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Predictors of gait velocity among community-dwelling stroke survivors

Ruth E. Taylor-Piliae^{a,*}, L. Daniel Latt^b, Joseph T. Hepworth^a, and Bruce M. Coull^{b,c}

^aCollege of Nursing, University of Arizona, Tucson, AZ, United States

^bCollege of Medicine, University of Arizona, Tucson, AZ, United States

^cUniversity Physicians Healthcare, United States

Abstract

Introduction—Gait velocity is an objective, fundamental indicator of post-stroke walking ability. Most stroke survivors have diminished aerobic endurance or paretic leg strength affecting their walking ability. Other reported underlying factors affecting gait velocity include functional disability, balance, cognitive impairment, or the distance they are required to walk.

Objective—To examine the relationship between gait velocity and measures of physical and cognitive functioning in chronic stroke.

Methods—Cross-sectional design using baseline data from community-dwelling stroke survivors enrolled in an exercise intervention study. Functional disability (modified Rankin Scale), aerobic endurance (2-min step-test), leg strength (timed 5-chair stand test), balance (single-leg stance) and cognitive impairment (Mini-Mental Status Exam) were assessed. Gait velocity was assessed using a timed 4-m walk test. Multiple linear regression was used to explore potential independent predictors of gait velocity.

Results—Subjects had an average gait velocity of 0.75 ± 0.23 m/s, categorized as limited community walkers. Approximately 37% of the variance in gait velocity, could be explained by the 5 independent variables, functional disability, aerobic endurance, leg strength, balance, and cognitive impairment ($R^2 = 0.37$, $F_{5, 74} = 8.64$, $p < 0.01$). Aerobic endurance ($t_{1,74} = 3.41$, $p < 0.01$) and leg strength ($t_{1,74} = -2.23$, $p = 0.03$) contributed significantly to gait velocity.

Conclusion—Diminished aerobic endurance and leg strength are major contributors to slow gait velocity in chronic stroke. Long term rehabilitation efforts are needed to improve gait velocity in chronic stroke, and may need to incorporate multifaceted strategies concurrently, focusing on aerobic endurance and leg strength, to maximize community ambulation and reintegration.

Keywords

Gait velocity; Chronic stroke; Aerobic endurance; Leg strength; Predictors

*Corresponding author at: College of Nursing, University of Arizona, 1305 N. Martin, PO Box 210203, Tucson, AZ 85721-0203, United States. Tel.: +1 520 626 4881; fax: +1 520 626 4062. rtaylor@nursing.arizona.edu (R.E. Taylor-Piliae).

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1. Introduction

Gait velocity is a simple indicator of health and vitality in older adults and is especially sensitive in those with functional limitations, such as stroke survivors [1,2]. Slow gait velocity in community-dwelling older adults, <0.60 meters/second (m/s), reflects diminished mobility and is associated with physical inactivity, placing them at high risk for co-morbidities or mortality [1,2]. A recent meta-analysis [2] representing approximately 34,000 adults aged 65 years and older, found gait velocity was significantly associated with survival. In addition, slower gait velocity is reported to be predictive of hospitalization, institutionalization, disability, dementia, and falls in older adults [2].

Following a stroke, 90% of survivors walk with impaired coordination [3]. Moreover, most stroke survivors are unable to safely cross an intersection before the signal changes, because crossing times are based on a gait velocity of 1.07–1.22 m/s [4]. This makes full community reintegration post-stroke problematic. Consequently, a major goal of rehabilitation is to improve walking ability post-stroke, to enable stroke survivors to safely negotiate their home and community settings [5]. Gait velocity is an objective indicator of post-stroke walking ability, a reliable marker of deficit severity, and a strong predictor of functional community walking, i.e. household walker (<0.4 m/s); limited community walker (0.4–0.8 m/s); and full community walker (>0.8 m/s) [6,7].

