

# Limitations in Gait Speed Persist at Discharge from Subacute Rehabilitation

APRIL M BARTHULY<sup>1)\*</sup>, RICHARD W BOHANNON<sup>2,3)</sup>, WALTER GORACK<sup>1)</sup>

<sup>1)</sup> AllStar Therapy: 108 Montoya Circle, Branford, CT, 06405, USA. TEL: +1 781-820-5046,  
FAX: +1 860-447-3749

<sup>2)</sup> Physical Therapy Program, Department of Kinesiology, University of Connecticut

<sup>3)</sup> Physical Therapy Consultants

**Abstract.** [Purpose] Walking speed is related to important outcomes such as mortality and is fundamental to independent and safe ambulation in the community. The objectives of this study were to determine if the discharge gait speed of patients completing subacute rehabilitation was slow relative to normative and street crossing reference values, and whether such speed was associated with age, gender, or diagnosis. [Subjects and Methods] Consecutive patients admitted to a subacute rehabilitation facility were screened based on inclusion and exclusion criteria. Participants were 109 patients (56 women) 60 to 98 (mean=78.2) years old who were divided into 10 diagnostic categories. Gait speed was measured over a distance of 5.2 meters as patients walked at their most comfortable speed beyond a designated finish line. Timing with a digital stopwatch began after an acceleration distance of 1 meter and ceased as patients crossed the finish line. [Results] The patients' comfortable gait speed (mean=0.58; SD=0.19; range=0.09–1.10 m/s) was significantly less than 1.0m/s (normal reference value) (1.11±0.15 m/s) but significantly greater than that required for crossing the street (0.49 m/s). Nevertheless, 27.5% of patients did not achieve a walking speed of 0.49 m/s. Speed was inversely related to age and was lower among women, but it was not affected by diagnostic category. [Conclusion] Gait speed remains limited when patients are discharged home from subacute rehabilitation and was slowest among older women patients. Further therapy may be warranted for such patients after discharge.

**Key words:** Gait speed, Rehabilitation, Older adults

(This article was submitted Feb. 5, 2013, and was accepted Mar. 19, 2013)

## INTRODUCTION

The ability to walk is valued highly by human beings<sup>1)</sup>. Although speed is only one aspect of gait about which individuals might be concerned<sup>2)</sup>, it is an important one. Gait speed has been shown to be a predictor of outcomes such as mortality and incident health events<sup>3, 4)</sup>. Gait speed is also fundamental to independent and safe ambulation in the community. Specifically with regard to safety, Andrews et al. recently reported that the mean speed necessary for crossing streets in the time allotted by crossing signals was 0.49 m/s<sup>5)</sup>.

Considerable time is spent on gait-training patients admitted to rehabilitation facilities<sup>6)</sup>. Nevertheless, older age and female gender<sup>7)</sup>, as well as various underlying pathologies or conditions, may limit the speed at which patients walk at discharge<sup>8)</sup>. If patients' walking speed is diminished when they are discharged home, additional therapy may be warranted if their risk of untoward outcomes is to be reduced and they are to manage life in the community. The primary purpose of this study, therefore, was to determine if the gait speed of older patients discharged to home from a subacute rehabilitation facility was limited relative to a gen-

der and age relevant normative reference value and a criterion reference value, street-crossing. The second purpose was to determine if gait speed at discharge was associated with age and whether it differed between men and women and across diagnostic groups.

## SUBJECTS AND METHODS

Prior to initiating this study the Institutional Review Board of the University of Connecticut granted approval. Participants provided their written informed consent.

### Subjects

Consecutive patients admitted to a subacute rehabilitation facility were screened based on inclusion and exclusion criteria. Inclusion in this study required that subjects were at least 60 years of age, were independently ambulatory in the community prior to the hospital admission preceding their transfer to the subacute facility, and were scheduled for a discharge to the community. Exclusion criteria were an Abbreviated Mental Test score of less than 6/10<sup>9)</sup> and a requirement of more than minimum assistance with walking at discharge from the facility. The first exclusion criterion was founded on the need for participants to understand instructions and provide informed consent; the second exclusion criterion was based on the requirement that partici-

\*To whom correspondence should be addressed.  
E-mail: abarthuly@gmail.com

pants themselves be the primary determinant of their own gait speed<sup>8</sup>).

