Published in final edited form as:

Arch Phys Med Rehabil. 2014 October ; 95(10): 1940–1945. doi:10.1016/j.apmr.2014.06.002.

DETERMINANTS OF USE OF A WALKING DEVICE IN PERSONS WITH PARKINSON'S DISEASE

Mon S Bryant, PT, PhD^{1,2,3}, Diana H Rintala, PhD², James E Graham, PhD³, Jyh-Gong Hou, MD, PhD⁴, and Elizabeth J Protas, PT, PhD³

¹Research Service, Michael E DeBakey Veterans Affairs Medical Center, Houston, TX

²Dept of Physical Medicine and Rehabilitation, Baylor College of Medicine, Houston, TX

³Rehabilitation Sciences, University of Texas Medical Branch, Galveston, TX

⁴Lehigh Neurology, Lehigh Valley Health Network, Allentown, PA

Abstract

Objective—To identify determinants for use of a walking device in persons with Parkinson's disease (PD).

Design—Cross-sectional study of participants with PD.

Setting—Laboratory.

Participants—Eighty-five persons (60 Males) with PD were studied. Their mean age was 69.4 ± 8.9 years. The average time since diagnosis was 7.9 ± 5.3 years.

Interventions—Not applicable.

Main Outcome Measures—Age, gender, disease duration, disease severity and motor impairment were recorded. Participants were asked whether they usually used any walking device (e.g., cane or walker) and were categorized as either an “independent walker” or a “device walker.” Clinical balance measures including functional reach, turn duration, 5m Timed-Up-and-Go test (5m-TUG) and Activities-specific Balance Confidence (ABC) scale were investigated for their contribution to the prediction of walking with a device.

© 2014 The American Congress of Rehabilitation Medicine. Published by Elsevier Inc. All rights reserved.

Corresponding author Mon S Bryant, PT, PhD., Research Service, Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd (Rehabilitation Research 153), Houston, TX 77030, USA. Tel: 713-791-1414. Fax: 713-794-7623., msbryant@bcm.edu.

Reprints are not available from the author.

Disclosures

The study was partially supported by the National Institute of Health, R01 HD051844. Dr. Bryant received research support from the Department of Veterans Affairs, Veterans Health Administration, Rehabilitation Research and Development Service, CDA-2 Grant No. B7878W (Bryant MS), the Michael E DeBakey VA Medical Center, Houston, TX. Dr. Graham was partially supported by grant # R24-HD065702 from the National Institutes of Health (NCMRR / NINDS). Financial disclosure statements were obtained, and no conflicts of interest were reported by the authors or by any individuals in control of the content of this article.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Results—Thirty-one participants (36.5%) reported they usually used a walking device. Classification and regression tree (CART) analysis determined that the 5m-TUG test and the ABC scale were important factors in differentiating participants who used a walking device from those who did not. Critical thresholds included 13 seconds for the 5m-TUG test and a score of 75 for the ABC scale in determining device walking. Using only those two determinants, the CART model correctly classified 81% of patients as either independent or needing a walking device.

Conclusion—The 5m-TUG test and ABC scale may be useful in clinical assessments of the need for a walking device in persons with PD.

Keywords

Parkinson's disease; assistive device; walking aid; Timed-Up-and-Go (TUG); Activities-specific Balance Confidence (ABC)

Gait deficits in persons with Parkinson's disease (PD) are common and inevitable problems, especially as the disease progresses. They are unlikely to be completely reversed by medical and surgical treatments. Therefore, ambulatory devices are eventually needed as an adjunctive intervention. Ambulatory devices allow persons with PD to better cope with their walking difficulties, maintain their activities of daily living (ADLs), and be more independent.

Ambulatory devices including canes, standard walkers, front-wheeled walkers, four-wheeled walkers and walking stabilizers are prescribed for persons with PD to improve mobility, maintain balance and possibly prevent or reduce falls. These devices can increase confidence and sense of safety, which can raise a person's level of mobility and independence.^{1,2,3} Use of an ambulatory device increases the base of support, thereby allowing a greater range for center of mass motion to be tolerated.^{4,5,6} Ambulatory devices also prevent loss of balance or instability by allowing stabilizing reaction forces such as holding on to an object or pushing against the ground.⁷ Motorized devices such as power wheelchairs and scooters are used by persons with PD who have impairments that severely limited their mobility and who are unable to ambulate due to freezing, poor endurance and/or instability.¹

Many factors are involved in determining whether a person with PD is an appropriate candidate for a walking device. These considerations are gait and balance impairments, cognitive function, vision, and living environment.⁸ Most health care providers who prescribe ambulatory devices use their clinical judgment based on interviews and motor examinations but without using any scientific guideline for recommending walking aids. Currently, there is no available clinical measure that can serve as a guideline for recommending use of a walking device. The purpose of this study was to identify clinical measures and optimal cut-points that best differentiate device walkers from independent walkers in a sample of community dwelling persons with PD. Identification of quantitative, clinically meaningful measures and cut-points may help clinicians decide whether to recommend use of a walking device.

