

Research Summary – 5 Times Sit-To-Stand Test (5XSST) – Lower Limb and Walking

Author Year Country Research Design Setting	Demographics and Injury Characteristics of Sample	Validity	Reliability	Responsiveness Interpretability
Amatachaya et al. 2023 Prospective cohort study to explore the responsiveness and MCID of the FTSST in ambulatory individuals with SCI Thailand	N= 109 participants with SCI who could walk with or without a walking device for at least Mean (SD) age 55.8 (13.1) years 87M, 14F Cause of injury: Non-traumatic (n = 54), traumatic (n = 57) AIS C (n = 16) and AIS D (n = 93) Level of injury: Incomplete paraplegia (n = 67), incomplete tetraplegia (n = 42) Mean (SD) time since injury 76.3 (72.1) months Conditions: Arms on a walking device (n = 109).			Responsiveness: Large internal responsiveness for all arm-placement conditions at 3 periods of follow up: - Arms on walking device: SRM 0-1 month = 0.91 SRM 1-3 month = 1.03 SRM 3-6 month = 0.99 - Arms on knees: SRM 0-1 month = 1.13 SRM 0-3 month = 0.85 SRM 3-6 months = 1.12 - Arms by sides: SRM 0-1 month = 1.04

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	- Arms on knees (n = 74) - Arms by sides (n = 73) - Arms folded over the chest (n = 72)			SRM 1-3 months = 1.00 SRM 3-6 months = 1.22 4. Arms folded over the chest: SRM 0-1 month = 0.95 SRM 1-3 months = 0.83 SRM 3-6 months = 1.09 Moderate external responsiveness compared to 10MWT: ($\rho = -0.28$ to -0.48, $p < 0.005$) MCID: >2.27 s for condition: arms on a walking device >2 s for all other conditions
Mato et al. 2022	N = 44 participants with incomplete SCI.	Correlations between FTSST with or without		

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Cross-sectional study to explore the cut-off point for knee extensor muscle strength in patients with iSCI to independently determine their FTSST results and the correlation between knee extensor muscle strength and FTSST results A tertiary rehabilitation centre and community hospitals in northeast Thailand	31 males, 13 females Mean (SD) age 50.93 (15.88) years Causes of SCI: traumatic (n = 19), non-traumatic (n = 25) Level of injury: Cervical (n = 9), thoracic (n = 12), lumbar (n = 18), sacral (n = 5) Mean (SD) time since injury 73.14 (4.20) months. Conditions: - FTSST with hands (n = 22) - FTSST without hands (n = 22)	hands and knee extensor muscles strength: See table 1.		
	Table 1:			
	Variables		Knee extensor muscle strength	P-value
	FTSST (with hands)		0.11	0.636
FTSST (without hands)		-0.45	0.035	

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Khuna et al. 2022 Cross-sectional study to assess the concurrent validity of the FTSST in ambulatory individuals with SCI who could complete the FTSST with or without hands as verified using the standard measures for the lower limb functions and functional mobility of ambulatory individuals with SCI Tertiary rehabilitation	N = 56 ambulatory individuals with motor incomplete SCI who were able to walk independently with or without a walking device over at least 10 m. 44 males, 12 females Mean (SD) age 51.0 (15.2) years Cause of injury: Non-traumatic (n = 30), traumatic (n = 26) Level of injury: C5-C8 (n = 12), T1-T6 (n = 7), T7-T12 (n = 4), L1-L5 (n = 33) AIS C (n = 18) and AIS D (n = 38) Mean (SD) time since injury 80.7 (75.4) months	Concurrent validity: - Time to complete the 5XSST of the participants who completed the test without hands (n = 28) correlated significantly with all lower extremity motor strength ($\rho = -0.38$ to -0.70, $P < 0.05$), except the knee extensor and ankle plantarflexor muscles ($P > 0.05$), and the functional mobility measures ($\rho = -0.58$ to -0.71, $P \leq 0.001$). - Time to complete the 5XSST of the participants who completed the test with hands (n = 28) correlated significantly and positive only with the strength of		