Following these criteria 109 patients were included in this study. They ranged in age from 60 to 98 years (78.2±9.4). Fifty-six were women and 53 were men. There were 9 diagnostic categories to which 4 or more patients belonged: total knee arthroplasty (n= 24), fall with or without fracture (n= 13), infection (n= 13), cardiac (n= 13), pulmonary (n= 8), total hip arthroplasty (n= 8), stroke (n= 7), cancer (n= 5), and spinal (n= 4). Fourteen patients did not belong to any of these categories and were categorized as "other." Most patients walked without personal assistance. Single-point canes were the most frequently used assistive device (Table 1).

### Methods

Gait speed was measured over a distance of 5.2 meters as patients walked at their most comfortable speed beyond a designated finish line. One of 2 testers timed a single trial as they walked behind and to the side of patients. Timing with a digital stopwatch began after patients had traversed an acceleration distance of 1 meter and ceased when they crossed the finish line<sup>7</sup>. Measurements of gait speed measured on consecutive days earlier during the rehabilitation stay demonstrated good test-retest reliability (intraclass correlation coefficient = 0.899).

All data analysis was conducted using the Statistical Package for Social Sciences (SPSS 14.0). Standard descriptive statistics were calculated. Thereafter patients' discharge walking speed was compared with age- and gender- matched normative reference values<sup>7</sup> and the speed required for crossing the street (0.49 meters/second)<sup>5</sup>. Sign tests were used for this purpose. The relationship between age and gait speed was determined using the Spearman correlation coefficient. The Mann-Whitney U test was used to compare the gait speed of men and women. The Kruskal-Wallis test was conducted to determine if gait speed differed among the diagnostic categories.

**Table 1.** Description of personal assistance and assistive device used for walking at discharge

Category	N (%)
Personal Assistance	
Minimum	2 (1.8)
Contact guarding	6 (5.5)
Supervision	11 (10.1)
None	90 (82.6)
Assistive Device	
Rolling walker/rollator	38 (34.8)
Walker	1 (0.9)
Crutches	1 (0.9)
Quad cane	4 (3.7)
Single point cane	47 (43.1)
Hand-held	1 (0.9)
None	17 (15.6)

## RESULTS

The patients' mean speed was 0.58±0.19 (range 0.09–1.10) m/s. The speed of apparently healthy individuals matched categorically for age and gender was 1.11±0.15 (range 0.94–1.34) m/s<sup>4</sup>. The sign test showed the patients comfortable gait speeds were significantly less than the relevant norms ( $z = -9.961$ ,  $p < 0.001$ ). Only 2 patients had comfortable speeds equal to or greater than their age and gender normative values. The sign test showed that the patients' comfortable gait speed was significantly faster than the 0.49 m/s street crossing criterion ( $z = -4.598$ ,  $p < 0.001$ ). Yet the comfortable walking speed of 27.5% of the patients was slower than this value. The Spearman correlation between age and gait speed was  $-0.249$  ( $p = 0.009$ ). The Mann-Whitney U test showed that the women walked significantly slower ( $z = -2.231$ ,  $p = 0.026$ ) than the men (0.54±0.18 m/s vs 0.62±0.20 m/s, respectively). Table 2 summarizes the speeds of the different diagnostic groups. The Kruskal-Wallis test did not demonstrate a significant difference in the speeds ( $\chi^2 = 15.86$ ,  $p = 0.070$ ).

## DISCUSSION

Gait limitations are a common target of intervention for patients admitted to rehabilitation facilities<sup>6</sup>. Although the 109 patients in our study belonged to diverse diagnostic categories, all but 7 had an ICD 9 treatment diagnosis of "Difficulty in Walking." The ICD 9 treatment diagnosis for 3 of the remaining patients was "Abnormality of Gait." Consequently, considerable time was spent gait-training these patients over a rehabilitation stay of 2 to 94 (mean= 17.0) days. This training notwithstanding, the walking speed at discharge was less than age- and gender based norms for all but 2 patients. Moreover, at discharge 27.5% demonstrated a speed less than required (0.49 m/s) to cross the street in the allotted time. These patients, it should be acknowledged, may have been able to walk faster than 0.49 m/s if asked to do so. Regardless, timing comfortable gait speed identified limitations in gait that might not be identified by other measures. For the 109 patients tested, 82.6% would not have been categorized as limited based on need of supervision or

**Table 2.** Description of gait speed (meters/second) at discharge for different diagnostic categories

Diagnostic Category	Mean ± SD	Minimum–Maximum
Cardiac	0.47±0.11	0.27–0.59
Cancer	0.50±0.28	0.09–0.87
Pulmonary	0.51±0.17	0.31–0.84
Spinal	0.51±0.17	0.29–0.69
Fall/fracture	0.54±0.13	0.38–0.86
Infection	0.58±0.24	0.28–1.04
Knee arthroplasty	0.61±0.15	0.32–0.87
Other	0.65±0.24	0.27–1.10
Hip arthroplasty	0.68±0.19	0.41–0.94
Stroke	0.68±0.22	0.36–0.98

personal assistance and 15.6% would not have been identified as limited based on use of an assistive device.