Methods

Participants

Eighty-five persons (60 Males) with PD were studied after they agreed to participate in the study and signed the approved consent form. The participants were recruited from movement disorder clinics in Houston and Galveston, TX. All participants reported that they experienced gait and balance problems from PD, however, they were able to stand and walk independently. All participants were able to perform all tests without using any walking device. Participants were screened for significant cognitive impairment with the Neurobehavioral Cognitive Status Examination (Cognistat) and any subtest score in the severely impaired range resulted in study exclusion.⁹ The study was approved by the Institutional Review Board for Human Subject Research for Baylor College of Medicine and Affiliated Hospitals and the University of Texas Medical Branch.

Measures

Demographic data including age, gender and disease duration were recorded. The Unified Parkinson's Disease Rating Scale (UPDRS)¹⁰ and the Hoehn and Yahr Scale (HY)¹¹ were scored by a neurologist. The UPDRS was used to describe motor impairment. The UPDRS is a standardized rating scale that assesses the degree of an individual's impairment from PD. The UPDRS consists of subscales on mentation, activities of daily living, motor examination, and therapeutic complications, with higher scores indicating greater impairment.¹⁰ The HY Staging Scale was used to rate severity of PD. The scale stages the progression or severity of the disease on a 1 to 5 scale. A particular HY stage provides a description of where an individual is in the possible progression of the disease.¹¹ The Postural Instability and Gait Disorder (PIGD) subscale of the UPDRS was calculated by adding 5 items (falling, freezing, walking, gait, and postural stability) to represent clinical mobility and stability.¹² Participants were asked whether they usually walked with or without an assistive device. Walking devices could include canes and walkers (with or without wheels). Device walkers included participants who reported using any one of these devices. They were categorized as independent walkers if they responded that they usually walked without any walking device. Wheelchair users were excluded from the study.

Balance Confidence and Fear of Falling—The Activities-specific Balance Confidence (ABC) scale was used to estimate fear of falling (FoF). The ABC scale was developed to assess participant balance confidence, a construct similar to fear of falling.¹³ Participants were asked to rate their self-perceived balance confidence level from 0 (no confidence) to 100 (complete confidence) in performing 16 ADLs. The mean score across all 16 activities was calculated and used to estimate the level of FoF. A lower mean ABC score indicates a higher level of FoF.

Clinical Measures of Balance and Mobility—Timed tests to measure balance included the timed 5-step test, time to turn, and the 5-meter Timed Up-and-Go (5m-TUG) test. For the timed 5-step test, the participants were timed while stepping up and back down an 8.8 cm step 5 times. For the turn duration test, the participants were timed while performing a 360 degree turn. Turn duration was performed both toward the left and the right. The

average of the two directions was used in data analysis. For the 5m-TUG test, participants were asked to get up from a chair, walk forward for 5 meters, turn around and walk back to sit on the same chair as fast as possible. A line on the floor was used to mark the walking distance at 5 meters from the chair. The functional reach test was used to estimate risk of falling. Participants were asked to reach their arm as far forward as possible without moving their feet or losing their balance. The distance of their forward reaching was measured.

Procedure

All participants read and signed an approved consent form prior to participation. All clinical assessments and testing were performed when the participants were in the optimal 'on' medication state, approximately one hour after taking their dopaminergic medication. They were assessed for disease severity using the HY and the UPDRS Motor section by a neurologist prior to completing the ABC scale and performing the clinical balance tests. One tester performed the clinical balance tests and one research assistant provided guarding to prevent falls. All balance tests were performed twice and their averages were used in data analysis. All participants wore a gait belt and performed all tests without using any walking device. They were allowed to push the chair to get up for the 5m-TUG, if needed.

