

Research Summary - Timed Up and Go Test (TUG)- Lower Limb and Walking

Author Year Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
<p>Sinovas-Alonso et al. 2023</p> <p>Observational cross-sectional</p> <p>Biomechanics and Technical Aids Unit of the National Hospital for Paraplegics of Toledo, Spain</p>	<p>N= 35 adults with incomplete SCI (24M, 11F). Average age: 35.2 (17.2) years</p> <p>N= 50 non-SCI participants (19M, 31F). Average age: 34.6 (15.2) years</p>	<p>Good correlation with the SCI Gait Deviation Index (r=0.582)</p>		
<p>Musselman et al. 2022</p> <p>Retrospective Longitudinal Study</p> <p>10 Canadian rehabilitation hospitals</p>	<p>N= 618 people with traumatic SCI (141F)</p> <p>Average age: 48.7 years</p> <p>Length of inpatient rehabilitation stay: 81.6 (53.1) days</p> <p>AIS A: 164 AIS B: 66 AIS C: 104 AIS D: 283 AIS E: 1</p>	<p>Convergent validity: Significant correlation between TUG and the Standing and Walking Assessment Tool (SWAT): $\rho = -0.691$; $p < 0.001$</p>		

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	Cervical: 383 Thoracic: 156 Lumbar: 72 Sacral: 7			
Jorgensen et al. 2017 Cross-sectional validation study Sunnaas Rehabilitation Hospital, Norway	N= 46 (32M, 14F) Mean age: 54.5 (17.0) years Median time since injury: 6.5 years AIS D: 39 AIS A, B, or C: 7	Construct validity: Strong spearman's rank correlation with the Mini BESTest (r= -0.75, p<0.001) Strong spearman's rank correlation with the Berg Balance Scale (r=-0.75, p<0.001)		
Srisim et al. 2015 Prospective cohort study Tertiary Rehabilitation Center in Thailand	N = 83 23 Multiple Fallers (Age: 44.21 ± 10.7): Time Since injury (months): 58.70 ± 60.03 AIS C: 9 (39%) 60 Non-multiple fallers (52.68 ± 11.21): Time Since injury (months): 46.72 ± 36.42 AIS C: 12 (20%)	Unable to predict and discriminate non-multiple fallers and multiple fallers Ability of cut-off score (≥ 26 s) to predict risk of multiple falls: Sensitivity: 56% Specificity: 69% AUC: 0.57	Interrater ICC= 0.999 (0.999-1.000)	SEM: 0.23
	N=83, (26F, 57M) Age: 18 - 50 Mean age: 47.28			MCID = -14.5s

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Duffell et al. 2015 Outpatient service at the Rehabilitation Institute of Chicago USA	Time Since Injury: > 12 months All AIS C or D			
Saensook et al. 2014 Cross-sectional	N= 85 (59M)			Responsiveness: Non-ambulative assistive device patients perform significantly better than patients with device (p<0.001); Cane users perform significantly better than walker (p<0.001) and crutches users. (p<0.05)
Poncumhak et al. 2014 Cross-sectional A tertiary rehabilitation center in Thailand	N=60, 42 male Mean age: 49.95 Mean time since injury: 55.5 yrs	Score of <18s "had good-to-excellent capability to determine the ability of walking without a walking device of subjects with SCI: ROC curve area: 0.95 (95%CI=0.89~1.00)	Interrater ICC: (N=20) = 0.998 (95%CI=0.997~0.999), p<0.001	SEM = 0.41

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		Sensitivity=90% Specificity=87%		
<p>Poncumhak et al. 2013</p> <p>Cross-sectional</p> <p>A tertiary rehabilitation center, Thailand</p>	<p>Validity Test: FIM-L 6: N=33, mean age = 50.9±13.5, Time since injury: 59.5 ±85.8 months AIS-C=9, AIS-D=24, tetraplegia=9, paraplegia=24 FIM-L 7: N=33, mean age = 50.23±9.5, Time since injury: 44±64.5 months AIS-C=1, AIS-D=32, tetraplegia=13, paraplegia=20</p> <p>Reliability Test: N=16, mean age = 50.8±10.3, Time since injury: 30.6±19.9 months AIS-C=2, AIS-D=15, tetraplegia=6, paraplegia=10</p>	With 10MWT Scores: point biserial correlation coefficient = -0.692 (P<0.05)	Interrater ICC = 0.999 (0.999-1.000) for FIM-L 6 (N=8); 1.000 (0.999-1.000) for FIM-L 7 (N=8)	

