.472 to -.764 All significant at P≤.001 Authors predicted all negative correlations.		
Fujiwara et al. (1999) Cross-sectional Subjects recruited from National Murayama Hospital (1995-1997)	N=14 (12M, 2F) C6 complete tetraplegic patients Mean age: 30.7 (13~62) Mean time since SCI: 462 (169~1080) days	Spearman's rho btwn: ASIA Motor Score and FIM Motor Score: .73 (p<.01) ASIA Motor Score and FIM Transfer Score: .64 (p<.01) Total shoulder strength score* and FIM motor score: .95 (P<.001) Total shoulder strength score* FIM transfer score: .93 (P<.001) Total shoulder strength score is		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		defined as the sum of MMT scores for: Bilateral scapular abduction Upward rotation Shoulder vertical adduction Shoulder extension		
Marino et al (1998) Methodological study. Survey of people with chronic spinal cord injury Regional Spinal Cord Injury Center	N=154 patients Avg. age = 37 years, injured for avg. of 8 years. 99% of subjects had neurological examinations within 2 years of completing study.	The FIM was correlated: Capabilities of Upper Extremity (CUE): r = .738, ρ = .798, P<.05 Upper Extremity Motor score (UEM): r = .741, ρ = .803, P<.05 None of the correlations were statistically different from each other at P<.05 CUE explained 73% of variance within FIM where as UEM only explains 67% of variance.		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	**Demographics and Injury Characteristics of Sample**	**Validity**	**Reliability**	**Responsiveness Interpretability**
Yavuz et al. (1998) Cross-sectional Ankara Rehabilitation Center	N=29 (20M, 9F) Mean age 37yrs (range 14-66yrs) C3-T1 tetraplegic (18 ASIA complete, 11 ASIA incomplete). Consecutive patients of the Ankara Rehab Centre between May 1994 and January 1996. Mean time since injury to admission 20wks (range 272wks).	*Comparison of FIM and Quadriplegia Index of Function (QIF) scores to ASIA scores.* **Spearman's correlation.** Total QIF and FIM scores were significantly correlated to each other (r=.97, P<.001), as well as to the scores for ASIA motor (QIF: r=.91, P<.001; FIM: r=.91; P<.001), ASIA light touch (QIF: r=.64, P<.001; FIM: r=.58; P<.01) and ASIA pinprick (QIF: r=.65, P<.01; FIM: r=.55; P<.01). Self-care category (bathing, grooming and feeding) scores for the QIF and FIM		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		were significantly correlated to each other (r=.91, .96, .91, respectively and P<.001) and to ASIA upper extremity motor scores (UEMS; r=.75 to .85; P<.001). Other category (dressing, transfers, mobility, bladder and bowel programs) scores for the QIF and FIM were significantly correlated to each other (r=.87-.99, P<.001) and to whole body ASIA motor scores (QIF range: .79-.91; FIM range: .74-.86; P<.001 for all). Percent recovery in ASIA motor scores over the rehabilitation stage was significantly correlated to percent		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		improvement in total QIF scores (r=.68, P<.001), but not significantly correlated to percent improvement in total FIM scores (r=.38, P>.05). Percent recovery in ASIA motor scores was not correlated to either QIF or FIM improvement when the patients were grouped according to age or length of hospital stay; however, it was significantly correlated to QIF improvement (P<.005), but not FIM improvement (P>.05), when patients were grouped based on a latency of more or less than 3 months		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		between injury and admission.		
Saboe et al. (1997) Prospective longitudinal study Tertiary care acute, rehabilitation hospitals and home settings.	N=160 (125M, 35F) Mean age at injury: 30±13 Admission ASIA-A/B/C/D/E: 97/14/7/37/5 Admission ASIA-A/B/C/D/E: 80/11/10/58/1 Lvls of Injury - Cervical/Thoracic/Thoracolumbar/Lumbar: 72/32/49/7	Correlation coefficient btwn FIM score 2 years after SCI onset and: ASIA Motor Score at rehab admission: .68 ASIA Motor Score at rehab discharge: .80 ASIA Impairment at rehab admission: .50 ASIA Impairment at rehab discharge: .53		
Heinemann et al. (1997) Correlation cohort design Rehab Hospital	N=129 traumatic brain injury (TBI) and N=53 traumatic brain injury (SCI) patients	Burden of care and measure of disability: Medication: r=.66 Treatment: r=.41 Teaching=.67 (all significant at P<.01) FIM motor and total nursing contact time at admission and discharge (4 of 6 categories were significant):	**Test re-test:** ICC = .89 or higher (no details given on range, actual values)	