A variety of physical and cognitive functioning measures are commonly used to assess walking ability in stroke survivors, including functional disability, aerobic endurance, leg strength, balance, and cognitive impairment. A number of studies have suggested that these physical and cognitive functioning factors may affect the performance on gait velocity testing among community-dwelling stroke survivors [8–10]. These studies measured gait velocity over a variety of distances (5–14 m), and as a consequence reported gait velocities ranging from 0.42 to 0.80 m/s. Since most stroke survivors are either deconditioned or have hemiparesis leading to slow gait velocity, the reported gait velocities were likely influenced by the distance they were required to walk [11,12]. An alternative is to test gait velocity with a shorter course, such as the 4-m gait speed test [13,14]. The 4-m gait speed test was specifically designed for older adults with disabilities. Our objective was to examine the relationship between gait velocity and measures of physical and cognitive functioning: functional disability, aerobic endurance, leg strength, balance, and cognitive impairment; using a 4-m gait speed test in community-dwelling stroke survivors. In doing so, we hope to uncover physical and cognitive functioning factors that underlie slow gait velocity, so that specific interventions can be tailored for these factors.

2. Methods

2.1. Research design

A cross-sectional study examining potential independent predictors of gait velocity among community-dwelling stroke survivors, using baseline data (collected between January 2009 and January 2011) from the first 100 subjects enrolled in an exercise intervention study. Approval to conduct the study was obtained from the Institutional Review Boards at the University of Arizona, HealthSouth and Carondelet Health Network in Tucson, AZ. The

investigation was carried out according to the principles outlined in the Declaration of Helsinki, including written informed consent from all subjects.

2.2. Subjects

Baseline characteristics of subjects in this study are presented in Table 1. Subjects were on average 70 (± 10) years old, and 39 (± 49) months post-stroke. The majority were married (59%), White/European-American (78%), college educated (79%), retirees (77%), reporting an ischemic stroke (68%) with hemiparesis (80%). Hypertension (72%) was the most commonly self-reported risk factor for recurrent stroke, followed by dyslipidemia (58%), diabetes (26%), and current smoker (10%). A total of 60% of subjects had a gait velocity 0.80 m/s, and were categorized as household or limited community walkers (Table 1).

2.3. Data collection

A comprehensive, self-administered health survey was mailed to subjects for completion prior to their baseline study visit. Survey items included age, gender, marital status, educational level, employment status, household income, race/ethnicity, and self-reported medical history. Self-reported medical history included risk factors for recurrent stroke, other cardiovascular health problems, major depression, and musculoskeletal problems.

Gait velocity was assessed with a 4-m gait speed test. Subjects were asked to complete the 4-m walk at their usual pace [13]. Subjects performed two trials, with the faster time recorded. Gait velocity is reported as meters/second (m/s) and takes <2 min to complete. Older adults without disabilities can complete a 4-m walk in 4.8 s or less (0.83 m/s) [13,14].

Functional disability was assessed using the modified Rankin Scale (mRS) [15,16]. The mRS is a widely used scale to assess functional disability following a stroke. Good interrater reliability of the mRS (ICC = 0.95–0.96) [16], as well as strong convergent validity with other measures of functional disability (Barthel Index, $r = 0.95$; Functional Independence Measure, $r = 0.89$) have been reported [17]. The mRS has 6 grades which range from 0 to 5 (0 = no symptoms at all, 5 = severe disability: bedridden, incontinent and requiring constant nursing care and attention), and is easy to administer, taking approximately 10 min to complete [16].

Aerobic endurance was assessed using a two-min step-in-place test [18,19]. The two-min step-in-place test involves having the subject raise their knees one at a time, to a height halfway between the middle of the patella and the iliac crest, as many times as possible within 2 min [18]. Normative data for the two-min step-in-place test among men aged 65–74 years ranges between 80 and 116 steps, for the 25th–75th percentiles; while for women aged 65–74 years values are between 68 and 107 steps [19]. Criterion, convergent and known-groups validity have been reported [18]. Since hemiparesis is very common in stroke survivors (80% in this study), we only required knee raises to be at the correct height for the non-paretic leg.

