



# Timed Ten-Meter Walk Test (10MWT): Reference Guide

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## Introduction

The importance of walking speed, or gait velocity, as a correlate to safety and function has been enforced over recent decades. It has been called an “almost perfect measure” of function and mobility and been recommended as a “sixth vital sign.”<sup>1,2</sup> The 10-meter walk test is an outcome measure designed to assess self-selected walking speed, fastest possible walking speed, and the ability of a subject to walk in a straight line.<sup>3</sup> The 10MWT can also be used to assess cadence.

The timed 10MWT has been used in the literature in many different forms over time. The standard 10MWT protocol is a 10-meter walkway with the first two meters and last two meters being used as space to allow for acceleration and deceleration of the subject. Gait speed is then calculated using the time it takes the subject to cover the middle six meters.<sup>12</sup> Self-selected or comfortable walking and fastest possible walking speeds are often performed and recorded separately.

**Establishing Author:** Collen FM, Wade DT, Bradshaw CM (1990)

**Data Type:** Ratio

**Measurement Type:** Performance-based outcome measure

**Assessment Type:** Observer

## Psychometric Properties

Outcome measures can improve the quality of clinical evaluations and notes as well as offer a reference for patient progress. The 10MWT has been used in a variety of patient populations including those individuals with spinal cord injury,<sup>4</sup> traumatic brain injury,<sup>5</sup> Parkinson’s disease,<sup>6</sup> multiple sclerosis,<sup>7</sup> stroke,<sup>8</sup> and lower extremity amputation.<sup>9</sup>

**Table 1.** A comparison of psychometric properties tested in common outcome measures

Outcome measure	Reliability			Validity	Responsiveness		Normative Data
	Test-Retest	Inter-rater	Intra-rater		MDC	Floor/Ceiling Effect	
<b>FSST</b>	yes	no	yes	yes	no	floor	yes
<b>Single Limb Stance</b>	Yes	no	no	yes	no	ceiling	yes
<b>Timed Up &amp; Go</b>	yes	yes	yes	yes	yes	ceiling	yes
<b>L-Test</b>	no	yes	yes	yes	yes	none	yes

**Reliability.** Excellent test-retest reliability was found for the comfortable walking speed measurement of the 10MWT in a variety of populations including spinal cord injury,<sup>9,10</sup> traumatic brain injury,<sup>5,11</sup> chronic stroke,<sup>12,13</sup> Parkinson’s disease,<sup>6</sup> children with neuromuscular deficit, and in healthy adults.<sup>5,15</sup> Similar results were found for fastest possible walking speed in some studies investigating patients with Parkinson’s disease<sup>6</sup> and traumatic brain injury,<sup>11</sup> and also in healthy adults.<sup>15</sup> Inter-rater and Intra-rater reliability was determined to be excellent for the 10MWT in studies of patients with spinal cord injury,<sup>16</sup> traumatic brain injury,<sup>17</sup> and stroke,<sup>12,5</sup> and adults with no significant health history.<sup>5</sup>

**Validity.** Concurrent validity of the 10MWT was analyzed in separate populations of patients with multiple sclerosis and history of stroke. Results of the study with MS patients showed an excellent correlation between the 10MWT and perceived difficulties in self-care score with  $r=0.72$  for comfortable walking speed and  $r=0.52$  for fastest possible walking speed. The same study showed an adequate to excellent correlation between the 10MWT and perceived difficulties in mobility score and perceived difficulties in domestic life score with correlational coefficients of  $r=0.50$  and  $r=0.53$ , respectively, for comfortable walking speed and  $r=0.38$  and  $r=0.63$ , respectively, for fastest possible walking speed.<sup>7</sup> Excellent concurrent validity between the 10MWT and dependence in instrumental activities of daily living score and the Barthel index was determined in a post-stroke population with  $r=0.76$  and  $r=0.78$ , respectively.<sup>17</sup> Convergent validity of the 10MWT has been studied extensively in SCI populations. It was found to have excellent correlations with the timed up and go (TUG),<sup>10,16</sup> 2-minute walk test (2MWT),<sup>18</sup> 6-minute walk test (6MWT),<sup>10,16,19</sup> and Berg balance scale.<sup>18</sup> In the chronic stroke population, excellent convergent validity has been established between the 10MWT and Berg balance scale,<sup>5</sup> TUG, and 6MWT.<sup>13</sup> Correlational coefficients for the TUG and 6MWT were found to be  $-0.84$  and  $0.89$ , respectively, for comfortable walking speed and  $-0.91$  and  $0.95$ , respectively, for fastest possible walking speed in those cases.<sup>13</sup> The 10MWT has not been found to have a floor or ceiling effect, as tested in an SCI population.<sup>18</sup>

