Discharge gait speed and hospital readmission for the elderly population: A pilot study

By

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ABSTRACT

Objective: To describe whether discharge gait speed, after a course of physical therapy, is related to hospital readmission in the elderly population.

Design: Observational cross-sectional study of discharge gait speed and a tracking system linking those who were readmitted to the hospital in 3 and 6 months post-discharge.

Setting: Acute care, skilled nursing, and inpatient rehabilitation facilities of a regional medical center in the United States.

Participants: Individuals (N=172) that were admitted with physical therapy orders with full weight bearing status who could ambulate 20 feet and consented to participate. Participants who had orthopedic or neurologic primary diagnoses or elective surgeries were excluded. Participants were contacted at home at 3 month and 6 months after inpatient stays to determine subsequent readmissions to any inpatient facility.

Main Outcome Measure: Discharge gait speed and 3 and 6 month inpatient readmission.

Results: Participants who required readmission to an inpatient setting had discharge gait speed of 0.44 m/s ±0.08 (N=12) while those not readmitted had a discharge gait speed of 0.52 m/s ±0.10 (N=23). Independent t-tests failed to show significant differences in the two speeds with the limited participant size.

Conclusions: Although significant differences in discharge gait speed were not realized in this small pilot study, discharge gait speed has the potential to be an informative measure of patient status after initial inpatient stay, given the appropriate statistical power. This is a pilot study that requires additional data collection (N=318) to obtain a power of 80% with the possibility of realized differences in the two groups.

Key Words: Gait Speed; Hospital Readmission; Mobility; Physical Therapy

INTRODUCTION

Gait speed is the measure of time it takes for a person to walk a set distance (often 5 meters) at a comfortable pace, represented in distance/time. Gait speed is also known as walking speed and gait velocity.

Gait speed has been described as a "sixth vital sign" that can be a predictor of comorbidities and future health status.[1,2] This measure has been used as an important outcome measure to determine hospital length of stay, discharge destination, the need for rehabilitation, and functional status.[1,3,4] Walking speed has also been used to predict falls, hospitalization, and mortality.[1,4,5]

Previous research has attempted to determine the speed at which gait speed is considered normal or abnormal. Table 1 reflects data from a meta-analysis completed by Bohannon et al. and describes the normative gait speed data taken from a variety of sources.[6] Ostir et al. suggests that a walking speed of 1.0 meters/second (m/s) reflects the ability to perform activities of daily living (ADL) and is an indicator for community living.[3] They also suggest that a gait speed of less than 0.6 m/s is considered abnormally low.[3] An abnormally low gait speed has been linked to an individual's ability to function in the community and can be used as a predictor of fall risk, dependence in ADL, and discharge destination.[7,8]

Hospital readmission can occur for a variety of reasons with many different predictors used to assess a patient's increased risk. Common demographics of patients who are readmitted are patients with heart disease, those who have had organ transplants, CHF patients, diabetes patients, patients with polypharmacy incidents, and those of increased age. Research has explored the correlation between many other factors and hospital readmission. For example, alcohol use disorders have been associated with a high risk of hospital readmission.[9] Quality of

care has also been identified as a predictor of readmission. Mokhtar et al found an inverse relationship between hospital readmission and the quality of care provided to diabetic patients.[10] Through using routine inpatient data, Halfon et al found that those with previous hospitalizations, a long length of stay, and high comorbidity were associated with a high risk of readmission.[11] Among surgical patients, the more common reasons for readmission after surgery include infection, GI complications, and malnutrition.[12] Patients with substance abuse disorder, psychotic illness, medical comorbidities, and a prior inpatient stay were more likely to be readmitted.[13] Munley et al. identified 6 variables that can be used to determine readmission which include: race, number of prior psychiatric hospitalizations, occupational level, report of depression upon admission, type of discharge, and suicide attempt 1 month prior to admission.[14] The elderly and those who use more hospital services in previous years are also more likely to be readmitted to the hospital.[15] Shu et al. found that patients with a longer hospitalization, active malignancy, anemia, and a high Charlson score are indicative of readmission.[16] The Charlson Comorbidity Index (CCI) is a scoring system that uses the International Classification of Diseases to measure disease severity and is commonly used to measure patient's premorbid conditions.[16,17] The higher the Charlson score, the more likely the predicted outcome will result in mortality or higher resource use[18]. The CCI has excellent interrater reliability and has been used for its accuracy in readmission prediction for those with cancer and acute illness.[16,17,19]

