White Paper: "Walking Speed: the Sixth Vital Sign"

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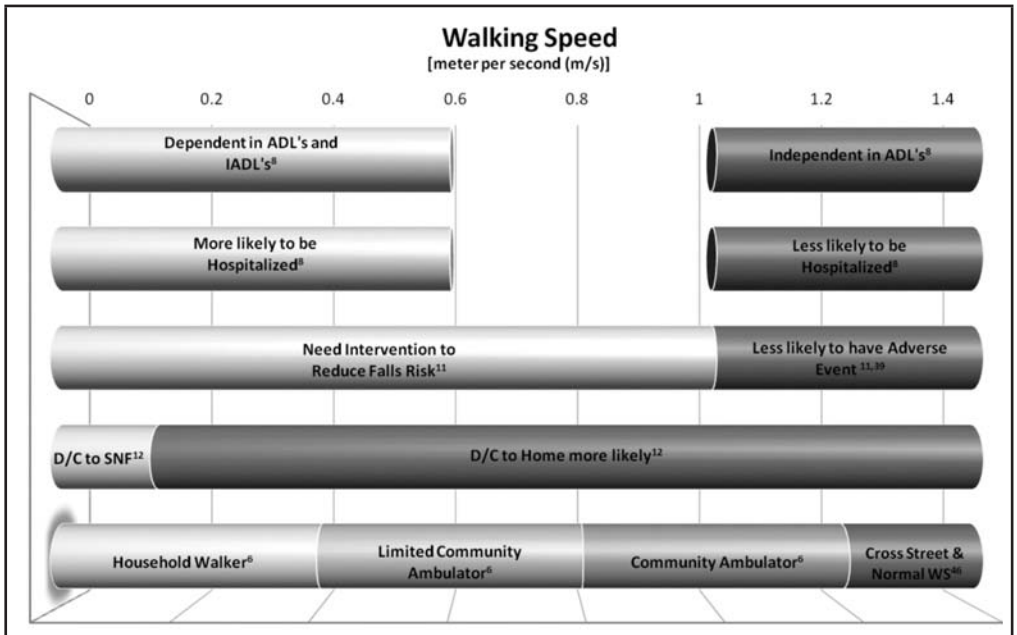
Walking speed is "almost the perfect measure."[1] A reliable, valid,[2,3] sensitive[4] and specific[5] measure, self-selected walking speed (WS), also termed gait velocity, correlates with functional ability,[6] and balance confidence.[7] It has the potential to predict future health status,[8,9] and functional decline[10] including hospitalization,[11] discharge location,[12,13] and mortality.[14] Walking speed reflects both functional and physiological changes,[6] is a discriminating factor in determining potential for rehabilitation,[15] and aids in prediction of falls[16] and fear of falling.[17] Furthermore, progression of WS has been linked to clinical meaningful changes in quality of life[18] and in home and community walking behavior.[19] Due to its ease of use[20] and psychometric properties, WS has been used as a predictor and outcome measure across multiple diagnoses.[8,9,19,21-26] In addition, WS was chosen by a panel of experts as the standardized assessment to measure locomotion for the Motor Function Domain of the NIH Toolbox.[27]

Walking speed, like blood pressure, may be a general indicator that can predict future events and reflect various underlying physiological processes.[8] While WS cannot stand alone as the only predictor of functional abilities, just at blood pressure is not the only sign of heart disease; WS can be used as a functional "vital sign" to help determine outcomes such as functional status,[6,8] discharge location,[12] and the need for rehabilitation[11] (Figure 1).

Walking is a complex functional activity; thus, many variables contribute to or influence WS. These include, but are not limited to, an individual's health status,[28] motor control,[29] muscle performance and musculoskeletal condition,[30,31] sensory and perceptual function,[32] endurance and habitual activity level,[33] cognitive status,[34] motivation and mental health,[35,36] as well as the characteristics of the environment in which one walks.[37] While performance measures used in conjunction with WS are often better able to predict health status,[28] the use of WS alone can be an excellent predictor.[11,20] For example, WS predicts the post hospital discharge location 78% of the time, and the addition of cognition or initial FIM scores does not significantly strengthen the ability of defining if a patient will be discharged to home or to a skilled nursing facility.[12]

Several standardized assessments and physical performance tests reliably predict function and health related events. Yet the consistent use of measures in physical therapy and other clinical settings is not widely practiced.[38] Factors contributing to this non-use of standardized assessments may include insufficient time, inadequate equipment or space, or lack of knowledge in interpreting the assessment.[39] Walking speed is one standardized measure that can be quickly and easily incorporated into the PT examination/evaluation process.

Determining feasibility is the first essential step in deciding to use a test or measure in the clinic. The main questions clinicians should pose regarding a test's or measure's feasibility are:
(1) Is the test safe?
(2) Is it cost effective?
(3) How easy is the test to administer? and
(4) How easily are the results of the test graded and interpreted?



0 mph	0.4 mph	0.9 mph	1.3 mph	1.8 mph	2.2 mph	2.7 mph	3.1 mph
10 meter walk time	50 sec	25 sec	16.7 sec	12.5 sec	10 sec	8.3 sec	7.1 sec
10 foot walk time	15.2 sec	7.6 sec	5 sec	3.8 sec	3 sec	2.5 sec	2.2 sec

ADL: activities of daily living; IADL: instrumental ADLs; D/C: discharged; WS: walking speed; mph: miles per hour; sec: seconds

Figure 1. A collection of walking speed times that are linked to dependence, hospitalization, rehabilitation needs, discharge locations, and ambulation category.

