Determinants of Balance Confidence in Community-Dwelling Elderly People

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Research Report

Determinants of Balance Confidence in Community-Dwelling Elderly People

Background and Purpose. The fear of falling can have detrimental effects on physical function in the elderly population, but the relationship between a person's confidence in the ability to maintain balance and actual balance ability and functional mobility is not known. The extent to which balance confidence can be explained by balance performance, functional mobility, and sociodemographic, psychosocial, and health-related factors was the focus of this study. **Subjects.** The subjects were 50 community-dwelling elderly people, aged 65 to 95 years ($\bar{X}$=81.7, SD=6.7). **Methods.** Balance was measured using the Berg Balance Scale. Functional mobility was measured using the Timed Up & Go Test. The Activities-specific Balance Scale was used to assess balance confidence. Data were analyzed using Pearson correlation, multiple regression analysis, and *t* tests. **Results.** Fifty-seven percent of the variance in balance confidence could be explained by balance performance. Functional mobility and subject characteristics examined in this study did not contribute to balance confidence. **Discussion and Conclusion.** Balance performance alone is a strong determinant of balance confidence in community-dwelling elderly people. [Hatch J, Gill-Body KM, Portney LG. Determinants of balance confidence in community-dwelling elderly people. *Phys Ther.* 2003;83:1072–1079.]

Key Words: *Balance, Balance confidence, Falling, Fear of falling, Geriatric.*

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Falling is a common problem associated with aging. Thirty percent of people over the age of 65 years fall annually, with that number rising to 40% for people over the age of 80 years.[1] Although serious injuries such as hip fractures and wrist fractures are a well-recognized consequence of falls, the fear of falling is thought to be a more pervasive problem in the elderly population. When compared with other common fears, fear of falling ranked first among elderly people living in the community.[2] Recent studies have shown that more than half of community-dwelling elderly people over the age of 62 years report a fear of falling.[3] Developing a fear of falling is more prevalent with increasing age and fall history,[3,4] but is not limited to individuals with a history of falls. Tinetti et al[5] found that 48% of people over age 75 years who had fallen in the previous year were afraid of falling, while 27% of those who had not fallen admitted having a fear of falling. The impact of fear of falling is far-reaching because it can lead to activity restriction and diminished mobility,[3,6,7] with as many as 56% of elderly people curtailing activities due to this fear.[3] Individuals without a history of falls who have a fear of falling have an increased risk for admission to an aged care institution.[8]

Fear of falling was originally conceptualized and measured as a dichotomous variable (present/absent). The simple presence or absence of fear of falling was used extensively in early research studies,[2–12] but is limited in its ability to determine whether different degrees of fear exist across different circumstances or have a varying effect on function. Furthermore, some researchers[9,10] have suggested that many people expressing a concern about their balance during functional tasks do not necessarily categorize themselves as "fearful," even when they have modified their behavior to avoid falling. Consequently, efforts to measure fear of falling have focused on using the concept of "self-efficacy" in place of "fear."[13,14] *Self-efficacy*, a concept based in the field of psychology, refers to an individual's perceived capability within a specific domain of activities.[15] Assessing falls-related self-efficacy in performing specific activities or tasks, rather than global fear of falling, should reveal the extent to which a person believes he or she is able to participate in specific activities without falling.

In an effort to measure fear of falling based on the concept of self-efficacy, 2 measurement tools have been developed: the Falls Efficacy Scale (FES)[13] and the

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Activities-specific Balance Confidence (ABC) Scale.[14] Although the FES scale is often referred to as a measure of "falls-related self-efficacy" and the ABC Scale is a measure of "balance confidence," both scales measure the same construct of perceived balance ability (ie, a person's level of confidence in the ability to maintain balance while performing specific daily activities).[14] The FES, developed by Tinetti et al,[13] is a 10-item questionnaire, either self-administered or administered through interview, that asks respondents to rate their level of confidence in performing common activities such as "taking a shower or bath," "getting dressed," and "reaching into cabinets" without falling. Each item is rated on a 10-point scale, with 1 indicating "extreme confidence" and 10 indicating "no confidence at all." The FES has been widely used in studies examining the effect of fear of falling on physical function. However, some investigators[8,10] have noted that FES scores in community-dwelling elderly people can be skewed toward the maximum score of 100, suggesting a ceiling effect for higher-functioning individuals. As a result, Powell and Myers[14] developed the ABC Scale, which includes functional activities with a wider continuum of activity difficulty.