It is obvious there are predictors of readmission proven through research, however, there is very little to no evidence showing a correlation between hospital readmission and patient risk factors such as gait speed. There are a variety of tests and measures used in the hospitals and clinical settings that assess gait and use the measured gait speed to predict a patient's safety and risk. The Timed Up and Go (TUG) test is an outcome measure used to assess gait speed, balance,

and fall risk in older adults. The higher the score, the higher the fall risk for the patient. The TUG test has excellent interrater reliability, intrarater reliability, and excellent criterion validity.[20] The Brief-BESTest is an abbreviated version of the BESTest and consists of 6 items taken from the 6 subsections of the BESTest. This outcome measure assesses balance and functional mobility. The Brief-BESTest utilizes the TUG test in one of its 6 sections and is a predictor of fall risk and balance deficit.[21] The Brief-BESTest demonstrates excellent correlation/content validity with the BESTest and has excellent interrater reliability.[21,22]

Gait speed can be used to predict dependence in ADLs, discharge to home, and community ambulation ability. There is also a relationship between gait speed and initial hospitalization. Montero-Odasso et al. studied 102 subjects for gait velocity as a predictor of adverse events in healthy seniors over 75. They concluded that individuals with low gait velocity had a significantly higher incidence of adverse events than those with high or median velocity and that gait velocity may be used to predict whether elderly people are at risk for adverse events such as initial hospitalization.[23]

Penninx et al. examined the impact of reduced lower extremity performance on subsequent hospitalizations in 2281 healthy subjects over 71 years of age. They observed that poor lower extremity performance significantly predicted subsequent hospitalization over 4 years, concluding that a measure of lower extremity performance can predict subsequent hospitalization.[24]

Functional outcome measures can be used to predict readmission. For example, Hoyer et al. found a correlation between low motor FIM scores and unplanned hospital readmissions.[25] Although gait speed is a functional outcome measure used to predict initial hospitalization[26], there is little to no research investigating whether gait speed can be used to predict hospital

readmission after a course of inpatient physical therapy. There is a lack of clinical knowledge to identify at what gait speed patients are more likely to be readmited to inpatient services. Previous research has shown that gait speed improves with physical therapy, even short term.[27] Therefore, the purpose of the current research is to determine if discharge gait speed can indicate hospital readmission for the elderly population after a bout of physical therapy in acute care, skilled nursing, or inpatient rehabilitation.

METHODS

The current study was an observational cross-sectional study considering discharge gait speed after an inpatient stay. The study included tracking and recording if participants were readmitted to the hospital in 3 and 6 months post-discharge. The study was approved by Angelo State University and Shannon Medical Center institutional review boards. This study involved consenting patients admitted to acute care, skilled nursing, and/or inpatient rehabilitation settings with physical therapy orders. The acute care medical center is a 400-bed level 3 trauma inpatient facility. Referral for physical therapy in acute care was 76% of all patients admitted during this study time period of 6 months. The skilled nursing facility consists of a total of 28 beds, and inpatient rehabilitation consists of a total of 14 beds, both of which had 100% patient referral for physical therapy. In acute care, patients were seen for one 30-minute session per day with 7 days per week frequency. Interventions included bed mobility and transfer practice at bedside, followed by ambulation training in the hallway. In skilled nursing, patients were seen for 45-60 minutes 5 times per week. Interventions included bed mobility, transfer training, strengthening, balance training, and gait training in the hallway or therapy gym. For inpatient rehabilitation, physical therapy was completed for 90-120 minutes 5 times per week. Interventions included bed mobility, transfer training, strengthening, balance training, and gait training in the hallway or

therapy gym. Consenting patients were examined on their initial and discharge physical therapy visit.