Leg strength was assessed using a chair stand test [13]. This test measures the actual time subjects needed to perform five rises from a chair to an upright position as fast as possible

without use of the arms [13]. Subjects did this test once, taking <2 min to complete. Older adults without disabilities can complete this test in 11.2 s or less [13,14].

Balance was assessed using the single leg stance (SLS) test. The SLS is frequently used in studies evaluating health-related fitness among older adults [20]. Subjects are timed on their ability to stand on a single leg with their eyes open. Subjects are instructed to lift one foot just off the floor, focus on a point on a nearby wall in front of them, and stand that way for as long as they are able, up to a one min maximum. The subject performs two trials, and the better of the two trials for each leg is recorded. The better times for the right and left legs are averaged for an overall SLS time. A recent meta-analysis of SLS times reported that men and women aged 70–79 years old ($n = 870$) were able to stand on one leg for 17.2 s on average (CI = 11.6–22.8) [20].

Cognitive impairment was assessed with the Mini-Mental Status Exam (MMSE). The MMSE was developed as a brief screening test to assess cognitive impairment and is commonly used in stroke populations [21,22]. Reported psychometric testing of the MMSE includes good reliability ($r = 0.54–0.96$), concurrent and construct validity [22]. The MMSE consists of 11 questions or tasks, which are grouped into seven cognitive domains. These domains include: orientation to time, orientation to place, registration of three words, attention and calculation, recall of three words, language and visual construction. MMSE scores range from 0 to 30, with levels of impairment classified as none (24–30), mild (18–23), and severe (0–17). Administration was done by a trained interviewer and takes approximately 10 min to complete.

2.4. Data analysis

All forms were reviewed for accuracy and completeness at the time of data collection. Frequency distributions were used to check for logically inconsistent values. Descriptive statistics were calculated for gait velocity, functional disability, aerobic endurance, leg strength, balance, and cognitive impairment. Pearson's correlations coefficients (r) were calculated to examine potential multicollinearity between these variables. Finally, multiple linear regression was conducted to explore potential independent predictors of gait velocity (i.e. functional disability, aerobic endurance, leg strength, balance, and cognitive impairment) in community-dwelling stroke survivors. Data were analyzed using SPSS 16.0 for Windows (SPSS, Inc.).

3. Results

Score distributions for the physical and cognitive functioning measures were approximately normal with similar mean and median scores, apart from the balance and leg strength tests which had leptokurtotic distributions (Table 2) [23]. A total of 13% ($n = 13/100$) of subjects tried but were unable to complete the chair stand test measuring leg strength. We had 10 subjects that were not asked to complete the SLS test. The majority of subjects completing the SLS test (73%, $n = 66/90$) were unable to stand on one leg for a minimum of 11.6 s, which is the lower bound of the confidence interval (CI = 11.6–22.8 s) for adults aged 70 years [20]. Complete data was available from 80 subjects to examine the relationship between gait velocity and measures of physical and cognitive functioning.

Correlation coefficients (Pearson's r) were calculated to examine multicollinearity between potential predictors with gait velocity (Table 3). While some variables were significantly correlated, none had strong correlations of concern [23]. Nevertheless, statistical diagnostics were conducted simultaneously with the regression analysis. Results indicated that residuals in the model were independent and not influenced by a single case (Durbin–Watson = 1.98; Cook's distance < 1), and that collinearity was not an issue (e.g. variance inflation factor close to 1 for all predictors).