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		Medication dispensing: r=-.33 (P=.014), r=-.47 (P<.001) Treatment provision: r=-.42 (P<.002), r=-.25 (P=.066) Teaching/ADL: r=-.47 (P<.001), r=-.54 (P<.001) Indirect: r=-.35 (P=.010), r=-.24 (P=.088) Total minutes: r=-.46, r=-.52 (P<.001)		
Karamehmetoglu et al. (1997) Cross-sectional Rehabilitation Centre, Istanbul, Turkey.	N=50 patients with SCI, 38 males, 12 female Mean age = 33.94 (SD = 14.59) 11 tetraplegic, 39 paraplegic		Excellent intra-rater correlation of FIM scores obtained by questioning the patient and by observation of patient performing the activity (*r* = .94)	
Stineman et al. (1996) Cross-sectional analysis of patient records	N=2609 nontraumatic SCI; mean age = 64.4 years N = 1831 traumatic SCI; mean age = 43.0 years		**Internal consistency** Excellent internal consistency for nontraumatic spinal cord diagnosis (Cronbach's alpha for total = .91; for	

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	**Demographics and Injury Characteristics of Sample**	**Validity**	**Reliability**	**Responsiveness Interpretability**
Patients discharged in 1992 from in-hospital rehabilitation units or freestanding rehabilitation hospitals.			FIM Motor = .91; for FIM Cognitive = .90) Excellent internal consistency for traumatic spinal cord diagnosis (Cronbach's alpha for FIM Total Score = .92; for FIM Motor = .94; for FIM Cognitive = .90)	
Hamilton et al. (1994) Methodological study Hospital	89 (1018 patients) facilities; 24 (306 patients) of which met criteria of facility inter rater reliability for the purpose of reporting USDmr aggregating data.		**Test-retest, Inter-rater, Intra-rater** All facilities: FIM total: ICC=.96 Motor domain: ICC=.96 (subscales=.90-.94) Cognitive domain: ICC=.91 (subscales=.89-.91) Criterion facilities: FIM total: ICC=.99 Motor domain: ICC=.99 (subscales=.97-.98)	

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
			Cognitive domain: ICC=.98 (subscales=.97-.98) FIM item scores: All facilities: Self Care: K=.54-.62 Sphincter control: K=.61-.62 Transfers: K=.57-.64 Locomotion: K=.57-.64 Communication: K=.59 Social cognition: K=.53-.56 Criterion facilities: Self Care: K=.71-.78 Sphincter control: K=.78-.84 Transfers: K=.78-.80 Locomotion: K=.76-.82 Communication: K=.73-.77 Social cognition: K=.69-.79	
Dodds et al. (1993)	N=786 (393M, 393F) in one of the NWARF facilities	Statistically significant differences in levels of impairment severity	**Internal consistency** FIM and the subscales at admission and	Significant improvements between admission

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	**Demographics and Injury Characteristics of Sample**	**Validity**	**Reliability**	**Responsiveness Interpretability**
The Northwest Assoc. of Rehabilitation Facilities (NWARF)	Mean age= 65 SCI patients	with scores decreasing with increased severity (P<.005).	discharge: α>.70 (except locomotion subscale α=.41)	and discharge Functional Independence Measure (FIM) scores (P<.0005)
Segal et al. (1993) Field study of institutional agreement of individual FIM items. Discharge data from the acute care rahab. setting (ACRS) and discharge data from the ongoing rehab. setting (ORS).	N=57 Received treatment between Jan. 1989 and May 1990. 14 complete quadriplegia, 17 incomplete quadriplegia 13 complete paraplegia, 9 incomplete paraplegia		**Test-retest, Inter-rater, Intra-rater** Across two settings acute care rehabilitation and ongoing rehabilitation setting: ρ=0.83 Median reliability coefficient for individual items: ρ=.42 Median proportion of agreement for items: .465 10 of 18 FIM items differed significantly across settings. Subgroup:	Mean (SD) FIM scores for the acute setting and ongoing rehabilitation setting: see table 6 below

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

<table>
<tr><th>Author Year
Country
Research Design
Setting</th><th>Demographics and Injury Characteristics of Sample</th><th>Validity</th><th>Reliability</th><th>Responsiveness
Interpretability</th></tr>
<tr><td></td><td></td><td></td><td>Complete quadriplegic: ρ=.87
Incomplete quadriplegic: ρ=.49
Complete paraplegic: ρ=.74
Incomplete paraplegic: ρ=.85</td><td></td></tr>
<tr><td></td><td colspan="4">Table 6
<table><tr><th>Item:</th><th>Acute setting Mean (SD)</th><th>Ongoing rehabilitation setting