Statistical analysis

All analysis was performed using IBM SPSS version 21. Participant characteristics and clinical variables were descriptively analyzed. Chi square tests were performed to assess the associations of device walking status (with or without device) with gender and marital status. Spearman' rho correlations were used to determine the strengths of association between other variables and device walking status. Classification and regression tree (CART) analysis was used to discriminate participants on the dependent variable (independent vs. device) based on predictors identified from the bivariate correlation analyses. CART methodology creates a hierarchical order of selecting predictors and determines their optimal cut-points that best classify participants into the dichotomous outcome groups. The analysis results in classification criteria and is represented as a hierarchical tree which facilitates simple interpretation and application in clinical settings.^{14, 15} The significance level was set at $P < 0.05$.

Results

Participant characteristics

Sixty (70.6%) men and 25 (29.4%) women with PD participated in the study. All of them were community-dwelling persons. Their mean age was 69.4 ± 8.9 years. The time since diagnosis was 7.9 ± 5.3 years. The average HY stage was 2.5 ± 0.5 . All participants were receiving dopaminergic treatment (carbidopa/ levodopa or carbidopa/levodopa/entacapone) and had not had any brain surgery therapy for PD. Thirty-one (36.5%) participants usually walked with one kind of ambulatory device. Among those who walked with a device, 18 walked with a cane and 13 walked with a walker.

Correlations with device walking status

Clinical variables and their correlation with device walking status are displayed in Table 1. Spearman's rho correlation analysis demonstrated that device walking status significantly correlated with disease duration ($p = .02$), disease severity (HY; $p < .001$), PIGD score ($p < .001$), balance confidence score (ABC; $p < .001$), turn duration ($p = .011$), 5m-TUG ($p < .001$), and functional reach ($p = .049$).

Factors selection and determination of cut-points

Among the seven variables demonstrating bivariate associations with walking status, only two were included in the final CART model. The 5m-TUG test was the strongest determinant with a cut-point of 13.1 seconds. Among participants who took more than 13.1 seconds to complete the 5m-TUG test, the ABC scale was the strongest determinant with a cut-point score of 75.6.

For ease of clinical application, we rounded down to the nearest whole number (13 second for the 5m-TUG and a score of 75 for the ABC scale), created dichotomous predictor variables, and repeated the CART analysis. The second CART analysis demonstrated results similar to the first one. The two determinants in the second CART model correctly classified 81% of participants into their respective groups (35 independent walkers at step 1 plus 13 independent walkers and 21 device walkers at step 2; Fig. 1). More specifically, the CART model correctly classified 48 of 54 (89%) independent walkers and 21 of 31 (68%) device walkers.

Discussion

Despite the need for walking devices in the PD population, to our knowledge there is no research-based guideline for clinicians as to who is more likely to benefit from use of a walking device. The main purpose of the study was to investigate which clinical tests would be strong determinants of walking device use among persons with PD. We entered clinical variables that were significantly correlated with device walking status into a CART analysis. The first step identified the 5m-TUG as the strongest determinant in differentiating participants based on their device walking status, yielding a cut-point of 13 seconds (Fig. 1). More than half (56.8%) of the participants who took more than 13 seconds usually used a walking device. Among those who took less than 13 seconds, only 14.6% usually used a walking device. The second step indicated that balance confidence or FoF was the strongest determinant among those who took longer than 13 seconds to complete the 5m-TUG test. More than three-quarters (77.8%) of the participants who had balance confidence scores less than 75 usually used a walking device.

The 5m-TUG test is a simple way to measure physical ability to get up from a chair, walk, turn, walk back and sit down on the same chair. These three mobility tasks (rising from a chair, walking, and turning) are known to be problematic for persons with PD.¹⁶ The TUG is used to quantify mobility impairment in persons with PD for both clinical and research purposes. Longer 5m-TUG times have been found to be associated with decreased mobility.¹⁷ Our results demonstrated that the 5m-TUG was a strong determinant in

differentiating PD device walkers from PD independent walkers, thus suggesting it may be useful in walking-aid assessments.

Falling is one of the most serious and disabling problems in persons with PD. The progression of the disease is eventually associated with FoF.¹⁸ FoF is common in persons with PD due to balance impairment and postural instability.¹⁹ FoF may lead to restriction of mobility, decreased functional ability, loss of functional independence, as well as social isolation.²⁰ FoF can develop from specific mobility disturbances associated with the progression of PD (e.g. festination, freezing),²¹ perceived imbalance,²² previous falls,²³ near fall experiences,²⁴ or a psychological response from having PD.²⁵ FoF may independently exacerbate functional decline and reduce quality of life.^{18, 19, 26} On the other hand, FoF could be protective against future falls by increasing caution during mobility. Clinically, FoF can be measured by the ABC scale, which is based on self-reported balance confidence in performing 16 ADLs. Our results clearly demonstrated that FoF was a second strong determinant for using a walking device with a cut-point of 75.