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centers and community hospitals in Thailand		ankle dorsiflexor and plantarflexor muscles ($\rho = 0.41$ and 0.47 , $P < 0.05$) and TUGT ($\rho = 0.52$, $P < 0.05$) and negatively correlated with hip adductor muscles and the outcomes of the 10MWT and 6MWT ($\rho = -0.40$ and -0.47 , $P < 0.05$); however, did not correlate with the WISC II scores ($P >$ 0.05).		
Khuna et al. 2020 Psychometric study to investigate the reliability and the concurrent validity of the five times sit-to-	N = 82 participants with incomplete SCI 69 males, 13 females Mean (SD) age 52.0 (14.2) years Mean (SD) time post injury 89.8 (79.3) months Non-traumatic (n = 41), traumatic (n = 41) Level of injury:	Concurrent validity: The time to complete the 5XSST of all conditions was significantly correlated with lower extremity motor strength and all the functional measures, particularly for 10MWT, TUGT, and 6MWT	The outcomes of all 5XSST conditions showed excellent intra- and inter- rater reliability for both the expert and novice raters ($ICC_{3,3} =$ $0.998-1.000$).	SEM and MDC values: - Arms on a walking device: - SEM: 1.09 - MDC: 3.01 - Arms on knees: - SEM: 0.88 - MDC: 2.44 - Arms by sides:

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stand test (5XSST) during various arm placement conditions in ambulatory participants with SCI Rehabilitation centers and communities in Thailand	Incomplete paraplegia (n = 55), incomplete tetraplegia (n = 26) AIS C (n = 18), AIS D (n = 63) The first 30 participants also participated in the reliability study. All participants were able to complete the FTSST with arms on a walking device, and 65% (n = 52–54) could accomplish the other conditions (p < 0.001). Conditions: - Arms on a walking device. - Arms on knees. - Arms by sides. - Arms crossed over the chest.	($\rho = -0.39$ to -0.72, $p < 0.01$ to $p < 0.001$, Table 1). In comparing the FTSST conditions, the tests conducted with arms by the sides had the highest correlation with lower extremity motor strength and functional ability ($\rho = -0.43$ to -0.72; $p < 0.001$), and the test with arms on a walking device showed a slightly lower correlation than those of the other conditions ($\rho = -0.43$ to -0.63; $p < 0.01$, Table 1).	Every condition had an excellent test-retest reliability ($ICC_{3,3} = 0.956-0.989$).	- SEM: 0.55 - MDC: 1.53 - Arms crossed over the chest: - SEM: 1.05 - MDC: 2.93

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	Table 1. The correlation between the four arm placement conditions of the five times sit- to-stand test (5XSST) and physical ability tests						
	Conditions of the FTSST		LEMS	10MWT	WISCI II	TUGT	6MWT
	Arms on a walking device (n = 82)		-0.43**	-0.55***	-0.44***	0.60***	-0.63***
	Arms on knees (n = 54)		-0.40**	-0.62***	-0.49***	0.70***	-0.70***
	Arms by sides (n = 53)		-0.43***	-0.65***	-0.53***	0.71***	-0.72***
	Arms crossed over the chest (n = 52)		-0.39**	-0.59***	-0.50***	0.67***	-0.67***
	The data are presented using Spearman's rho coefficient (ρ) ** p < 0.01, *** p < 0.001						
Poncumhak et al. 2013 Cross-sectional study A tertiary rehabilitation center in Thailand	Population: Validity study: (46M, 20F) - FIM-L 6: N=33, mean age = 50.9±13.5, AIS-C=9, AIS-D=24, tetraplegia=9, paraplegia=24 - FIM-L 7: N=33, mean age = 50.23±9.5, AIS-C=1, AIS-D=32, tetraplegia=13, paraplegia=20	Significant correlation with FIM-L scores: r _{pb} = -0.595 (p < 0.001)	High inter-tester reliability in both participants who walked with and without a walking device (intraclass correlation coefficients = 0.997 - 1.00)				

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	Reliability study: (11 males, 5 females) Mean age = 50.8±10.3 AIS-C=2, AIS-D=15, Tetraplegia = 6, Paraplegia = 10			