Subjects

Participants were within an acute care hospital, skilled nursing facility, and inpatient rehabilitation facility in the West Texas town of San Angelo over a period of 6 months. One hundred seventy-two participants (acute N=68, skilled nursing, N=56, and inpatient rehab N=48) consented to participate in this study. All the patients asked to participate consented to do so. Potential participants were able to walk a distance of at least 20 feet (ft) with or without an assistive device and had no weight bearing restrictions. Patients were allowed to use the appropriate assistive device and progress to a lesser device from testing of initial to discharge gait speeds. Potential participants were excluded if they did not have ambulatory potential, had weight bearing restrictions, or had contraindications to ambulation. Patients who did not have ambulatory potential included those whose prior baseline level of function was wheelchair-level mobility. Of the 172 participants who consented to participate, data was analyzed for 37 participants who met the inclusion and exclusion criteria. Figure 1 describes the participant inclusion and exclusion criteria. Sixteen patients were excluded because they were unable to complete the minimum walking distance. Six patients were excluded because they went home prior to obtaining discharge gait speed. One hundred fifteen of the participants had orthopedic or neurologic primary diagnoses or elective procedures and were excluded. Patients with orthopedic and elective procedures were excluded since these diagnoses temporarily impact baseline function in patients. Patients with neurologic primary diagnoses, such as a stroke, were excluded as they often walk slowly without being particularly frail.

For data analysis, 35 participants (mean age ± SD, 75.4 ± 10.6 y; 16 males and 19 females) were used. Six of the participants from acute care were also participants in skilled nursing at a later date. One of the participants in inpatient rehabilitation was a prior participant in acute care. Table 2 presents characteristics of the 35 participants who completed the study.

Testing Procedure

Physical therapists in their respective settings used a standardized procedure to measure gait speed for patients on their individual caseloads as verified in an initial training session prior to data collection. Gait speed was assessed by the physical therapist during initial and discharge physical therapy visits in a regional medical center in the United States. Patients were asked to walk at their self-selected, comfortable speed over a marked course in a hospital corridor. Gait speed is reliable whether measuring a distance of 20 ft or 20 m[28,29], so varying distances were used in this study to calculate gait speed depending on patient ability. For patients who were not initially able to ambulate 20 m, the 20-ft course was used to record gait speed. The 20-ft course included a 5-ft zone for acceleration, a central 10-ft "steady-state" zone that was timed with a stopwatch, and a 5-ft zone for deceleration. If the patient was initially able to ambulate 20 m, then gait speed was assessed using a 5-m zone for acceleration, a central 10-m "steady-state" zone that was timed with a stopwatch, and a 5-m zone for deceleration. Gait speed has been measured as a single trial[30,31] or by averaging multiple trials[28]. A single trial of self-selected gait speed at initial and discharge examinations was utilized. Level of assistance (maximum, moderate, minimal/contact guard assist, supervision, or none) and device used (walker, single-point cane, crutches, or none) were documented. Patient height and mass were documented. Patients were unaware of the timed start and stop points and received no feedback or training during trials. Patients were contacted at 3 months and 6 months by phone and asked, "Since your

initial hospitalization with us 3 (or 6 depending on which call it was) months ago, have you been readmitted to any hospital facility?" If initial contact was not made, a voicemail was left with a contact number and request to return the call. In the case of a confirmed hospital readmission, the patient was asked to provide the reason for readmission. Caregivers were asked the question for confirmation and accuracy of reporting.

Statistical Analysis

Independent t-tests were used to determine if discharge gait speed was significantly different for the two groups (patients readmitted versus those not readmitted). All statistical analysis was conducted with SPSS 18.0 (IBM Corporation, Armonk, New York).

RESULTS

Participants who required readmission to an inpatient setting had discharge gait speed of 0.44± 0.08 m/s (N=12) while those not readmitted had a discharge gait speed of 0.52± 0.10 m/s (N=23). Independent t-tests failed to show significant differences in the two speeds with the limited participant size of this pilot study ($p>.05$). Power analysis revealed this study was limited by too few participants meeting inclusion and exclusion criteria. For a power of 80%, the study needs more participants (N=318).

