

# Gait Speed as a Measure in Geriatric Assessment in Clinical Settings: A Systematic Review

Nancye M. Peel,<sup>1</sup> Suzanne S. Kuys,<sup>2,3</sup> and Kerenaftali Klein<sup>4</sup>

<sup>1</sup>Centre for Research in Geriatric Medicine, School of Medicine, The University of Queensland, Australia.

<sup>2</sup>Allied Health Research Collaborative, Metro North Health Service District, Queensland Health, Australia.

<sup>3</sup>School of Physiotherapy and Exercise Science, Griffith University, Queensland, Australia.

<sup>4</sup>Queensland Clinical Trials & Biostatistics Centre, School of Population Health, The University of Queensland, Australia.

Address correspondence to Nancye M. Peel, PhD, Centre for Research in Geriatric Medicine, Level 2, Building 33, Princess Alexandra Hospital, Ipswich Road, Woolloongabba, Queensland 4102, Australia. E-mail: [n.peel@uq.edu.au](mailto:n.peel@uq.edu.au)

**Background.** Gait speed is a quick, inexpensive, reliable measure of functional capacity with well-documented predictive value for major health-related outcomes. Numerous epidemiological studies have documented gait speed in healthy, community-dwelling older people. The purpose of this study is to undertake a systematic review and meta-analysis of gait speed in a specific group with mobility limitations—geriatric patients in clinical settings.

**Methods.** Relevant databases were searched systematically for original research articles published in February 2011 measuring gait speed in persons aged 70 or older in hospital inpatient or outpatients settings. Meta-analysis determined gait speed data for each setting adjusting for covariates.

**Results.** The review included 48 studies providing data from 7,000 participants. Across the hospital settings, the gait speed estimate for usual pace was 0.58 m/s (95% confidence interval [CI]: 0.49–0.67) and for maximal pace was 0.89 m/s (95% CI: 0.75–1.02). These estimates were based on most recent year of publication (2011) and median percentage of female participants (63%). Gait speed at usual pace in acute care settings was 0.46 m/s (95% CI: 0.34–0.57), which was significantly slower than the gait speed of 0.74 m/s (95% CI: 0.65–0.83) recorded in outpatient settings.

**Conclusions.** Gait speed is an important measure in comprehensive geriatric assessment. The consolidation of data from multiple studies reported in this meta-analysis highlights the mobility limitations experienced by older people in clinical settings and the need for ongoing rehabilitation to attain levels sufficient for reintegration in the community.

**Key Words:** Gait speed—Geriatric assessment—Systematic review—Meta-analysis—Clinical settings.

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THE ability to walk underlies many basic and community functions necessary for independence (1). Slowing of movement with ageing appears to be a universal biological phenomenon and is likely to reflect the integrated performance of numerous organ systems. Factors that influence walking ability can be classified into six main physiological subsystems: central nervous system, perceptual system, peripheral nervous system, muscles, bone and/or joints, and energy production and/or delivery (2). When these systems become dysfunctional, for example, as a consequence of an acute medical condition such as stroke or hip fracture or as a result of frailty-associated progressive decline, walking slows. The appearance of difficulties in walking marks a critical point such that assessment of gait speed has been described as the “sixth vital sign” (3) with the potential to serve as a core indicator of health and function in ageing and disease (1).

Of the available physical performance measures, gait speed represents one that is suitable to be implemented in the standard clinical evaluation of older persons (4), because it is

a quick, inexpensive, reliable measure of functional capacity (5), with high interrater and test–retest reliability (6). It has well-documented predictive value for major health-related outcomes such as hospitalizations, nursing home placements, mortality, poor quality of life, physical and cognitive functional decline, and falls (7,8), making it a useful screening measure to identify older persons at risk of such events (5). Moreover, it has been used as an outcome measure in rehabilitation (9) and in trials of interventions to delay the onset of disability or frailty (10). Advantages are that the test of gait speed is easy to administer, does not require laboratory equipment and is not limited to a specific health care discipline (8).

However, a recent systematic review of the assessment of gait speed (8) found that protocols for walking tests vary widely, influencing interpretations of physical performance (11). Timed walking tests varied according to pace (usual or maximal speed), whether static or moving start, distance walked (ranging from 4 to 500 m), and characteristics of the study group (11). The lack of consensus regarding walk

test protocol may limit intergroup comparisons and broader standardization of norms (11).