The ABC Scale is a 16-item questionnaire that asks respondents to score their level of confidence in performing situation-specific activities such as "reaching at eye level," "reaching on tiptoes," "picking up slipper from floor," and "walking in crowded mall" "without losing . . . balance or becoming unsteady."[14] Each item is scored from 0% to 100%, with 0% being no confidence and 100% being full confidence in the ability to perform the activity without losing balance. The total ABC Scale score is the average sum of the individual item scores. The ABC Scale was found to yield data with strong test-retest reliability ($r=.92$), and good convergent validity with the physical activity subscale of the Physical Self-Efficacy Scale ($r=.63$).[14] Discriminant validity of data obtained with the ABC Scale in elderly people was supported by the low correlation of ABC Scale scores with overall scores on the Positive and Negative Affectivity Scale ($r=.12$), which assesses emotionality.[14] Furthermore, the ABC Scale has been shown to have better scale responsiveness than the FES when used with community-dwelling elderly people aged 65 to 95 years.[14] When compared in a group of community-dwelling elderly people, the FES and the ABC Scale have both been found to be able to discriminate between fearful and nonfearful subjects and between those who avoided activity due to fear of falling and those who did not avoid activity.[16]

Several studies have demonstrated a strong link between falls-related self-efficacy as measured by the FES and physical function. Scores on the FES have been found to be highly correlated with self-reports of basic and instrumental activities of daily living (ADL) status and physical function and moderately associated with level of social activity.[9] Prospective studies have shown that low baseline FES scores are associated with greater declines in self-report ADL status, deterioration of health-related quality of life, and an increased risk for falling in community-dwelling elderly people.[16,17] Cumming and colleagues[8] reported that low baseline FES scores in community-dwelling elderly people were associated with greater declines in self-reported ADL performance over a 12-month period. Mendes de Leon and colleagues[17] examined the role of falls-related self-efficacy on changes in physical functioning in community-dwelling elderly people in an effort to determine if self-efficacy would be protective of self-care behaviors. Physical functioning was measured using a self-report of ADL status. Subjects' physical performance capacity was also measured using timed tests of balance and gait, including chair stands, turning 360 degrees, and walking 20 ft (6.1 m). Over the 18-month study period, ADL performance was preserved in subjects with high baseline FES scores, despite declines in physical performance capacity.[17] The ADL performance levels in these subjects were similar to those in subjects who experienced no physical decline. The results of these studies suggest that confidence in being able to perform activities without falling may have a powerful buffering effect on preserving function despite declining physical capacity.

A few investigators have explored the relationship between balance ability and both fear of falling and balance confidence. Maki et al[10] found that elderly people with a fear of falling demonstrated poorer performance of one-legged standing balance and anterior-posterior platform sway measures as compared with nonfearful subjects. A trend toward poorer clinical balance scores as measured by the Performance-Oriented Mobility Assessment of Balance (POMA)[18] also was noted in fearful subjects, although this relationship did not reach statistical significance. A prospective 2-year study examining fear of falling and restriction of mobility in community-dwelling elderly people showed that fear of falling was associated with a decline of balance and gait scores (POMA) at follow-up in those who did not have abnormalities at baseline.[7] Individuals who were prone to falling who initially reported a fear of falling also were found to have more balance and gait disorders at baseline than persons who were prone to falling but had no fear of falling.[7] Myers and colleagues[16] investigated the association between balance confidence, as measured by the ABC Scale, and balance performance, as measured by static posturography, in elderly people. They reported a strong relationship between balance confidence and performance on mediolateral sway, with subjects with higher balance

confidence demonstrating less postural sway in standing than subjects with lower balance confidence.[16]

Although the results of these studies suggest that individuals who have a concern about their ability to avoid falling may have impaired balance, our understanding of the relationship between balance confidence and actual balance ability is quite limited. The use of static posturography as a measure of balance ability by Myers et al[16] provides little information about a person's ability to maintain upright postural control while performing functional activities that challenge balance through multidirectional self-initiated perturbations, such as reaching, lifting, bending, and ambulatory transfers. Thus, it remains unclear whether the ability to perform typical balance and mobility tasks is impaired in people who report diminished balance confidence. In addition, we need to investigate how health-related, psychosocial, and sociodemographic factors previously reported as correlates of fear of falling[3,4] may influence balance confidence in an effort to gain a better understanding of this phenomenon. Understanding the extent to which each of these factors plays a role in determining balance confidence is an important prerequisite to the development of interventions that effectively address balance, falling, and diminished balance confidence and their impact on physical function in elderly people.