**Responsiveness.** Responsiveness has been studied extensively across many patient populations. Small meaningful changes were found to be  $0.13$  m/s in an SCI population<sup>10</sup> and  $0.05$  m/s in both post-stroke and geriatric populations.<sup>8</sup> A substantial meaningful change of  $0.10$  m/s was found for those same post-stroke and geriatric populations.<sup>8</sup> Minimum detectable changes (MDC) and minimally clinically important differences have been established for the 10MWT in many pathological populations as well. An MDC of  $0.18$  m/s for comfortable walking speed and  $0.25$  m/s for fastest possible gait speed has been found for patients with Parkinson's disease.<sup>6</sup> In a population of patients with spinal cord injury, an MDC for the 10MWT was determined to be  $0.13$  m/s.<sup>10</sup> Researchers in a study of TBI patients found that an improvement of  $0.05$  seconds or more on the 10MWT was greater than the standard error rate, thus noting improvement in ambulatory status. MCID marks of  $0.06$  m/s and  $0.16$  m/s were established for populations with history of SCI<sup>19</sup> and acute stroke,<sup>20</sup> respectively. MCID marks have also been established in the TBI population, for both comfortable and fastest possible walking speeds at  $0.15$  m/s and  $0.25$  m/s, respectively.<sup>11</sup> Additionally, the 10MWT was found to be more responsive to locomotor improvement than the walking index for spinal cord injury version II (WISCI II) in an SCI population.<sup>21</sup> Ambulatory profiles have been established using the 10MWT and comfortable gait speed in a population of patients with history of stroke. A measured gait speed of  $0.4$  m/s or less indicated that the tested patients were more likely to be household ambulators, whereas measured gait speeds of  $0.4$  to  $0.8$  m/s indicated limited community ambulatory status and measured gait speeds of  $0.8$  m/s or greater indicated full community ambulatory status.<sup>2</sup>

## Required Resources

**Time:** 3-10 minutes

**Personnel:** 1-2 persons

**Equipment:** stopwatch and tape

**Space:** about 10 square meters

**Cost:** free



## Test Administration

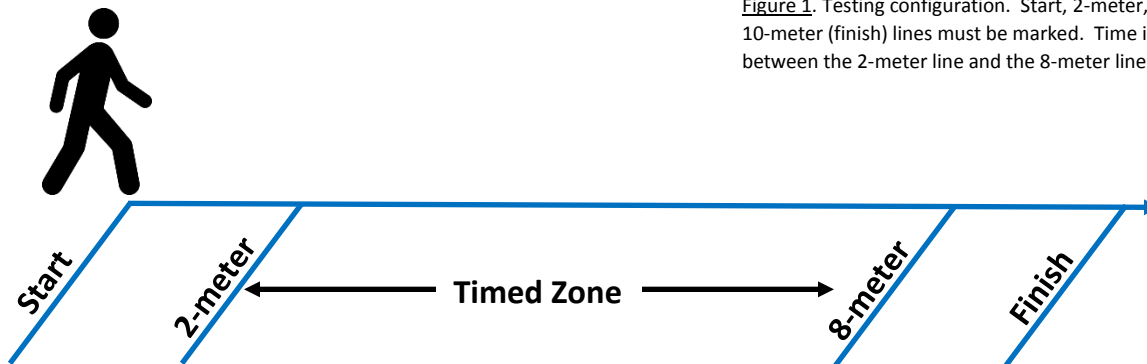


Figure 1. Testing configuration. Start, 2-meter, 8-meter, and 10-meter (finish) lines must be marked. Time is recorded between the 2-meter line and the 8-meter line.