Judgments about how an individual’s gait speed compares with those of the population to which they belong requires the availability of reference values (12). Numerous large scale epidemiological studies have documented gait speed in healthy, community-dwelling older people (7,13) and normative values have been established specific to this group (12,14). However there is limited data for groups with mobility limitations. The clinical application of gait speed would benefit from estimates of the distribution of performance scores that are specific to subgroups based on, among other things, age, gender, and setting (1), taking into account test protocol.

The purpose of this article, therefore, is to undertake a systematic review and meta-analysis of gait speed for geriatric patients in hospital inpatient and outpatient settings.

METHODS

Identification and Selection of Studies

A comprehensive literature search was undertaken of Medline, Cinahl, EMBASE, Cochrane, Amed and PEDro from inception of the databases in February 2011. Search terms included (i) aged or elder\* or seniors or geriatric or frail, (ii) walk or gait or physical performance or lower extremity, and (iii) timed or speed or velocity or accel\*. A typical search strategy is outlined in Appendix 1 (see [Supplementary Material](#)). Only original studies published in English and reporting gait speed measured over a short distance (maximum 50 ft or 15 m) in a population sample of at least 20 people aged 70 years and older were eligible for inclusion in this review. Detailed criteria of studies included in this review are outlined in [Box 1](#).

Titles of identified studies were screened (S.K.) to remove those that were not relevant, for example, participants who were not human or were aged younger than 70 years, such as children. Two authors (N.P. and S.K.) independently reviewed abstracts to further eliminate studies not meeting the criteria. If there was doubt about inclusion, the decision was deferred until the entire article was reviewed. The full articles of all identified studies remaining were retrieved. Studies were further excluded if they did not meet the specified inclusion criteria, were commentaries or reviews of studies, were conference proceedings only, or were duplicated records. In addition, reference lists of included studies were hand searched to identify others meeting the inclusion criteria.

For the purposes of this review, only those studies were included if they were conducted in a clinical inpatient or outpatient hospital setting. Inpatient settings were defined as acute care and subacute care or rehabilitation. Outpatient settings included day hospital or ambulatory care clinics (eg, falls clinics).

Box 1: STUDY SELECTION CRITERIA

Article Type

- Reporting original research results (ie, reviews, editorials, and conference abstracts excluded)
- Written in English

Study Design

- Observational and experimental studies (baseline data only)

Participants

- Adults, mean age ≥70 years
- Able to undertake bipedal locomotion (ie, amputees excluded)
- At least 20 participants from the same population sample

Setting

- Participants recruited in a clinical setting including hospital inpatients (acute and subacute care or rehabilitation) and outpatients (ambulatory or day care) (ie, studies recruiting participants from residential aged care facilities or in community settings excluded)

Gait Speed

- Timed over a short distance (maximum 50 ft or 15 m)
- Reported as a continuous measure with measures of central tendency (mean and/or median) and distribution (standard deviation and/or range) (ie, categorical measures excluded)
- Measured as a straight walk on a level indoor surface with no turns (excluding walking on treadmill)
- Timed under same conditions (ie, walking under manipulated physical environment, while performing tasks, or on different surfaces excluded).

Data Extraction

Data regarding the study origins, the population being studied and protocol used to measure gait speed were extracted from the retrieved studies. Study origin data included authors, country, year of publication, and name of study, if appropriate. Study methods and population characteristics recorded were design, setting, diagnostic group, number of participants, age and gender of participants, and the study inclusion and exclusion criteria. Information recorded pertaining to the measurement of gait speed included distance walked, timing method, walking pace, static or moving start, whether walking aids were permitted during the test, number of walking trials, and if the average or fastest speed of the trials was recorded. The reported

gait speed measures, as well as the time point at which the measures were taken (eg, admission or discharge) were recorded. In studies that included patients who were unable to perform the gait speed test, data extracted included the number of nonwalkers as well as whether they were allocated a gait speed of zero. Where gait test protocol pertaining to walking pace and type of start were not available in the published study or referenced protocols, clarification was sought from the study authors.

Data were extracted by two reviewers (N.P. and S.K.) working independently and entered into a purpose designed spreadsheet. An extraction manual was developed outlining items and specific data requiring extraction. Consensus on data extraction, a method suitable for medical clinical trials (15), was achieved via pilot testing and ongoing regular meetings where coding issues and specific data extracted were compared. Disagreements were resolved through consensus.