From a clinical perspective, determining those needing a walking device is important. Walking devices can be acquired by patients either with or without a prescription from physicians or other health care professionals. Some patients may feel the need because of their impaired gait and balance due to PD, but their level of impaired mobility might not be enough to necessitate using a walking device. Potential consequences caused by an unnecessary use of a walking device may include inherent facilitation of stooped posture, unavoidable elimination of natural arm swing and gait modifications. Persons with PD immediately walked with a slower gait speed when using either a cane or a wheeled walker and with a shorter stride length when walking with a wheeled walker.²⁷ The long-term effect of gait modifications caused by using walking devices has not been reported. The central nervous system has a tendency to persist in the ongoing task of holding an object (e.g., a cane) and give it priority before the execution of a balancing reaction by the upper extremity.²⁸ Considering this, the unnecessary use of walking device may predispose a person to fall because they hold on to the device rather than recover from an imbalance. Of equal importance is the fact that persons who should be walking with a device might not be prescribed the device. The possible damages caused by not using a device when one is actually needed may include otherwise preventable falls, limited walking distance, limited ADLs, limited societal and leisure activities, and a precipitate loss of independence. Use of a cane was reported to improve postural recovery from the first, unpracticed slip in persons with PD,²⁹ thus possibly preventing falls, especially in unfamiliar environments or terrains.

The clinical importance of this study is demonstrated in the ability to identify those needing a walking device based on two simple measures--the 5m-TUG test and the ABC scale. These two measures can be performed quickly in clinical settings where time is a constraint. Justification for recommending using or not using a walking device is possible by considering the combined outcomes of these two measures.

Study Limitations

There are limitations that need to be addressed in this study. First, PD has a negative impact on several aspects of health including both motor and non-motor symptoms. Therefore, there

are several possible factors that could be associated with using a walking device that were not investigated in this study. Forward stooped posture alone can necessitate the use of a device because of an increased tendency to fall forward. Anti-parkinsonian medications can cause orthostatic hypotension, and, when that occurs, a walking device is needed to prevent unexpected, nonslip falls. Freezing, start hesitation and dyskinesia can force the use of a walking device. Increased confidence in balance (i.e. reduced fear of falling) can be achieved by simply holding a stick or a cane, but not actually using it for ambulation.

Second, the self-report of balance confidence might be influenced by either over- or under-estimation by the person and is subject to recall bias. We minimized the risk of recall bias by the exclusion of severely cognitively impaired participants. Third, the 5m-TUG test performed in a laboratory might over-estimate the person's usual performance due to a strong intention or motivation to perform at his or her best when being tested or being watched by researchers. Fourth, participants were asked whether they walked with an assistive device but were not asked the reason why they used it. Therefore, the factors contributing to the use of the device may not be solely due to PD. Fifth, cognitive function and depression are common in PD and might influence the use of the device, and need further investigation. Finally, persons may decide to use or not use a device based on other reasons (e.g., the stigma of being handicapped if walking with a device, walking on uneven terrain, and a need to navigate in unfamiliar or crowded environments). Further study is needed to validate the cut-points found in this study in comparison to, or in conjunction with other factors that might determine the use of a walking device such as gait and balance impairments, cognitive function, vision, and living environment.

Conclusions

Our study was the first to demonstrate empirically-derived determinants for use of a walking device in persons with PD that can be easily applied in general clinical settings. We demonstrated that the 5m-TUG and level of balance confidence were two strong determinants in differentiating participants based on their device walking status with 81% correct classification. The suggested cut-points of the 5m-TUG and the ABC can be used as a way to determine whether a patient is likely to need a walking device.

Acknowledgments

We thank all the participants for their time and effort in this study.