DISCUSSION

Gait speed is commonly used to predict functional mobility and determine clinical meaning. Previous studies by Braden et al. found that although patients significantly improved gait speed while in acute care[32], speeds (.38 m/s on average) were less than what is required to cross the street safely at a city crosswalk (.49 m/s)[33] and fall into the category of less likely to return home immediately upon discharge (<.40 m/s)[33]. In those studies, 52.8% of the patients in acute care discharged to home ambulating at gait speeds less than that required to cross the street

at a city crosswalk (.49 m/s)[33]. If they did return home, they would likely be household ambulators requiring assist with doorway entries and stairs. In skilled nursing, patients achieved discharge gait speeds (.61 m/s) that indicate they are limited community ambulators with the ability to maneuver in non-crowded areas and upstairs. Inpatient rehabilitation participants achieved discharge gait speeds (.95 m/s) that define independent community ambulation in which participants are expected to ambulate through shopping centers successfully.[34] The current study assessed discharge gait speed after a bout of inpatient physical therapy to observe whether readmission rates were related to a risk factor of gait speed at the patients' most recent discharge.

There is evidence that physical therapy intervention improves patient function and mobilitiy. Gorgon et al. conducted a study investigating the mobility of elderly patients that were discharged from an inpatient rehabilitation center. Findings indicate that several functional measures improved including chair transfers, bed transfers, and level surface walking following individualized physical therapy services.[35] Unlu et al. compared physical therapist prescribed home exercises and inpatient therapist supervised exercises vs. walking alone in patients who underwent total hip arthroplasty.[36] It was concluded that groups that recieved physical therapist prescribed home exercises and therapist supervised exercises in an inpatient setting improved maximum isometric hip abduction torque, gait speed, and cadence. Kwok et al. compared patients who received center based physical therapy with patients who received exercises that were carried out in the home environment under the supervision of a care worker. The center-based training group supervised by a physiotherapist was found to have beneficial effects on physical function, quality of life and fall incidence while home-based training assisted by a care worker had no effect on physical condition and self-rated health status in community dwelling older adults.[37]

Gait speed is easy to administer and a cost efficient outcome measure that can be performed in various settings such as skilled nursing facilties (SNF), inpatient rehabilitation, schools, doctor's offices, and outpatient settings. Therefore, it has the potential to be the go-to measure for outcomes assessment with a variety of diagnoses in various settings.

Hospital readmissions are costly to both facility and patient. A 0.10m/s difference in gait speed at hospitalization could mean longer hospital stays, higher inpatient costs and more med-surgical visits.[4] A gait speed improvement of just 0.10 m/s at 1 year can mean less ADL and instrumental ADL (IADL) disability, fewer days of hospitalization and a 1-year cost reduction of ~$1,188 per 0.10m/s improvement.[4] There is also risk of health decline due to adverse medical events during a patient's inpatient hospital stay.[38-40] The ability of a hospital to identify those who are at risk for readmission would be beneficial for both parties. Those at risk could be identified by outcome measures proven to predict readmission and the plan of care tailored to address unique factors in order reduce the chance of readmission.

Although no significant difference was found statistically in this pilot data for discharge gait speed in the group that was readmitted (0.44 m/s) versus the group that was not readmitted (0.52 m/s), the signals might be recognized when the study reaches power of 80% (N=318).

Future studies will examine discharge gait speed after physical therapy in home health and outpatient settings to observe the ability to predict readmission rates. Follow up studies should focus on including a larger group of participants (N=318) from a larger region to make data more generalizeable and a control group of patients not receiving physical therapy orders for comparison.

Study Limitations

This study had limitations despite its clinical relevance. The sample size was limited in this pilot study, and an N=318 would enable power of 80%. Next, the results came from a single region of the United States and may not be generalizable to specialized units in other health care settings. Future research includes the importance of replicating the findings in a multisite study. Finally, the current study did not include a control group of patients who did not receive physical therapy orders.

CONCLUSION

Although significant differences in discharge gait speed were not realized in this small pilot study, discharge gait speed has the potential to be an informative measure of patient status after initial inpatient stay, given the appropriate statistical power. This is a pilot study that requires additional data collection (N=318) to obtain a power of 80% with the possibility of realized differences in the two groups.With the trend for patients to be released from hospitalization sooner, consideration for a safe, progressive discharge environment may be key to preventing readmissions.

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Table 1

Gender and Age	Average Gait Speed in Literature (m/s)
Men (60-29)	1.36
Men (30-39) (40-49) (50-59)	1.43
Men (60-69)	1.34
Men (70-79)	1.26
Men (80-89)	.97
Women (20-29) (30-39)	1.34
Women (40-49)	1.39
Women (50-59)	1.31
Women (60-69)	1.24
Women (70-79)	1.13
Women (80-89)	.94

Figure 1

Flow diagram showing participants who consented, were excluded, and completed testing.