### Data Analysis

All reported gait speed measures were converted to meters per second (m/s). For studies that included more than one group of homogenous participants, for example, an intervention group and control group, data were converted to calculate a total study group gait speed mean and standard deviation. If a study reported gait speed measures at two time points (eg, admission and discharge), only the first time point measure was included in the meta-analysis. Both fixed and random effects models were used to analyze the data. Analyses were performed in “R” by using the Metafor statistical packages, package version 1.6-0 (<http://www.R-project.org>).

Variables investigated for possible correlation with reported gait speed were publication year, mean age of participants, percentage of female participants in the study, walking pace (usual or maximal), static or moving start, clinical setting (acute, subacute, and outpatient or ambulatory), and distance for the timed walk. A metaregression was carried out to find the significant association between these variables and the outcome measure, gait speed, for both usual and maximal pace. The residual heterogeneity estimate was also obtained using restricted maximum-likelihood estimator and the subsequent test, whether the estimate is zero, was performed using Cochran’s *Q* test. In order to evaluate whether the significant effects of some of the variables to the gait speed were genuine, possible interactions of those variables were tested.

## RESULTS

### Flow of Studies Through the Review

A total of 4,646 articles were retrieved from the initial search strategy and 1,300 excluded after screening of the title. Abstracts of remaining 3,346 studies were obtained

and reviewed based on article type and participant inclusion criteria (Box 1). Duplicates were also identified and removed, leaving 1,147 potentially relevant studies for which the full text was obtained. A detailed schematic of the study selection process at Figure 1 shows reasons for exclusion. Hand searching of reference lists of reviews identified 15 further studies, resulting in a total of 460 studies that met the inclusion criteria. Studies were then classified according to the setting from which participants were recruited: community, clinical (hospital inpatient or outpatient), or residential aged care facility. This was done as it likely that gait speed could be measured differently in different settings and the reported gait speed measure may vary across different settings (16–18). For the purposes of this review, only the studies where gait speed was measured in a clinical setting have been included.

### Characteristics of Studies

Fifty-nine studies (References [30–88] in [Supplementary Material](#)) were identified that were conducted in a clinical setting. Clinical settings were grouped according to location as acute care, subacute or rehabilitation, and outpatient or ambulatory care. Six studies (30–35) were excluded from meta-analysis as they reported results on the same data set as another included study. In these cases, the study that provided the most complete data was included in this review. In addition, one study (36) was excluded as the gait speed standard deviation was not reported. Two studies (37,38) measured gait speed under different conditions and were also excluded from the meta-analysis. A further two studies (39,40) were excluded when walking pace protocol could not be established.

Study details, including participant characteristics, of the remaining 48 studies (References [41–88] in [Supplementary Material](#)) are presented for inpatient (acute or subacute) and outpatient clinical settings in [Supplementary Tables 2–4](#), respectively. A total of 7,000 participants were included in the 48 reported studies. Gait speed was recorded for 5,428 (78%) of the included participants in clinical settings (52% in acute care, 84% in subacute care, and 95% in outpatient care). Eight studies were conducted in acute care settings (41–48); 23 studies (49–71) in subacute or rehabilitation settings; and 17 studies (72–88) in outpatient or ambulatory care settings. Common diagnostic groups reported were those with neurological conditions such as stroke (49–51,60,62,66,67,71) and Parkinson’s disease (55,80); and orthopedic conditions requiring surgical repair, such as hip fracture (44,61,64,65), or joint replacement (56,79,84,87).

### Gait Speed

*Measurement of gait speed.*—As illustrated in [Supplementary Tables 2–4](#), there were variations in the protocol to measure gait speed. Distance for the timed walk