List of abbreviations

PD	Parkinson's disease
5m-TUG	5m Timed-Up-and-Go test
ABC	Activities-specific Balance Confidence scale
CART	Classification and regression tree
ADLs	Activities of daily living

UPDRS	Unified Parkinson's Disease Rating Scale
HY	Hoehn and Yahr Scale
PIGD	Postural Instability and Gait Disorder subscale of the UPDRS
FoF	Fear of falling

References

- Constantinescu R, Leonard C, Deeley C, Kurlan R. Assistive devices for gait in Parkinson's disease. *Parkinsonism Relat Disord*. 2007; 13:133–8. [PubMed: 16914362]
- Aminzadeh F, Edwards N. Exploring seniors' views on the use of assistive devices in fall prevention. *Public Health Nurs*. 1998; 15:297–304. [PubMed: 9682623]
- Dean E, Ross J. Relationships among cane fitting, function, and falls. *Phys Ther*. 1993; 73:494–500. [PubMed: 8337237]
- Joyce BM, Kirby RL. Canes, crutches and walkers. *Am Fam Physician*. 1991; 43:535–542. [PubMed: 1990737]
- Tagawa Y, Shiba N, Matsuo S, Yamashita T. Analysis of human abnormal walking using a multi-body model joint models for abnormal walking and walking aids to reduce compensatory action. *J Biomech*. 2000; 33:1405–14. [PubMed: 10940399]
- Bateni H, Maki BE. Assistive devices for balance and mobility: benefits, demands, and adverse consequences. *Arch Phys Med Rehabil*. 2005; 86:134–45. [PubMed: 15641004]
- Maki BE, McIlroy WE. The role of limb movements in maintaining upright stance the “change-in-support” strategy. *Phys Ther*. 1997; 77:488–507. [PubMed: 9149760]
- Van Hook FW, Demonbreun D, Weiss BD. Ambulatory devices for chronic gait disorders in the elderly. *Am Fam Physician*. 2003; 67:1717–24. [PubMed: 12725450]
- Oehlert ME, Hass SD, Freeman MR, Williams MD, Ryan JJ, Sumerall SW. The Neurobehavioral cognitive status examination: accuracy of the ‘Screen-Metric’ approach in a clinical sample. *J Clin Psychol*. 1997; 53:733–7. [PubMed: 9356903]
- Fahn, S.; Elton, RL. Members of the UPDRS Development Committee. Unified Parkinson's Disease Rating Scale. In: Fahn, S.; Marsden, CD.; Calne, DB.; Goldstein, M., editors. *Recent developments in Parkinson's disease*. Vol. 2. Florham Park: Macmillan Health Care Information; 1987. p. 153–63.
- Hoehn M, Yahr MD. Parkinsonism: onset, progression, and mortality. *Neurology*. 1967; 17:427–42. [PubMed: 6067254]
- Bronte-Stewart HM1, Minn AY, Rodrigues K, Buckley EL, Nashner LM. Postural instability in idiopathic Parkinson's disease: the role of medication and unilateral pallidotomy. *Brain*. 2002; 125:2100–14. [PubMed: 12183355]
- Powell LE, Myers AM. The Activities-specific Balance Confidence (ABC) Scale. *J Gerontol A Biol Sci Med Sci*. 1995; 50A:M28–34. [PubMed: 7814786]
- Allore H, Tinetti ME, Araujo KL, Hardy S, Peduzzi P. A case study found that a regression tree outperformed multiple linear regression in predicting the relationship between impairments and Social and Productive Activities scores. *J Clin Epidemiol*. 2005; 58:154–61. [PubMed: 15680749]
- Fisher SR, Graham JE, Brown CJ, Galloway RV, Ottenbacher KJ, Allman RM, Ostir GV. Factors that differentiate level of ambulation in hospitalised older adults. *Age Ageing*. 2012; 41:107–11. [PubMed: 21908470]
- Nieuwboer A, De Weerd W, Dom R, LesaVee E. A frequency and correlation analysis of motor deficits in Parkinson patients. *Disabil Rehabil*. 1998; 20:142–50. [PubMed: 9571381]
- Falvo MJ, Earhart GM. Six-minute walk distance in persons with Parkinson disease: a hierarchical regression model. *Arch Phys Med Rehabil*. 2009; 90:1004–8. [PubMed: 19480877]
- Adkin AL, Frank JS, Jog MS. Fear of falling and postural control in Parkinson's disease. *Mov Disord*. 2003; 18:496–502. [PubMed: 12722162]