The purposes of this study were: (1) to explore whether a relationship exists among balance confidence, balance performance, and functional mobility and (2) to examine the extent to which balance confidence can be explained by clinical measures of balance and functional mobility, as well as sociodemographic, health-related, activity-level, and fall-related characteristics. We hypothesized that balance performance and functional mobility would be strongly associated with balance confidence in elderly individuals.

Method

Subjects

Participants were a convenience sample of 50 community-dwelling elderly people between 65 and 95 years of age ($\overline{X}$=81.7, SD=6.7), with and without a history of falls, residing in the greater Boston area. Subjects were enrolled on a volunteer basis in response to informative lectures in senior centers and senior housing sites. The primary author (JH) contacted interested people by telephone to review the format of the study, address any questions, and screen potential subjects for study eligibility. In order to participate in the study, subjects needed to be English speaking, be able to walk at least 20 ft (6.1 m) without human assistance, be able to follow 3-step commands, have no history of clinical depression or progressive neurological disorder, be able to see well enough to read, and have had no lower-extremity fracture, surgery, or joint replacement within the past year. Eligible participants were then scheduled for a single study session. Informed consent was obtained immediately prior to data collection.

Demographic information regarding subject characteristics and medical history is summarized in Table 1. Fifty percent of the subjects reported a fear of falling. Of those subjects reporting a fear of falling, 63% experienced a fall in the past year, and 30% had no history of falls. Of those subjects with a history of falls, 25 (63%) required medical attention for falls; only 7 (18%) of those subjects required hospitalization or surgery. Forty-one subjects (82%) knew someone who had a serious fall requiring medical attention. Thirty-six subjects (72%) were independent with self-care and homemaking tasks, while 14 (28%) required some level of assistance with ADL (meals, bathing, homemaking tasks). Thirty-nine subjects (78%) exercised on a regular basis; 4 of these subjects regularly participated in high-level activities (heavy housework, outdoor gardening, skating, skiing). All subjects participated in weekly social activities; most participated greater than 3 times per week. When asked if they could rely on friends and family for support in the event of an injurious fall, 13 subjects (26%) were completely confident that they would have support, 25 (50%) were somewhat confident, and 12 subjects (24%) were not at all confident that they would have help.

Procedure

Interviews and subject testing were each performed in separate designated common areas (to ensure tester masking) in the senior housing sites and the senior center where recruitment took place. A research assistant gathered sociodemographic data (subject characteristics, living situation, and subject's level of confidence in social support in the event of an injurious fall), health-related information (past medical history, use of assistive device, amount of daily assistance required, activity level, and use of medication and alcohol), and fall-related information (fear of falling [yes/no], fall history and frequency, the need for medical attention due to falls, and knowledge of someone who had sustained a serious fall) using a standardized interview protocol. The selection of questions to include in the interview was based on clinical experience as well as correlates of fear of falling identified in the literature.[3,4,6,7] Fall history was considered to be the number of falls in the past year, with a *fall* defined as an episode of unintentionally coming to rest on the ground or lower surface that was not the result of dizziness, fainting, sustaining a violent blow, loss of consciousness, or other overwhelming external factors. The ABC Scale standardized questionnaire was then administered through interview by the research assistant.

Table 1.
Subject Characteristics (N=50)

Characteristic	N	%
Age ($\bar{X}$±SD)=81.7±6.7 y		
Sex		
Female	46	92
Male	4	8
Marital status		
Married	8	16
Widowed	35	70
Single	7	14
Assistive device		
Walker	8	16
Cane	12	24
None	30	60
Sociodemographic		
Living situation		
Private house	13	26
Assisted living	14	28
Senior housing	23	46
Living alone	40	80
Confidence in availability of support in event of injurious fall		
Yes	38	76
No	12	24
Activity level		
Participation in social activities	50	100
Participation in regular physical exercise	39	78
Requires assistance for daily activities	14	28
Health related		
Reported medical conditions		
Diabetes	7	14
Cancer	9	18
Osteoporosis	13	26
Osteoarthritis	23	46
Vertigo	6	12
Joint replacement	9	18
Rheumatoid arthritis	4	8
Fracture	19	38
Cardiac	28	56
Stroke	4	8
Visual problems	37	74
Coumadin[a] use	6	12
Alcohol use	23	46
7 or more medications	5	10
Fall related		
Fear of falling	25	50
History of falls	40	80
Requires medical attention for falls	25	50
Hospitalization/surgery	7	14
Knows someone who sustained serious fall	41	82

[a] Bristol-Myers Squibb Co, PO Box 4500, Princeton, NJ 08543-4500.