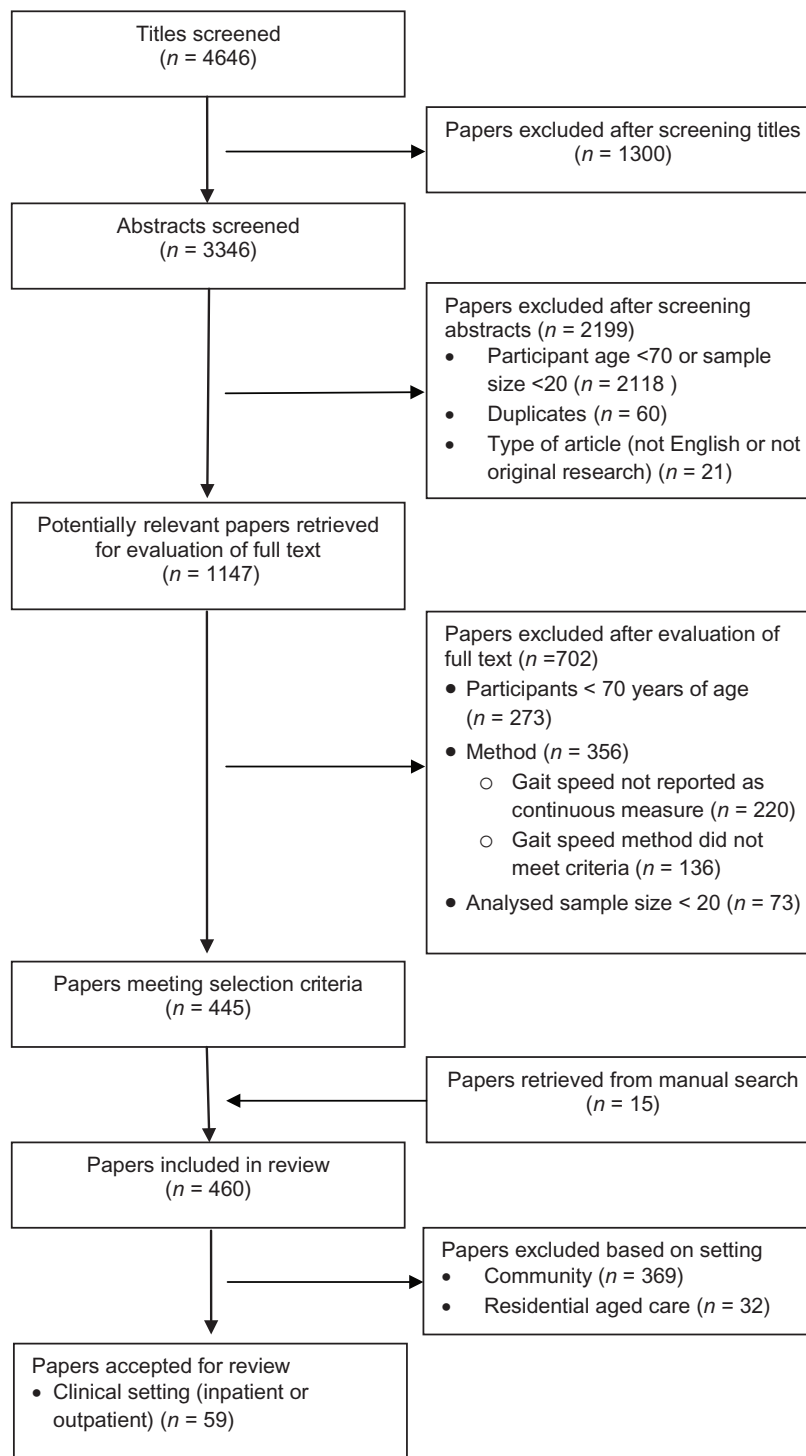


Figure 1. Schematic of the study selection process.

ranged from 2 to 15 m, and one study (44) measured gait speed over two distances (10 and 50 ft). Because the gait speeds were comparable and more participants could complete the shorter walk, this measure was included in the meta-analysis. Another variation in protocol was whether timing commenced from a static or moving start. Where a

computerized mat was used to measure gait parameters, a moving start was assumed.

Forty-two studies measured gait speed using a self-selected or usual pace. Other terms in the literature to denote gait speed at *usual* pace included *comfortable*, *habitual*, *normal*, or *preferred*. Nine studies recorded gait



speed at a maximal or fast pace, including two studies in the outpatient or ambulatory setting (77,88) and one study in the postacute or rehabilitation setting (54) measuring gait speed with both a usual and a maximal pace.

**Gait speed values.**—The fit of a random effects model was significantly better than that of a fixed effects model ( $p < .01$ ). Significant residual heterogeneity was found ( $p < .01$ ). There were two final models—the first with the following covariates: publication year, percentage of female participants in the study, and walking pace. The second model included an extra covariate: the clinical setting

(acute, subacute, or outpatient). Mean age, type of start (static or moving), whether walking aid permitted, and distance were not found to be significantly associated with the recorded gait speed. The mean gait speeds with 95% confidence interval (CI) from the included studies (42 with usual and 9 with maximal walking pace) are shown in Figure 2, as well as overall random effects estimates for the two walking paces (the first model).