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<p>Lemay & Nadeau 2010</p> <p>Longitudinal Study</p> <p>An intensive rehabilitation center in Montreal, Canada (Institut de readaptation Gingras-Lindsay de Montreal)</p>	<p>32 SCI subjects (25 males, 7 females) Mean age: 47.9± 12.8 yrs Neurological level: 15 paraplegic, 17 tetraplegic Level of injury: 17 cervical, 10 thoracic, 5 lumbar Type of injury: 21 traumatic, 11 non-traumatic</p> <p>Inclusion criteria: (1) Adults with SCI AIS D either of traumatic or non-traumatic etiology and (2) the ability to walk 10m independently with or without upper-extremity assistive devices.</p>	<p>Spearman's correlations with other walking scales (all P<0.01): Berg Balance Scale: -0.815</p> <p>Spinal Cord Injury-Functional Ambulation Inventory (SCI-FAI) parameter: -0.761</p> <p>SCI-FAI assistive devices: -0.802</p> <p>SCI-FAI mobility: -0.724</p> <p>WISCI II: -0.799</p> <p>10 Meter Walk Test: -0.646 (For 10 MWT, Pearson's product moment correlation instead of Spearman's ρ)</p>		<p>Mean (SD) TUG scores of the whole group and subgroups: Total group: 17.0 (18.7), range: 6.4-111.3 Paraplegia: 19.7 (25.9), range: 6.4-111.3 Tetraplegia: 14.6 (8.8), range: 6.5-36.7</p>
<p>Lam et al. 2008</p> <p>Systematic Review</p>	<p>Data reported in study was from Van Hedel, Wirz & Dietz 2005 (population</p>			<p>Interpretability: Calculated from data from Van Hedel et al. 2005:</p>

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	characteristics available below).			SEM = 3.9 seconds MDC = 10.8 seconds
van Hedel 2008 Retrospective analysis The European Multicenter Study of Human Spinal Cord Injury Database. 19 SCI rehabilitation centers across Europe.	N = 6 – 127 (range seen below) Acute, Subacute, Chronic SCI	See Table 1. below		
	Table 1. Construct validity with the 10MWT over time			
	Time Since Injury	N	Spearman Rho	R2 (adjusted value)
	2 weeks	6	0.81*	0.96
	1 month	74	0.87**	0.57
	3 months	136	0.95**	0.75
	6 months	131	0.96**	0.76
	12 months	127	0.92**	0.72
	*p < 0.05; **p < 0.001			

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<p>van Hedel et al. 2005</p> <p>Cross-sectional and repeated assessments</p> <p>SCI center of a university hospital in Switzerland</p>	<p>Validity study: N = 75 (30 females & 45 males) Mean age = 54±20 years Cervical = 25 Thoracic = 21 Lumbar = 21 Sacral = 8</p> <p>Reliability study: N = 22 (8 females & 14 males) Mean age = 52±20 years Cervical = 7 Thoracic = 7 Lumbar = 7 Sacral = 1</p>	<p>Correlation of the TUG with other scales measuring the same construct as the TUG: 10MWT and TUG: r = 0.89, n=70 6MWT and TUG: $\rho = -0.88$, n=62</p> <p><u>Subgroups:</u> WISCI scores of 0 to 10: 10MWT and TUG: r=0.92, n=15 6MWT and TUG: r=-0.96, n=15</p> <p>WISCI scores of 11 to 20 6MWT and TUG: r=-0.78, n=47 10MWT and TUG: r=0.88, n=27</p> <p>Dependent walking group: 6MWT and TUG: $\rho = -0.74$, n=18 10MWT and TUG: r=0.88, n=27</p>	<p>Pearson correlations Intrarater r=0.979, P<.001 Interrater r=0.973, P<.001</p> <p>Bland-Altman plot: Significant difference in intra-rater (3.3±7.0s) using Wilcoxon signed-rank test at p=0.001. No significant differences with inter-rater assessment (-0.3±7.5s).</p>	<p>Interpretability: Mean (SD) TUG score: 36 (27) seconds Range: 8-156 seconds</p>

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		<p>Independent walking group: 6MWT and TUG: $\rho = -0.88$, $n=44$ 10MWT and TUG: $\rho = -0.86$, $n=43$</p> <p>Walking Index for Spinal Cord Injury II (WISCI II): $\rho = -0.76$, $n=67$</p> <p><u>Subgroups:</u> WISCI II scores of 0 to 10: $\rho = 0.16$, $n=20$ WISCI II scores of 11 to 20: $\rho = -0.65$, $n=47$ WISCI II dependent walking group: $\rho = -0.22$, $n=23$ WISCI II independent walking group: $\rho = -0.66$, $n=45$</p>		