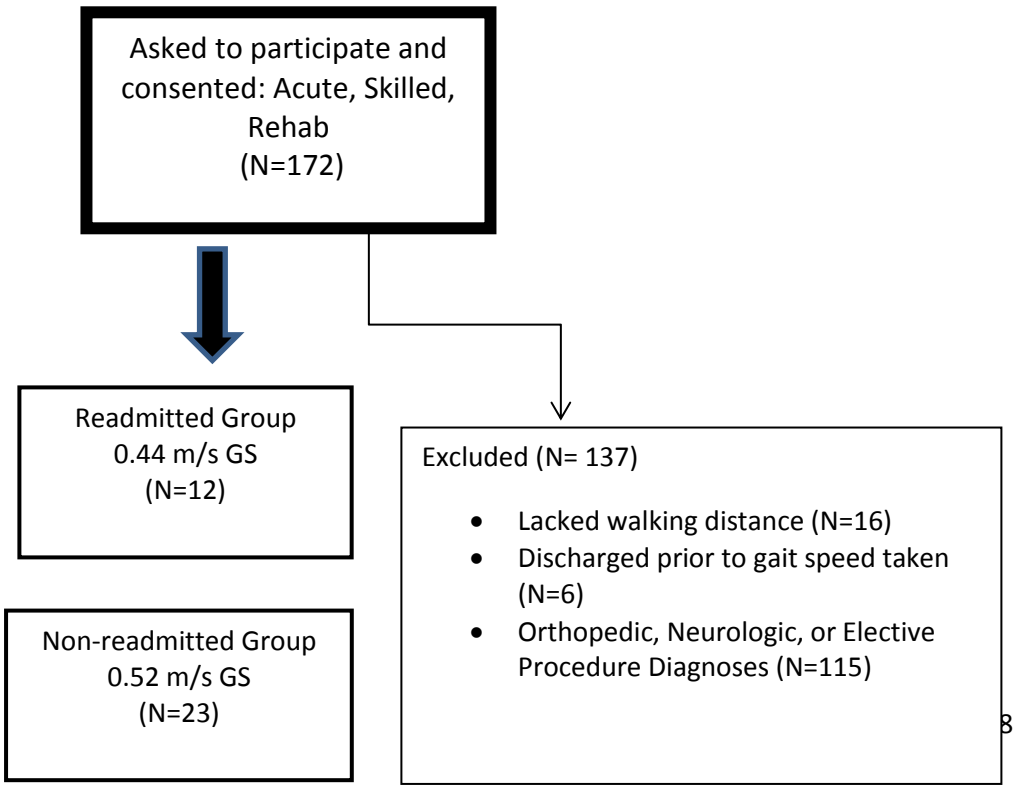

Table 2

Patient characteristics of those meeting inclusion and exclusion criteria

Variable	**Readmitted Group**	**Non-readmitted Group**
Participants	12	23
Weight (kg)	80.23	76.10
Height (cm)	167.01	165.47
Body Mass Index (kg/m^2)	28.8	27.8
Admitting diagnosis		
Cardiopulmonary	5 (42%)	11 (48%)
Gastrointestinal/Genitourinary	1 (8%)	4 (17%)
Trauma	0 (0%)	0 (0%)
Infection	2 (17%)	3(13%)
Other	4 (33%)	5 (22%)
Level of Assistance at Discharge		
Minimal Assistance, Contact Guard	1 (8%)	1 (4%)
Standby Assist, Supervision	5 (42%)	11 (48%)
Modified Independent, Independent	6 (50%)	11 (48%)
Assistive Device Used at Discharge		
Rolling walker/Rollator	10 (84%)	16 (70%)
Crutches	0%	0%
SPC	1 (8%)	7 (16%)
None	1 (8%)	3 (12%)
Discharge Gait Speed (m/s)	.44 ±0.08	.52 ±0.10
Length of Initial Therapy (days)	6.42	6.96
Previous Hospital Length of Stay (days)	9.00	12.83

[α]Values are mean (SD), unless denoted by %.