From a random effects model, faster gait speeds were reported by more recent publications. Gait speed increased by 0.013 m/s (95% CI: 0.003–0.023) per year of publication, which ranged from 1988 to 2011. Studies with a

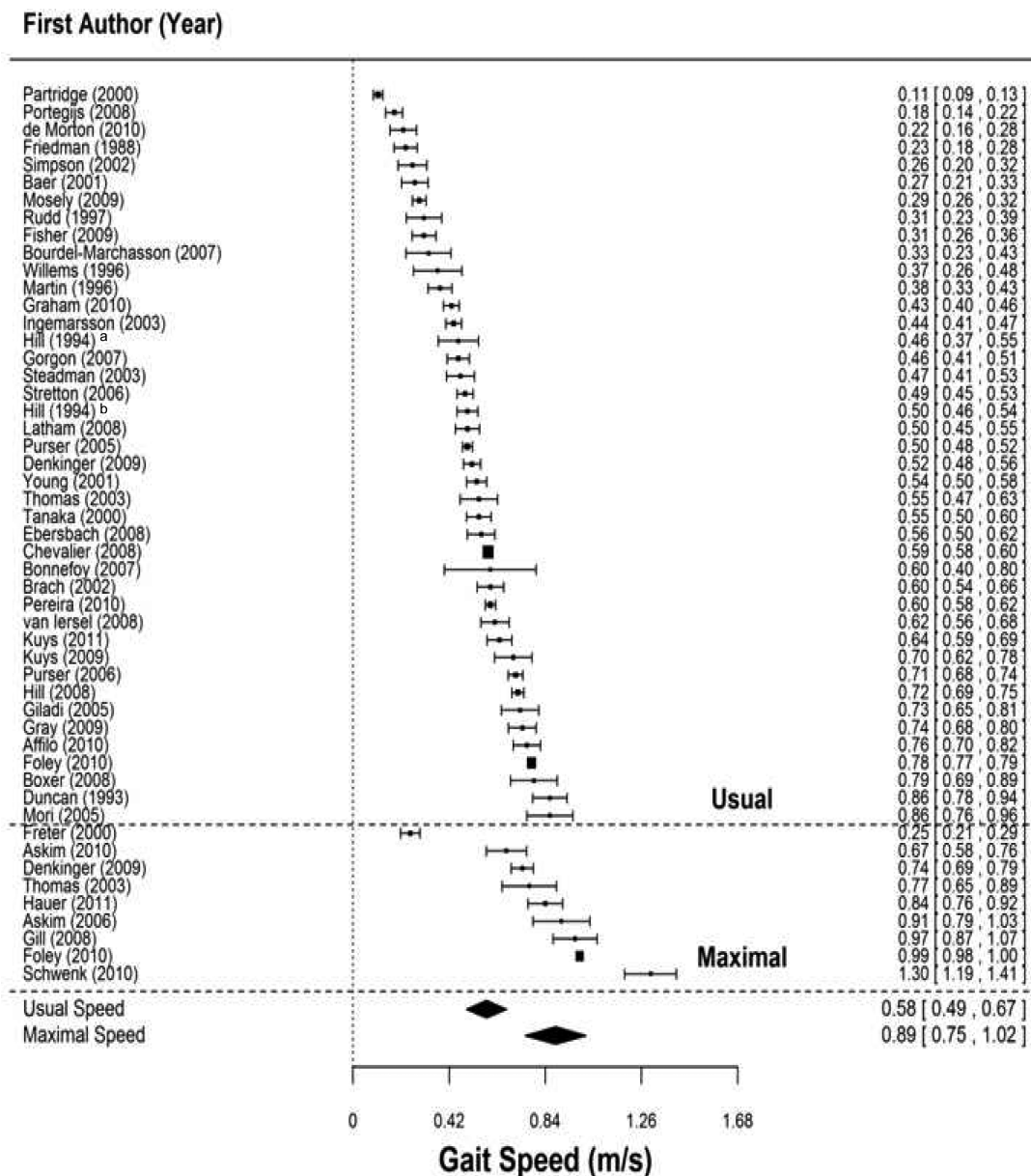


Figure 2. Mean gait speeds with 95% confidence interval (CI) of 42 included studies for usual pace and 9 included studies for maximal pace (3 studies measured both usual and maximal pace). Metaregression of 48 studies, illustrating overall random effects estimates (mean and 95% CI) for usual and maximal pace. <sup>a</sup>Reference 60 (Supplementary Material). <sup>b</sup>Reference 81 (Supplementary Material).

greater percentage of female participants included in the study population were found to report a significantly slower gait speed. There was an incremental decrease in gait speed of 0.003 m/s (95% CI: 0.001–0.006) for every percentage increase in the proportion of female participants in the study population. Gait speed measured using maximal compared with usual pace was significantly faster by 0.302 m/s (95% CI: 0.158–0.447).