Mean (SD)</th></tr><tr><td>Feeding</td><td>5.30 (1.90)</td><td>4.49 (2.46)</td></tr><tr><td>Grooming</td><td>4.95 (2.07)</td><td>4.30 (2.50)</td></tr><tr><td>Bathing</td><td>3.26 (1.96)</td><td>2.58 (1.83)</td></tr><tr><td>Dressing: upper body</td><td>3.88 (2.10)</td><td>3.26 (2.29)</td></tr><tr><td>Dressing: lower body</td><td>2.53 (1.65)</td><td>2.07 (1.40)</td></tr><tr><td>Toilet</td><td>1.56 (1.30)</td><td>1.95 (1.25)</td></tr><tr><td>Bladder management</td><td>1.44 (1.28)</td><td>1.77 (1.43)</td></tr><tr><td>Bowel management</td><td>1.51 (1.38)</td><td>1.72 (1.35)</td></tr><tr><td>Bed transfer</td><td>2.65 (1.85)</td><td>2.40 (1.50)</td></tr><tr><td>Toilet transfer</td><td>2.19 (1.54)</td><td>2.33 (1.49)</td></tr></table></td></tr>
</table>

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
	Tub/shower transfer | 1.86 (1.43) | 2.14 (1.51) Walk/wheelchair | 3.88 (2.31) | 3.18 (2.35) Stairs | 1.07 (0.53) | 1.26 (1.17) Comprehension | 6.84 (0.62) | 6.86 (0.48) Expression | 6.82 (0.63) | 6.84 (0.53) Social interaction | 5.00 (1.57) | 6.21 (1.42) Problem solving | 5.04 (1.60) | 6.23 (1.55) Memory | 5.53 (1.43) | 6.63 (1.17)			
Grey and Kennedy (1993) Longitudinal study. Looking at self-report version of FIM. In hospital and postdischarge. National Spinal Injuries Centre, Stoke Mandeville Hospital, UK.	N=40 patients with SCI mean age at time of injury = 29.6 yrs Mean (SD) time post-SCI at discharge = 24.75 (8.57) weeks 85% male 32.5% tetraplegic, 67.5% paraplegic	Face validity was evaluated by asking clinicians specific questions addressing: • Difficulty of understanding (88% had no difficulty) • Unnecessary items (97% reported no unnecessary items • Items that should be added (83% felt no extra items needed)	**Inter-rater reliability:** Excellent correlation b/w total FIM scores taken by clinician discharge report and self-report at one month (r = .828) Poor to Excellent correlation between FIM subscales scores taken by clinician discharge report and self-report at one month: • Self care: *r* = .841 (Excellent)	**Floor/ Ceiling Effects:** Ceiling: 92% of subjects and 88% of clinicians reported a max score on communication 75% of subjects and 73% of clinicians reported a max score on social cognition

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
			• Sphincter control: *r* = .710 (Adequate) • Mobility: *r* = .733 (Adequate) • Locomotion: *r* = .454 (Adequate) • Communication: *r* = .029 (Poor) Social cognition: *r* = .085 (Poor)	
Marino et al. (1993) Cross-sectional SCI centre	N=22 (all male) Avg. age = 33 years (range 10 to 63 years) Inpatients traumatic quadriplegia C4-C7 injury	Quadriplegia Index (QIF) modified and FIM: ρ=.93 (ns) Subscale Grooming: ρ=.94 (ns) Bathing: ρ=.92 (ns) Feeding: ρ=.75 (ns) Upper Extremity Motor Score and FIM: ρ=.84 (ns) Subscale Grooming: ρ=.91 (ns) Bathing: ρ=.75 (ns)		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		Feeding: ρ=.53 (P<.01) Best FIM predictive model was using separate ASIA upper extremity motor score (UEMS) and lower extremity motor score (LEMS) (model 3). ASIA UEMS and FIM motor score: t=91.0 (P<.001) ASIA LEMS and FIM motor score: t=33.2 (P<.001) Use of separate ASIA UEMS and LEMS improved prediction of motor FIM scores (R^2 = .71) over that of total ASIA motor scores (R^2 = .59) ASIA UEMS and FIM upper cord score: t=101.7 (P<.001) ASIA LEMS and FIM upper cord score: t=8.4 (P<.001) R^2 = .72		

Reviewer ID: Ben Mortenson, Elsa Sun, Carlos L. Cano

Last updated: August 4th, 2024

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
		ASIA UEMS and FIM lower cord score: t=73.0 (P<.001) ASIA LEMS and FIM lower cord score: t=41.0 (P<.001) R^2 = .75		
Davidoff (1990) FIM subscales of cognition/communication compared to comprehensive neurological battery. Patients admitted to a university medical center for acute care and rehabilitation within 45 days of injury.	N=41 acute care traumatic SCI patients (35M, 6F) Age range: 18 to 55 N=22 control subjects (12M, 10F) completed the same testing			**Floor/ Ceiling Effect:** Ceiling effect: most patients were rated 6 or 7 (out of 7) on each of the FIM items in Cognitive/ Communication subscales. Such scores give the impression that a patient is cognitively intact, when in fact there may be several neurocognitive and language impairments.