1. Mark out a 10-meter long section with markings at 2 and 8 meters. Markings may also be placed at 4 and 6 meters as well to further blind the subject.
2. The patient is instructed to walk the length of the 10-meter course at normal walking speed and then fastest possible safe walking speed.
3. The time is started when the subject breaks the plane of the 2-meter line.

The administrator of the test may walk next to the subject or simply observe. If the latter applies, the administrator should stand at the end line and have an additional administrator signal when to start the time. The average of three (3) trials should be recorded for self-selected comfortable walking speed and then also for fastest possible walking speed. The subject should not run. Assistive devices may be used to complete the test, however they should be kept consistent between tests.<sup>12</sup>

## Interpretation

Shorter times to complete the test and corresponding higher walking speeds show an increased ambulatory capacity by the subject. Minimum detectable changes, minimum clinically important differences, and normative data are listed in charts below. Comparing a patient's results with these times can help clinicians justify orthotic or prosthetic prescriptions. Medical necessity for a device can be shown by:

- Surpassing a threshold of reduced fall risk.
- Returning a patient to a score that is average among a patient's normal peers.
- Improving a score by a clinically significant amount

## Limitations

This test is not intended for individuals with extreme instability who may not be able to walk 10 meters safely without assistance. This test fails to assess transfers, endurance, and balance. It should be used in conjunction with other outcome measures such as the timed up and go (TUG), 2-minute walk test, and four-square step test (FSST), to provide a more thorough assessment.



Table 2. Normative 10MWT gait speeds

Gait Speeds for 10MWT by Age (m/s) <sup>15</sup>				
	Male		Female	
<u>Age</u>	<u>Comfortable</u>	<u>Fast</u>	<u>Comfortable</u>	<u>Fast</u>
20's	1.39	2.53	1.41	2.47
30's	1.46	2.45	1.42	2.34
40's	1.46	2.46	1.39	2.12
50's	1.39	2.07	1.40	2.01
60's	1.36	1.93	1.30	1.77
70's	1.33	2.08	1.27	1.74

MDCs by Population (m/s)		
<u>Population</u>	<u>Comfortable</u>	<u>Fast</u>
Parkinson's disease	0.18	0.25
SCI	0.13	-
TBI	0.05	-

MCIDs by Population (m/s)		
<u>Population</u>	<u>Comfortable</u>	<u>Fast</u>
acute stroke	0.06	0.16
SCI	0.06	0.16
TBI	0.15	0.25

### Documentation in Clinical Notes

Example: When assessed with the 10-meter walk test, the patient had a comfortable walking speed of 1.25m/s and fastest possible walking speed of 1.85m/s today. This shows an decrease/increase in speed measured of 0.12m/s for normal walking and 0.05m/s for fastest possible since last assessed on 99/99/9999. These increases in walking speed represent an improvement/regression in the patient mobility and correlate to improved levels of safety in gait.

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**Disclaimer:** The Authors, the Outcomes Research Committee, and the American Academy of Orthotists and Prosthetists does not endorse the use of any single outcome measure over any other single outcome measure and declares no conflict of interest in the presentation of this measure. There may be multiple versions of the instructions published in research literature. This reference guide has attempted to remain consistent with the instructions from the original developers of the outcome measure wherever possible, however in some instances one version of the instructions was chosen for ease of use in the clinic.