The overall gait speed estimate for usual pace for all included studies was 0.58 m/s (95% CI: 0.49–0.67) and maximal pace was 0.89 m/s (95% CI: 0.75–1.02) as shown in Figure 2. These estimates are deemed to be determined from the hypothetical population from which the set of studies included in the meta-analysis are assumed to be a random selection. The estimates are calculated based on the most recent year of publication (2011) and median percentage of female participants (63%).

The addition of clinical setting in the model found that the studies performed in an outpatient (ambulatory care) setting compared with the acute inpatient setting reported significantly faster gait speed by 0.293 m/s (95% CI: 0.173–0.414). There was no significant difference in estimated gait speed between the acute and subacute inpatient hospital settings. Table 1 shows the estimates of usual and maximal pace gait speed for each clinical setting.

## DISCUSSION

The overall gait speed estimate for usual pace was 0.58 m/s (95% CI: 0.49–0.67) and maximal pace was 0.89 (95% CI: 0.75–1.02). These estimates are slower than that regarded as normal for community-dwelling adults older than 70 years of age. A comfortable gait speed for healthy women aged between 70 and 79 years is 1.13 m/s and for men 1.26 m/s (14). For women and men aged 80–99 the values are 0.94 m/sec and 0.97 m/sec, respectively (14). In addition, this is a slower gait speed than that measured for community-dwelling older adults deemed as transitioning to frailty (mean: 0.97 m/s) (19). With a recent systematic review proposing a gait speed of 0.8 m/s as a predictor of poor clinical outcomes and 0.6 m/s as a threshold to predict further functional decline in those older adults already impaired (7), the findings of

this review highlight the low functional ability and high-risk nature of people in clinical settings.

An interesting finding of this review was that more recent publications reported a faster gait speed, even after adjusting for the clinical setting and the walk pace. Researchers found that gait speed increased a mean estimate of 0.013 m/s (95% CI: 0.003–0.023) per publication year. The relevant interaction models also confirmed that similar faster gait speed for recent publications was expected in all three clinical settings and the two walk pace groups. The publication dates of included studies in this review ranged from 1988 to 2011—a total of 23 years. Such a time frame is sufficient to be influenced by improving health and survival rates in older populations. Reviews of morbidity and mortality trends have shown a significant reduction in the rate of functional decline over the last three decades (20,21).

Other personal factors known to influence gait speed include age and gender (22). In this meta-analysis, age did not influence the estimated gait speed, possibly because this review only included studies where the average participant age was at least 70 years, and thus representative of the geriatric population of interest. Gender did, however, influence the estimated gait speed. Those studies with a higher proportion of female participants reported, on average, a slower gait speed. For every 1% increase in female participants, gait speed slowed by 0.003 m/s (95% CI: 0.001–0.006). Although aerobic capacity and body stature (height and weight) are also known to influence gait speed (17,23), none of the studies selected in the review adjusted for these factors.

The accuracy of measuring gait speed over distances less than 4 m, particularly when using a static start, has been questioned (4). The use of a moving start to allow for acceleration prior to commencing timing potentially could result in a faster gait speed. A distance of 2.5 m has been suggested before steady state walking is achieved in frail older people (24). However, the current review findings showed no significant difference in gait speed adjusting for type of start (static or moving). This is in agreement with a previous review that also demonstrated that although faster gait speeds were recorded when measured with a moving compared with a static start, the findings were not significantly different (11).

Only studies measuring gait speed over distances of 15 m or less were included in this review, with the majority (34 studies) using a timed walk over less than 10 m. In agreement with other studies (17,25), this review showed that distance walked during the gait speed test did not influence the recorded gait speed. One study (44) that measured gait speed over two distances (10 and 50 ft) in the same population sample found no difference in gait speed mean or standard deviation for those who could complete the test, but a population-based study measuring normal gait speed over 8 and 20 ft (17) showed that speeds over these distances differed significantly but not clinically. The conclusion was