Approximately 37% of the variance in gait velocity (m/s), could be explained by the 5 independent variables, functional disability (mRS), aerobic endurance (step test), leg strength (5-chair stand test), balance (single-leg stance) and cognitive impairment (MMSE) ($R^2 = 0.37$, $F_{5,74} = 8.64$, $p < 0.01$) (Table 4). Aerobic endurance was significant ($t_{1,74} = 3.41$, $p < 0.01$) indicating on average that gait velocity increases by 0.37 m/s with each step increased in aerobic endurance, while holding all other variables constant. Aerobic endurance uniquely accounted for 9.9% of the variance in gait velocity ($sr^2 = .099$, $p < 0.01$). Leg strength was significant ($t_{174} = -2.23$, $p = 0.03$) indicating on average that gait velocity decreases by 0.22 m/s with each second increased in leg strength test time (5-chair stands), while holding all other variables constant. Leg strength uniquely accounted for 4.2% of the variance in gait velocity ($sr^2 = .042$, $p = 0.03$). Functional disability, balance and cognitive impairment did not provide unique significant contributions to the overall model.

4. Discussion

In our study, we found 37% of the variance in gait velocity was explained by the combination of functional disability, aerobic endurance, leg strength, balance and cognitive impairment among community-dwelling stroke survivors. We used a shorter 4 m gait speed course that is valid and reliable for use among older adults with disabilities [13,14]. Following a stroke, gait velocity is dependent on several underlying factors [6–10]. However, only aerobic endurance and leg strength, contributed significantly to gait velocity in our study. This may partly be explained by the diminished aerobic endurance of our subjects (IRQ= 26–55 steps), as well as the high percentage with hemiparesis (80%), which are conditions that affect gait velocity [12,24,25]. In addition, subjects in our study were older (70 ± 10 years), while the leg strength and balance tests administered had non-normal distributions. Prior studies examining predictors of gait velocity among community-dwelling stroke survivors included smaller sample sizes (range = 50–74 subjects) while examining multiple predictors (range = 5–12), and may have been affected by multicollinearity or Type 1 errors.

Subjects in our study had an average gait velocity of 0.75 ± 0.23 m/s and were categorized as limited community walkers. This average gait velocity of our subjects, translates to a walking speed of 1.68 mph (2.7 km/m), which is considered a very-slow light-intensity physical activity requiring approximately 2.3 metabolic equivalents [26]. This is consistent with prior studies that have reported an average gait velocity between 0.42 m/s and 0.74 m/s, among community-dwelling stroke survivors [6,8,10].

Exercise therapy sessions to improve gait velocity post-stroke are effective though costly, as sessions are predominantly provided by one therapist to one stroke survivor. While improvements have been reported for a variety of therapeutic interventions to improve gait velocity post-stroke, e.g. exercises to strengthen the lower extremities, motor imagery practice, progressive adaptive physical activity, or treadmill gait training in the short-term [5,25,27]; this has not translated to the achievement of long-term maintenance of gait velocity among community-dwelling stroke survivors [5]. Future interventions to improve gait velocity post-stroke may need to incorporate multifaceted strategies concurrently, including balance, leg strength, endurance, and cognitive-motor processing [10]; and consider providing group-based exercise sessions [5]. Tai Chi may be an ideal group-based form of exercise for stroke survivors, as Tai Chi integrates balance, strength, flexibility, aerobic endurance, and emphasizes mindful movements (cognitive-motor processing) while practicing the form [28,29].

5. Conclusion

A hallmark of gait dysfunction in chronic stroke is slow gait velocity. Gait velocity is simple to measure requiring only a stopwatch and flat surface for walking, but is able to quantify deficits and monitor changes during rehabilitation and recovery post-stroke.

Following a stroke, gait velocity is dependent on several underlying factors. We found aerobic endurance and leg strength, contributed significantly to gait velocity among community-dwelling stroke survivors in our study. Functional disability, balance and cognitive impairment did not provide significant contributions to gait velocity. Long term rehabilitation efforts are needed to improve gait velocity in chronic stroke, and may need to incorporate multifaceted strategies concurrently, focusing on aerobic endurance and leg strength, to maximize community ambulation and reintegration.