An affirmative answer to all these questions, as there is with WS, lends to feasibility of use in a clinical setting. Walking speed is safe, requires no special equipment, adds no signif - cant cost to an assessment, requires little additional time (can be administered in less than 2 minutes[8]), is easy to calculate (distance/time), and is easy to interpret based on published norms[3,40-42] (Figure 2).

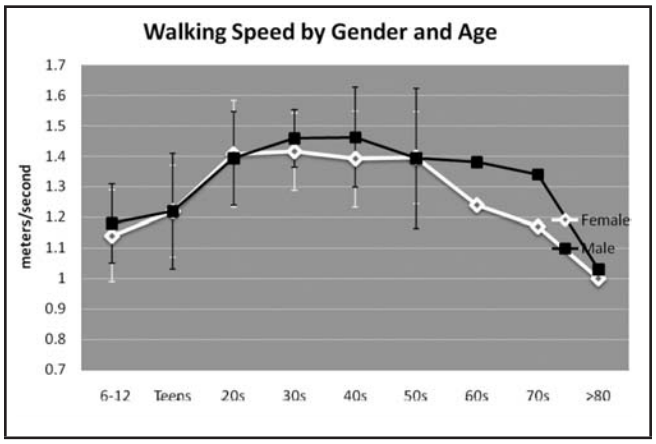


Figure 2. Self selected walking speed categorized by gender and age (6-12 and teens,[47] 20s-50s,[42] & 60s-80s[48]).

Walking speed can be quickly and accurately assessed in the majority of physical therapy practice settings, including home care, subacute and acute rehabilitation facilities, long-term care facilities, out-patient offices, and schools, as well as during community wellness/screening activities.[43] Measurements of walking speed are highly reliable, regardless of the method for measurement, for different patient populations and for individuals with known impairments affecting gait.[3,42] Examination of WS requires a stopwatch and as little as a 20 foot space to walk forward.[3] While most reported normative values are based on measuring in the middle two-thirds of a longer walkway, allowing walking speed to reach a steady state, others have used shorter distances.[44,45] If possible, timing WS three times during the examination (with a few minutes of rest between trials) and developing a mean WS value will provide a more accurate estimate of actual self-selected walking speed than a single trial would.[3,41,43]

Figure 3 displays a suggested reliable, inexpensive method to collect WS by using the 10 meter (m) walk test.[25] It requires a 20 m straight path, with 5 m for acceleration, 10 m for steady-state walking, and 5 m for deceleration. Markers are placed at the 5 and 15 m positions along the path. The patient begins to walk "at a comfortable pace" at one end of the path, and continues walking until he or she reaches the other end. The Physical Therapist uses a stopwatch to determine how much time it takes for the patient to traverse the 10 m center of the path, starting the stopwatch as soon as the patient's limb crosses the f rst marker and stopping the stopwatch as soon as the patient's limb crosses the second marker.

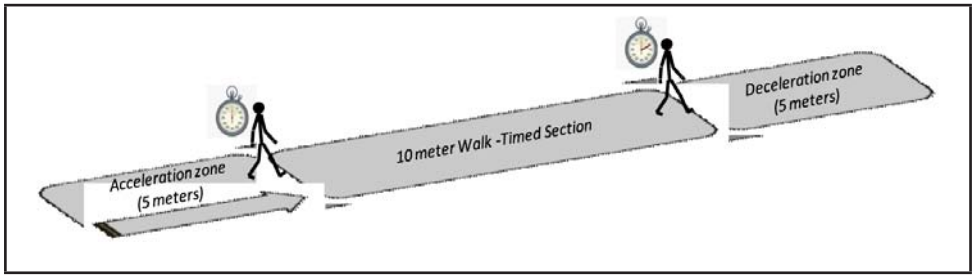


Figure 3. Suggested methods for collecting 10 meter walk test times.

If a full 20 m walkway is not available, shorter distances can be used, as long as there is adequate room for acceleration and deceleration (eg, 5 ft acceleration, 10 ft. steady state, 5 ft. deceleration).

While WS varies by age, gender, and anthropometrics, the range for normal WS is 1.2-1.4m/sec.[46] This general guideline can help in monitoring our patients, along with norms by age [42,47,48](Figure 2), and other cited cutoff points[6,8,11,12,46] (Figure 1). Interpretation of WS also includes understating what constitutes true change and what change may be due to measurement error.[49] In a recent study, with a diverse group of older participants with varying diagnoses, 0.05 m/s was calculated as the needed change for a small but meaningful improvement in WS.[25] In addition, for patients who do not have normal walking speed, an improvement in WS of at least 0.1 m/s is a useful predictor for well-being,[9,14] while a decrease in the same amount is linked with poorer health status, more disability, longer hospital stays, and increased medical costs.[9] The MDC scores are specif c to the population and will vary according to your client's presentation.[26,50]

Walking speed is an easily accessible screening tool[11] that should be performed to offer insight into our patients functional capacity and safety. Physical therapists, as specialists in movement and function, can use WS as a practical and informative functional sixth "vital sign" for all patients; examining walking speed in the same way that we routinely monitor blood pressure, pulse, respiration, temperature, and pain.[51] This sixth "vital sign" provides a relevant functional perspective to the health status provided by the system-level vital signs assessed on most visits to physicians' offices.

This review summarizes the strong psychometric properties of WS and robust evidence for using this clinical measurement. Walking speed is easily measurable, clinically interpretable,[14] and a potentially modif able risk factor.[52] For these reasons, using WS as the sixth vital sign is both pragmatic and essential.

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