Table 1. Estimates for Usual and Maximal Pace Gait Speed in Clinical Settings

| Pace    | Location   | Gait Speed Estimates (m/s) | SE    | 95% CI      |
|---------|------------|----------------------------|-------|-------------|
| Usual   | Acute      | 0.455                      | 0.057 | 0.344–0.567 |
|         | Subacute   | 0.529                      | 0.046 | 0.438–0.619 |
|         | Ambulatory | 0.739                      | 0.046 | 0.648–0.831 |
| Maximal | Acute      | 0.749                      | 0.080 | 0.592–0.905 |
|         | Subacute   | 0.822                      | 0.057 | 0.711–0.933 |
|         | Ambulatory | 1.033                      | 0.063 | 0.910–1.156 |

Notes: CI = confidence interval; SE = standard error.

that, as gait speed over these short distances was comparable, using the shorter distance appears justifiable (17). However, results are not consistent and may be dependent on patient diagnosis (eg, stroke) and time since onset (26).

In reporting the walk test protocol, 31 (64.6%) of selected studies permitted the use of a walking aid if necessary, four studies (8.3%) did not allow the use of assistive devices, and 13 (27.1%) did not specify whether use of walking aids was permitted during testing.

The proportion of patients using a mobility aid ranged from 15% to 98.5% indicating the heterogeneity of included studies with respect to mobility limitations. Although the use and type of walking aid may potentially affect the measured gait speed (27), few studies reported the type of walking aid used during the gait test. Only one study (84) compared gait speed for participants who did, or did not, use a walking aid (cane) and found that individuals with gait aids performed more poorly than those without.

A key issue to consider when measuring gait speed involves handling of those participants who are unable to complete the timed walk. Many of the included studies in this review only recruited participants when they could walk the required distance. Such an inclusion criteria may be reasonable but it does have implications for the interpretation of a study's findings. Some test protocols, such as the Short Physical Performance Battery (4), suggest that a gait speed of 0 m/s should be assigned to nonwalkers or participants who cannot complete the walk test, so that accurate estimates of gait speed in this clinical population are ascertained and progress can be monitored over time. At the very least, the number of nonwalkers at each assessment point should be reported.

There were several limitations to this review. Only including studies where the average age was 70 years or more resulted in the exclusion of many studies particularly those with earlier onset of specific diseases, for example, stroke and Parkinson's disease. Other factors influencing gait speed estimates such as height, weight, and gait aid used were not included in the models because of the heterogeneity of selected studies and lack of detail in reported walk test protocols. Similarly, diagnoses and underlying pathology such as focal gray matter atrophy associated with motor disturbances in older age (28) were not accounted for in gait speed estimates. Limitations in the methodology reported to extract data for this review were the lack of quantitative measures of interrater agreement on variables used in the meta-analysis, as well as independent expert advice on comprehensiveness of the search strategy to include all relevant articles. Identification of articles for inclusion as well as data extraction was done independently by the authors and agreement was achieved by consensus.

## CONCLUSION

Gait speed has been shown to be an important measure in comprehensive geriatric assessment in all clinical settings

for the purposes of developing risk profiles and care plans for geriatric patients (29). The consolidation of data from multiple studies reported in this meta-analysis highlights the mobility limitations experienced by older people in clinical settings and the need for ongoing rehabilitation to attain levels sufficient for reintegration in the community.

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## SUPPLEMENTARY MATERIAL

Supplementary material can be found at: <http://biomedgerontology.oxfordjournals.org/>.