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References

1. Hardy SE, Kang Y, Studenski SA, Degenholtz HB. Ability to walk 1/4 mile predicts subsequent disability, mortality, and health care costs. *J Gen Intern Med*. 2010; 26(2):130–5. [PubMed: 20972641]
2. Studenski S, Perera S, Patel K, Rosano C, Faulkner K, Inzitari M, et al. Gait speed and survival in older adults. *JAMA*. 2011; 305(1):50–8. [PubMed: 21205966]
3. Fritz SL, Pittman AL, Robinson AC, Orton SC, Rivers ED. An intense intervention for improving gait, balance, and mobility for individuals with chronic stroke: a pilot study. *J Neurol Phys Ther*. 2007; 31(2):71–6. [PubMed: 17558360]

4. Kirschbaum, JB.; Axelson, PW.; Longmuir, PE.; Mispagel, KM.; Stein, JA.; Yanmada, DA. Designing sidewalks and trails for access Part II: best practices design guide. Washington (DC): U.S Department of Transportation: Federal Highway Administration; 2001. Pedestrian crossings.
5. Dickstein R. Rehabilitation of gait speed after stroke: a critical review of intervention approaches. *Neurorehabil Neural Repair*. 2008; 22(6):649–60. [PubMed: 18971380]
6. van de Port IG, Kwakkel G, Lindeman E. Community ambulation in patients with chronic stroke: how is it related to gait speed? *J Rehabil Med*. 2008; 40(1):23–7. [PubMed: 18176733]
7. Fulk GD, Echternach JL. Test–retest reliability and minimal detectable change of gait speed in individuals undergoing rehabilitation after stroke. *J Neurol Phys Ther*. 2008; 32(1):8–13. [PubMed: 18463550]
8. Michael KM, Allen JK, Macko RF. Reduced ambulatory activity after stroke: the role of balance, gait, and cardiovascular fitness. *Arch Phys Med Rehabil*. 2005; 86(8):1552–6. [PubMed: 16084807]
9. Dennis A, Dawes H, Elsworth C, Collett J, Howells K, Wade DT, et al. Fast walking under cognitive-motor interference conditions in chronic stroke. *Brain Res*. 2009; 1287:104–10. [PubMed: 19527695]
10. Hyndman D, Ashburn A, Yardley L, Stack E. Interference between balance, gait and cognitive task performance among people with stroke living in the community. *Disabil Rehabil*. 2006; 28(13–14):849–56. [PubMed: 16777772]
11. Patterson SL, Forrester LW, Rodgers MM, Ryan AS, Ivey FM, Sorkin JD, et al. Determinants of walking function after stroke: differences by deficit severity. *Arch Phys Med Rehabil*. 2007; 88(1):115–9. [PubMed: 17207686]
12. Jorgensen JR, Bech-Pedersen DT, Zeeman P, Sorensen J, Andersen LL, Schonberger M. Effect of intensive outpatient physical training on gait performance and cardiovascular health in people with hemiparesis after stroke. *Phys Ther*. 2010; 90(4):527–37. [PubMed: 20203092]
13. Guralnik JM, Simonsick EM, Ferrucci L, Glynn RJ, Berkman LF, Blazer DG, et al. A short physical performance battery assessing lower extremity function: association with self-reported disability and prediction of mortality and nursing home admission. *J Gerontol*. 1994; 49(2):M85–94. [PubMed: 8126356]
14. Perera S, Mody SH, Woodman RC, Studenski SA. Meaningful change and responsiveness in common physical performance measures in older adults. *J Am Geriatr Soc*. 2006; 54(5):743–9. [PubMed: 16696738]
15. van Swieten JC, Koudstaal PJ, Visser MC, Schouten HJ, van Gijn J. Interobserver agreement for the assessment of handicap in stroke patients. *Stroke*. 1988; 19(5):604–7. [PubMed: 3363593]
16. Shinohara Y, Minematsu K, Amano T, Ohashi Y. Modified Rankin scale with expanded guidance scheme and interview questionnaire: interrater agreement and reproducibility of assessment. *Cerebrovasc Dis*. 2006; 21(4):271–8. [PubMed: 16446542]
17. Kwon S, Hartzema AG, Duncan PW, Min-Lai S. Disability measures in stroke: relationship among the Barthel Index, the functional independence measure, and the modified Rankin Scale. *Stroke*. 2004; 35(4):918–23. [PubMed: 14976324]
18. Rikli RE, Jones CJ. Development and validation of a functional fitness test for community-residing older adults. *J Aging Phys Act*. 1999; 7:129–61.
19. Rikli RE, Jones CJ. Functional fitness normative scores for community-residing older adults, ages 60–94. *J Aging Phys Act*. 1999; 7:162–81.
20. Bohannon RW. Single limb stance times: a descriptive meta-analysis of data from individuals at least 60 years of age. *Top Geriatr Rehabil*. 2006; 22(1):70–7.
21. Iverson GL. Interpretation of Mini-Mental State Examination scores in community-dwelling elderly and geriatric neuropsychiatry patients. *Int J Geriatr Psychiatry*. 1998; 13(10):661–6. [PubMed: 9818300]
22. Tombaugh TN, McIntyre NJ. The mini-mental state examination: a comprehensive review. *J Am Geriatr Soc*. 1992; 40(9):922–35. [PubMed: 1512391]
23. Field, A. *Discovering statistics using SPSS*. 3rd. Los Angeles: Sage; 2009.
24. Jonsdottir J, Recalcati M, Rabuffetti M, Casiraghi A, Boccardi S, Ferrarin M. Functional resources to increase gait speed in people with stroke: strategies adopted compared to healthy controls. *Gait Posture*. 2009; 29(3):355–9. [PubMed: 19211250]