Following the interview, 2 physical performance measures were used to assess balance performance and functional mobility. The Berg Balance Scale (BBS) and the Timed Up & Go Test (TUG) were administered by the primary author in random order as determined by a coin toss. The BBS is a 14-item balance assessment tool that is scored on a 5-point ordinal scale (0–4), measuring levels of ability in performing each task (4=safe and independent, 0=unable).[19] The BBS includes tasks such as standing with eyes closed, reaching, standing on one foot, and picking up objects from the floor. The BBS has been shown to yield data with high interrater reliability (intraclass correlation coefficient [ICC]=.98) and high intrarater reliability (ICC=.99)[19] and to be highly specific in identifying elderly people who are not prone to falling (cutoff score=45).[20] The TUG is a measure of basic functional mobility. The time it takes for a subject to rise to stand, walk 10 ft (3 m), walk back to the chair, and sit is recorded (in seconds).[21] The TUG can be used as a screening tool because its measurements have been shown to be well correlated to function.[21] It has been shown to yield measurements with good interrater and intrarater reliability (ICC=.99) in patients with various neurological disorders[21] and is predictive for fall risk in community-dwelling elderly people using a cutoff score of 14 seconds.[11] The tester was masked to the results of the ABC Scale as well as to information regarding fear of falling and fall history to avoid bias. Subjects also were asked not to reveal this information during testing.

Prior to testing, each subject was informed that the therapist would closely guard him or her to minimize the risk for falls. Each new task was explained and demonstrated, and the subject asked if he or she felt safe performing that task. Subjects who did not feel safe performing a task were reassured that they could attempt to complete as much of the task as possible while they were being closely guarded for safety. If the subject still did not feel safe attempting the task, the examiner entered the lowest possible score for the task and continued to the next item. For the TUG and the last 3 items on the BBS, each subject was allowed one practice trial before scoring to ensure that these more difficult tasks were understood. Intermittent rest periods were given between tasks at intervals that were standard across all subjects. Subjects were allowed to take more frequent rest periods as needed. The majority of subjects required no additional rest periods. Time to complete the interview and testing procedures ranged from 40 to 60 minutes.

Data Analyses

Descriptive analyses were performed on all subject characteristic variables and test scores. The Pearson product moment coefficient of correlation was used to examine the relationship among the BBS, TUG, and ABC Scale scores.

To analyze the determinants of balance confidence, a stepwise multiple regression analysis was performed with

Table 2.
Pearson Correlations for Activities-specific Balance Confidence (ABC) Scale, Berg Balance Scale (BBS), and Timed Up & Go Test (TUG)

	ABC Scale	BBS
BBS	.752[a]	
TUG	.698[a]	.810[a]

[a] $P < .01$ (2-tailed).

ABC Scale score as the dependent variable. The regression model used the BBS and TUG scores as well as all subject characteristics as independent variables. Subject characteristics (sociodemographic, health-related, activity-level, and fall-related variables) were dichotomized (yes/no) for use in the regression analysis and are listed in Table 1. A .05 level of significance was used.

We also wanted to explore whether balance confidence differed for people based on fall risk, as determined by established cutoff scores for the BBS (score of 45)[20] and the TUG (14 seconds).[11] Separate independent *t* tests were used to compare ABC Scale scores for those determined to be at risk or not at risk as classified by the BBS and TUG scores. A Bonferroni correction (P=.025) was used to control for Type I error. The SPSS version 10.0* was used for all statistical analyses.