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## REFERENCES

1. Studenski S. Bradypedia: is gait speed ready for clinical use? *J Nutr Health Aging*. 2009;13(10):878–880.
2. Ferrucci L, Bandinelli S, Benvenuti E, et al. Subsystems contributing to the decline in ability to walk: bridging the gap between epidemiology and geriatric practice in the InCHIANTI study. *J Am Geriatr Soc*. 2000;48(12):1618–1625.
3. Fritz S, Lusardi M. White paper: “walking speed: the sixth vital sign.” *J Geriatr Phys Ther*. 2009;32(2):46–49.
4. Guralnik JM, Ferrucci L, Pieper CF, et al. Lower extremity function and subsequent disability: consistency across studies, predictive models, and value of gait speed alone compared with the short physical performance battery. *J Gerontol A Biol Sci Med Sci*. 2000;55(4):M221–M231.
5. Cesari M, Kritchevsky SB, Penninx BW, et al. Prognostic value of usual gait speed in well-functioning older people—results from the Health, Aging and Body Composition Study. *J Am Geriatr Soc*. 2005;53(10):1675–1680.
6. Studenski S, Perera S, Wallace D, et al. Physical performance measures in the clinical setting. *J Am Geriatr Soc*. 2003;51(3):314–322.
7. Abellan van Kan G, Rolland Y, Andrieu S, et al. Gait speed at usual pace as a predictor of adverse outcomes in community-dwelling older people: an International Academy on Nutrition and Aging (IANA) Task Force. *J Nutr Health Aging*. 2009;13(10):881–889.
8. Graham JE, Ostir GV, Fisher SR, Ottenbacher KJ. Assessing walking speed in clinical research: a systematic review. *J Eval Clin Pract*. 2008;14(4):552–562.
9. Skinner A, Turner-Stokes L. The use of standardized outcome measures in rehabilitation centres in the UK. *Clin Rehabil*. 2006;20(7):609–615.
10. Fairhall N, Aggar C, Kurrle SE, et al. Frailty Intervention Trial (FIT). *BMC Geriatr*. 2008;8:27.
11. Graham JE, Ostir GV, Kuo YF, Fisher SR, Ottenbacher KJ. Relationship between test methodology and mean velocity in timed walk tests: a review. *Arch Phys Med Rehabil*. 2008;89(5):865–872.
12. Bohannon RW, Andrews AW, Thomas MW. Walking speed: reference values and correlates for older adults. *J Orthop Sports Phys Ther*. 1996;24(2):86–90.
13. Studenski S, Perera S, Patel K, et al. Gait speed and survival in older adults. *JAMA*. 2011;305(1):50–58.
14. Bohannon RW, Williams Andrews A. Normal walking speed: a descriptive meta-analysis. *Physiotherapy*. 2011;97(3):182–189.
15. Orwin R, Vevea J. Evaluating coding decisions. In: Cooper H, Hedges L, Valentine J, eds. *The Handbook of Research Synthesis and Meta-Analysis*. 2nd ed. New York: Russell Sage Foundation; 2009:175–205.

16. Bohannon RW. Measurement of gait speed of older adults is feasible and informative in a home-care setting. *J Geriatr Phys Ther.* 2009;32(1):22–23.
17. Bohannon RW. Population representative gait speed and its determinants. *J Geriatr Phys Ther.* 2008;31(2):49–52.
18. Moseley AM, Lanzarone S, Bosman JM, et al. Ecological validity of walking speed assessment after traumatic brain injury: a pilot study. *J Head Trauma Rehabil.* 2004;19(4):341–348.
19. Kressig RW, Gregor RJ, Oliver A, et al. Temporal and spatial features of gait in older adults transitioning to frailty. *Gait Posture.* 2004;20(1):30–35.
20. Crimmins EM, Beltrán-Sánchez H. Mortality and morbidity trends: is there compression of morbidity? *J Gerontol A Psychol Sci Soc Sci.* 2011;66B(1):75–86.
21. Mor V. The compression of morbidity hypothesis: a review of research and prospects for the future. *J Am Geriatr Soc.* 2005;53(9 suppl):S308–S309.
22. Bohannon RW. Comfortable and maximum walking speed of adults aged 20–79 years: reference values and determinants. *Age Ageing.* 1997;26(1):15–19.
23. Fiser WM, Hays NP, Rogers SC, et al. Energetics of walking in elderly people: factors related to gait speed. *J Gerontol A Biol Sci Med Sci.* 2010;65(12):1332–1337.
24. Lindemann U, Najafi B, Zijlstra W, et al. Distance to achieve steady state walking speed in frail elderly persons. *Gait Posture.* 2008;27(1):91–96.
25. Ng SS, Ng PC, Lee CY, Ng ES, Tong MH. Walkway lengths for measuring walking speed in stroke rehabilitation. *J Rehabil Med.* 2012;44(1):43–46.
26. Salbach NM, Mayo NE, Higgins J, Ahmed S, Finch LE, Richards CL. Responsiveness and predictability of gait speed and other disability measures in acute stroke. *Arch Phys Med Rehabil.* 2001;82(9):1204–1212.
27. Schwenk M, Schmidt M, Pfisterer M, Oster P, Hauer K. Rollator use adversely impacts on assessment of gait and mobility during geriatric rehabilitation. *J Rehabil Med.* 2011;43(5):424–429.
28. Rosano C, Bennett DA, B Newman A, et al. Patterns of focal gray matter atrophy are associated with bradykinesia and gait disturbances in older adults. *J Gerontol A Biol Sci Med Sci.* 2012. doi:10.1093/gerona/glr262
29. Cesari M. Role of gait speed in the assessment of older patients. *JAMA.* 2011;305(1):93–94.