## References

1. Wade D. *Measurement in Neurological Rehabilitation*. Oxford: University Press; 1992.
2. Fritz S, Lusardi M. White paper: "walking speed: the sixth vital sign." *J Ger Phys Ther*. 2009; 32(2): 2-5.
3. Rehab Measures: 10 Meter Walk Test. <http://www.rehabmeasures.org/Lists/RehabMeasures/DispForm.aspx?ID=901&Source=http%3A%2F%2Fwww%2Erehabmeasures%2Eorg%2Frehabweb%2Fallmeasures%2Easpx%3FPa geView%3DShared>. Center for Rehabilitation Outcomes Research Website. Published October 30, 2010. Updated August 28, 2014. Accessed January 6, 2015.
4. Burns, AS, Delparte, JJ, Patrick M, Marino RJ, et al. The reproducibility and convergent validity of the walking index for spinal cord injury. *Neurorehabil Neural Repair*. 2011; 25(2): 149-57.
5. Watson MJ. Refining the ten-metre walking test for use with neurologically impaired people. *Physiotherapy*. 2002; 88(7): 386-97.
6. Steffen T, Seney M. Test-retest reliability and minimal detectable change on balance and ambulation tests, the 36-item short-form health survey, and the united Parkinson disease rating scale in people with parkinsonism. *Phys Ther*. 2008; 88(6): 733-46.
7. Paltamaa J, Sarasoja T, Leskinen E, Wikstorm J, et al. Measures of physical functioning predict self-reported performance in self-care, mobility, and domestic life in ambulatory persons with multiple sclerosis. *Arch Phys Med Rehabil*. 2007; 88(12): 1649-57.
8. Perera S, Mody S, Woodman RC, Studenski SA. Meaningful change and responsiveness in common physical performance measures in older adults. *J Am Ger Soc*. 2006; 54(5):743-9.
9. Bowden MG, Behrman AL. Step activity monitor: accuracy and test-retest reliability in persons with incomplete spinal cord injury. *J Rehabil Res Dev*. 2007; 44(3): 355-62.
10. Lam T, Noonan V, et al. A systematic review of functional ambulation outcome measures in spinal cord injury. *Spinal Cord*. 2007; 46(4): 246-54.
11. van Loo MA, Moseley AM, Bosman JM, de Bie RA, Hassett L. Test-re-test reliability of walking speed, step length, and step width measurement after traumatic brain injury: a pilot study. *Brain Inj*. 2004; 18(10): 1041-8.
12. Collen F, Wade D, Bradshaw CM. Mobility after stroke: reliability of measures of impairment and disability. *Disabil & Rehabil*. 1990; 12(1): 6-9.
13. Flansbjerg UB, Holmback AM, Patten C, Lexell J. Reliability of gait performance tests in men and women with hemiparesis after stroke. *J Rehabil Med*. 2005; 37(2): 75-82.
14. Pirpiris M, Wilkinson A, Rodda J, Nguyen TC, Baker RJ, Natrass GR, Graham HK. Walking speed in children and young adults with neuromuscular disease: comparison between two assessment methods. *J Ped Orthopaed*. 2003; 23(3): 302.
15. Bohannon RW. Comfortable and maximum speed of adults aged 20-79 years: reference values and determinants. *Age Ageing*. 1997; 26(1): 15-9.
16. van Hedel HJ, Wirz M, Dietz V. Assessing walking ability in subjects with spinal cord injury: validity and reliability of 3 walking tests. *Arch Phys Med Rehabil*. 2005; 86(2): 190-6.
17. Tyson S, Connell, L. The psychometric properties and clinical utility of measures of walking and mobility in neurological conditions: a systematic review. *Clin Rehabil*. 2009: 1018-33.
18. Lemay JF, Nadeau S. Standing balance assessment in ASIA D paraplegic and tetraplegic participants: concurrent validity of the Berg balance scale. *Spinal Cord*. 2010; 48(3): 245-50.
19. Musselman K. Clinical significance testing in rehabilitation research: what, why, and how?. *Phys Ther Reviews*. 2007; 12(4): 287-96.
20. Van Hedel HJ, Wirz M, et al. Improving walking assessment in subjects with an incomplete spinal cord injury: responsiveness. *Spinal Cord*. 2006; 44(6): 352-56.
21. Tilson JK, Sullivan KJ, et al. Meaningful gait speed improvement during the first 60 days poststroke: minimal clinically important difference. *Phys Ther*. 2010; 90(2): 196-208.