19. Rahman S, Griffin HJ, Quinn NP, Jahanshahi M. On the nature of fear of falling in Parkinson's disease. *Behav Neurol*. 2011; 24:219–28. [PubMed: 21876261]
20. Vellas BJ, Wayne SJ, Romero LJ, Baumgartner RN, Garry PJ. Fear of falling and restriction of mobility in elderly fallers. *Age Ageing*. 1997; 26:189–93. [PubMed: 9223714]
21. Thomas AA, Rogers JM, Amick MM, Friedman JH. Falls and the falls efficacy scale in Parkinson's disease. *J Neurol*. 2010; 257:1124–8. [PubMed: 20157723]
22. Rubino FA. Gait disorders. *Neurologist*. 2002; 8:254–62. [PubMed: 12803684]
23. Mak MK, Pang MY. Parkinsonian single fallers versus recurrent fallers: different fall characteristics and clinical features. *J Neurol*. 2010; 257:1543–51. [PubMed: 20449601]
24. Sohng KY, Moon JS, Lee KS. Prevalence and associated factors of falls among people with Parkinson's disease. *Taehan Kanho Hakhoe Chi*. 2004; 34:1081–91. [PubMed: 15613843]
25. Kurlan R. "Fear of falling" gait: a potentially reversible psychogenic gait disorder. *Cogn Behav Neurol*. 2005; 18:171–2. [PubMed: 16175021]
26. Cumming RG, Salkeld G, Thomas M, Szonyi G. Prospective study of the impact of fear of falling on activities of daily living, SF-36 scores, and nursing home admission. *J Gerontol A Biol Sci Med Sci*. 2000; 55:M299–305. [PubMed: 10819321]
27. Bryant MS, Pourmoghaddam A, Thrasher A. Gait changes with walking devices in persons with Parkinson's disease. *Disabil Rehabil Assist Technol*. 2012; 7:149–52. [PubMed: 21954911]
28. Bateni H, Zecevic A, McIlroy WE, Maki BE. Resolving conflicts in task demands during balance recovery: does holding an object inhibit compensatory grasping? *Exp Brain Res*. 2004; 157:49–58. [PubMed: 14758453]
29. Boonsinsukh R, Saengsirisuwan V, Carlson-Kuhta P, Horak FB. A cane improves postural recovery from an unpracticed slip during walking in people with Parkinson disease. *Phys Ther*. 2012; 92:1117–29. [PubMed: 22628583]

Fig. 1.

Classification and regression tree analysis. Two determinants differentiated participants based on their device walking status. The 5m-TUG test was the strongest determinant in the total sample with a cut-point of 13 seconds. Among participants who took more than 13 seconds to complete the 5m-TUG, the ABC scale further differentiated participants with a cut-point score of 75.

Table 1

Characteristics of independent and device walkers with PD.

	Independent Walker (N=54)	Device Walker (N=31)	Spearman's ρ (P-value)
Age	68.3 (9.0)	71.3 (8.5)	.144 (.190)
Gender	M=37 (68.5%)	M=23 (74.2%)	.306 (.580) ^a
Marital status	45 (83.3%)	24 (77.4%)	.451 (.502) ^a
Years of PD	6.8 (4.6)	9.8 (5.9)	.252 (.020)
UPDRS motor score ^b	17.5 (9.1)	19.8 (7.7)	.149 (.175)
Hoeft & Yahr stage^c	2.3 (0.5)	2.7 (0.3)	.435 (<0.001)
PIDG score^d	4.4 (2.3)	6.6 (2.6)	.416 (<0.001)
ABC score^e	73.8 (19.2)	57.4 (20.1)	-.387 (<0.001)
Timed 5-step test (s)	11.0 (3.0)	12.6 (3.9)	.211 (.053)
Turn duration (s)	3.9 (1.7)	5.0 (2.5)	.273 (.011)
5m-TUG test (s)	12.5 (3.8)	18.3 (7.6)	.471 (<0.001)
Functional reach (inch)	11.6 (3.1)	10.4 (2.3)	-.214 (.049)

Mean (SD) unless otherwise indicated. Bolded variables demonstrated statistically significant bivariate associations with walking status and were included in the subsequent classification and regression tree (CART) analysis.

^a Chi-Square test.

^b Score range = 0–108; higher scores represent a higher degree of impairment.

^c Score range = 0–5; higher scores represent more severe disability.

^d Score range = 0–20; higher scores represent a higher degree of impairment.

^e Score range = 0–100; lower scores represent a higher level of fear of falling.

PD = Parkinson's disease

UPDRS = Unified Parkinson's Disease Rating Scale

PIDG = Postural Instability and Gait Disorder subscale of the UPDRS, a composite score of 5 items (falling, freezing, walking, gait, and postural stability).

ABC = Activities-specific Balance Confidence scale

5m-TUG = Timed Up-and-Go test