25. Rimmer JH, Wang E. Aerobic exercise training in stroke survivors. *Top Stroke Rehabil.* 2005; 12(1):17–30. [PubMed: 15735998]
26. Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, et al. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc.* 2000; 32(9 Suppl):S498–504. [PubMed: 10993420]
27. Michael K, Goldberg AP, Treuth MS, Beans J, Normandt P, Macko RF. Progressive adaptive physical activity in stroke improves balance, gait, and fitness: preliminary results. *Top Stroke Rehabil.* 2009; 16(2):133–9. [PubMed: 19581199]
28. Taylor-Piliae RE, Haskell WL. Tai Chi exercise and stroke rehabilitation. *Top Stroke Rehabil.* 2007; 14(4):9–22. [PubMed: 17698454]
29. Lan C, Lai JS, Chen SY. Tai Chi Chuan: an ancient wisdom on exercise and health promotion. *Sports Med.* 2002; 32(4):217–24. [PubMed: 11929351]
30. Kernan WN, Viscoli CM, Brass LM, Makuch RW, Sarrel PM, Roberts RS, et al. The stroke prognosis instrument II (SPI-II): a clinical prediction instrument for patients with transient ischemia and nondisabling ischemic stroke. *Stroke.* 2000; 31(2):456–62. [PubMed: 10657422]

Table 1Subject demographics, $n = 100$.

	$n = 100$
Age, mean years $\pm$ SD	70 $\pm$ 10
Women, %	46
Married/partner, %	59
College graduate, %	79
Retired, %	77
Income, %	
<\$50,000	58
\$50,000–74,999	13
>\$75,000	19
Refused to answer	10
Race/ethnicity	
White/European-American, %	78
Hispanic (including Latino (a), Mexican-American), %	9
Black/African-American, %	4
Native-American, %	3
Asian/Asian-American, %	2
Other, %	4
Months post-stroke, mean $\pm$ SD (range = 3–356 months)	39 $\pm$ 49
Stroke type, %	
Ischemic	68
Hemorrhagic	31
Hemiparesis, %	
Right	39
Left	42
First stroke, %	87
Uses assistive devices for walking, %	9
Recurrent stroke risk profile, % ^a	
Low risk score 0–3	42
Moderate risk score 4–7	46
High risk score 8–15	12
Gait velocity, %	
Household walker (<0.4m/s)	10
Limited community walker (0.4–0.8m/s)	50
Full community walker (>0.8m/s)	40
Self-reported health problems, %	
Hypertension	72
Dyslipidemia	58
Arrhythmia	28
Diabetes	26