Our findings corroborate those of others reporting limitations in the gait speed of older adults discharged from hospital<sup>10)</sup> and rehabilitation programs<sup>8, 11)</sup>. These findings, along with a recognition of the implications of gait speed for outcomes among older adults<sup>3, 4)</sup>, highlight the importance of addressing gait speed in this population. Our study identified older women as more likely to demonstrate slow walking speeds. This finding, which is consistent with what is known about healthy individuals<sup>7)</sup>, suggests that the walking speed of older women merits particular scrutiny. Our study did not identify diagnostic group as a determinant of walking speed. Although the study may have been underpowered to detect such differences, this finding suggests that slow walking speed is a likely problem regardless of diagnostic group.

Our study does not address whether a specific rehabilitation intervention or an extended rehabilitation stay would be beneficial for in increasing gait speed. It does not report on walking speed before admission to the hospital or after discharge from subacute rehabilitation. Nevertheless, broader use of gait speed as a vital sign<sup>12)</sup> would appear warranted as would be interventions for patients who continue to demonstrate limitations in gait speed.

### CONCLUSION

Despite undergoing short-term rehabilitation with a focus on gait-training, patients continued to walk slowly at discharge. This was particularly true of older women. Given the importance of gait speed to consequential outcomes and community ambulation, follow-up would appear warranted.

### REFERENCES

- 1) Iezzoni L: When Walking Fails. Mobility Problems of Adults with Chronic Conditions. Berkeley and Los Angeles: University of California Press, 2003.
- 2) Bohannon RW, Andrews AW, Smith MB: Rehabilitation goals of patients with hemiplegia. *Int J Rehabil Res*, 1988, 11: 181–184. [[CrossRef](#)]
- 3) McGinn AP, Kaplan RC, Verghese J, et al.: Walking speed and risk of incident ischemic stroke among postmenopausal women. *Stroke*, 2008, 39: 1233–1239. [[Medline](#)] [[CrossRef](#)]
- 4) Afilalo J, Eisenberg MJ, Morin JF, et al.: Gait speed as an incremental predictor of mortality and major morbidity in elderly patients undergoing cardiac surgery. *J Am Coll Cardiol*, 2010, 56: 1668–1676. [[Medline](#)] [[CrossRef](#)]
- 5) Andrews AW, Chinworth SA, Bourassa M, et al.: Update on distance and velocity requirements for community ambulation. *J Geriatr Phys Ther*, 2010, 33: 128–134. [[Medline](#)]
- 6) Jette DU, Latham NK, Smout RJ, et al.: Physical therapy interventions for patients with stroke in inpatient rehabilitation facilities. *Phys Ther*, 2005, 85: 238–248. [[Medline](#)]
- 7) Bohannon RW, Andrews AW: Normal walking speed: a descriptive meta-analysis. *Physiotherapy*, 2011, 97: 182–189. [[Medline](#)] [[CrossRef](#)]
- 8) Gorgon E, Said C, Galea M: Mobility on discharge from an aged care unit. *Physiother Res Int*, 2007, 12: 72–81. [[Medline](#)] [[CrossRef](#)]
- 9) Hodkinson HM: Evaluation of mental test score for assessment of mental impairment in the elderly. *Age Ageing*, 1972, 1: 233–238. [[Medline](#)] [[CrossRef](#)]
- 10) Braden HJ, Hilgenberg S, Bohannon RW, et al.: Gait speed is limited but improves over the course of acute care physical therapy. *J Geriatr Phys Ther*, 2012, 35: 140–144. [[Medline](#)] [[CrossRef](#)]
- 11) Friedman PJ, Richmond DE, Baskett JJ: A prospective trial of serial gait speed as a measure of rehabilitation in the elderly. *Age Ageing*, 1988, 17: 227–235. [[Medline](#)] [[CrossRef](#)]
- 12) Studenski S, Perera S, Wallace D, et al.: Physical performance measures in a clinical setting. *J Am Geriatr Soc*, 2003, 51: 314–322. [[Medline](#)] [[CrossRef](#)]