	<i>n</i> = 100
Depression	21
Back pain	19
Prior CABG	17
Congestive heart failure	14
Asthma	12
Previous myocardial infarction	11
Arthritis	11
Current smoker	10

^aBased on stroke prognosis instrument II [30].

Table 2

Physical and cognitive functioning descriptives, $n = 100$.

	Possible range of scores	Desired score direction	Mean $\pm$ SD	Median scores	Interquartile range, 25–75%	Skewness $\pm$ SE	Kurtosis $\pm$ SE
Gait velocity ^a	0– ∞	↑	0.7 $\pm$ 0.3	0.7	0.6–0.9	−0.2 $\pm$ 0.2	−0.3 $\pm$ 0.5
mRS	0–5	↓	2.1 $\pm$ 0.7	2.0	2.0–3.0	−0.1 $\pm$ 0.2	0.6 $\pm$ 0.5
Endurance ^b	0– ∞	↑	39.7 $\pm$ 20.4	37.0	26.0–54.8	0.3 $\pm$ 0.2	−0.3 $\pm$ 0.5
Leg strength ($n=87$) ^c	0– ∞	↓	19.8 $\pm$ 6.9	18.3	15.5–21.6	3.2 $\pm$ 0.3	15.0 $\pm$ 0.5
Balance ($n=90$) ^d	0–60	↑	10.2 $\pm$ 14.8	4.3	1.2–12.4	2.2 $\pm$ 0.3	4.4 $\pm$ 0.5
MMSE	0–30	↑	27.9 $\pm$ 2.2	29.0	27.0–30.0	−1.5 $\pm$ 0.2	2.3 $\pm$ 0.5

mRS, modified Rankin Scale; MMSE, Mini-Mental Status Exam.

^a m/s.

^b Number of steps in 2-min.

^c Number of seconds to complete five chair stands.

^d Number of seconds standing on one leg.

Table 3

Correlations between physical and cognitive functioning variables, $n = 80$.

	Gait velocity	mRS	Endurance	Leg strength	Balance	MMSE
Gait velocity	–					
mRS	-.27**	–				
Endurance ^a	.51**	-.38	–			
Leg strength ^b	-.37**	-.14	-.24	–		
Balance ^c	.35**	-.17	.37**	-.24*	–	
MMSE	.20*	-.10	.07	-.10	-.04	–

mRS, modified Rankin Scale; MMSE, Mini-Mental Status Exam.

* $p < 0.05$.

** $p < 0.01$.

^aNumber of steps in 2-min.

^bNumber of seconds to complete five chair stands.

^cNumber of seconds standing on one leg.

Table 4

Predictors of gait velocity, $n=80$.

Source	R^2	Beta	sr^2	df	F	p-Value
Overall model	0.37			5,74	8.64	<0.01
mRS		-.054	.003	1,74	-0.54	0.59
Endurance ^a		.365	.099	1,74	3.41	<0.01
Leg Strength ^b		-.217	.042	1,74	-2.23	0.03
Balance ^c		.164	.022	1,74	1.62	0.11
MMSE		.155	.023	1,74	1.66	0.10

mRS, modified Rankin Scale; MMSE, Mini-Mental Status Exam.

^aNumber of steps in 2-min.
^bNumber of seconds to complete five chair stands.
^cNumber of seconds standing on one leg.