Results

Mean test scores (±SD) for the sample were as follows: ABC Scale=78.87±19.08, BBS=46.50±9.46, and TUG=16.00±14.31 seconds. The mean BBS score was just above the established cutoff of 45 for fall risk,[20] and the mean TUG time was slightly longer than the cutoff of 14 seconds for fall risk.[11]

Relationship Among Balance Confidence, Physical Performance Test Results, and Subject Characteristics

A strong association was found between ABC Scale and BBS scores, between ABC Scale and TUG scores, and between TUG and BBS scores (Tab. 2). Stepwise regression analysis performed to determine the extent to which balance performance, mobility, and subject characteristics (sociodemographic, health-related, activity-level, and fall-related variables) could explain balance confidence revealed that the BBS scores accounted for 57% of the variance in ABC Scale scores. Adding fear of falling to the model increased R^2 to .62. The TUG scores and subject characteristic variables did not enter the stepwise regression model as predictors of balance confidence. Independent *t* tests revealed that the ABC Scale scores were higher for subjects with no fall risk as compared with those at risk for falls as classified by the BBS and TUG cutoff scores (Figure).

* SPSS Inc, 233 S Wacker Dr, Chicago, IL 60606.

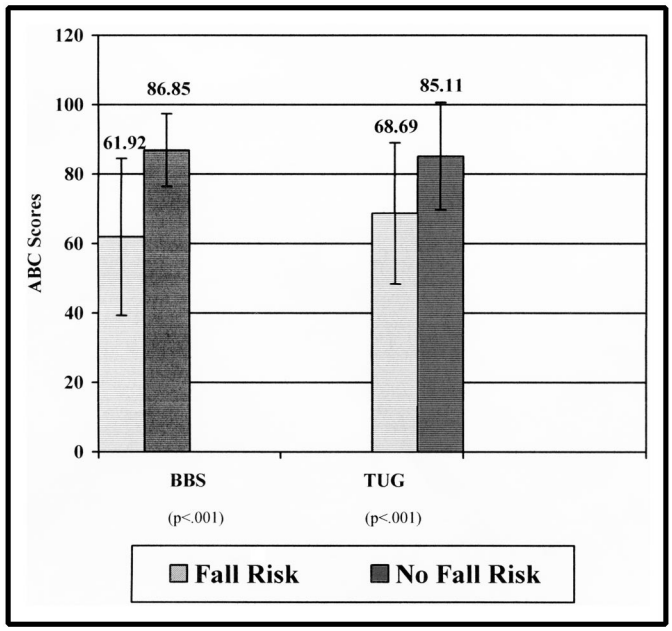

Figure.
Mean Activities-specific Balance Confidence (ABC) Scale scores for subjects classified according to fall risk using cutoff scores for the Berg Balance Scale (BBS) (45)[20] and the Timed Up & Go Test (TUG) (14 seconds).[21] BBS: fall risk, n=16; no fall risk, n=34. TUG: fall risk, n=23; no fall risk, n=27.

Discussion

The results of this study support our hypothesis that balance performance and functional mobility are strongly associated with balance confidence in community-dwelling elderly people. The BBS, which measures risk for falls based on physical performance, explained close to 60% of the variance in the ABC Scale scores and was the major determinant of balance confidence among all variables measured in this study. This finding suggests that individuals who have concerns about their balance may have actual balance deficits as compared with having low confidence due to past experiences, health concerns, and sociodemographic factors. This study is the first to demonstrate a link between balance confidence and balance ability during functionally based tasks. Our results are in agreement with and extend those of Myers et al,[16] who reported a relationship between balance confidence and instrumented measures of balance performance. Fear of falling also contributed to explaining balance confidence, indicating that people who report reduced balance confidence not only have impaired balance, but are fearful that they are likely to fall due to these balance limitations.

Although functional mobility (TUG scores) did not enter the stepwise regression model as a predictor of balance confidence, this result is likely to have occurred because TUG scores were highly correlated with BBS scores (Tab. 2). The TUG and BBS both assess balance ability and fall risk, but they do so by measuring different

constructs of balance. The BBS assesses balance ability during functionally based activities in sitting and standing, whereas the TUG assesses ability to maintain balance during timed locomotion and ambulatory transfers. The TUG scores also were highly correlated with balance confidence scores (ABC Scale scores), demonstrating that a relationship exists between balance confidence and functional mobility. Similar findings were reported for studies that investigated fear of falling and restriction of activity and self-reported declines in mobility[3,6,7] and reduced physical function in people with low falls-related self-efficacy.[9]

Balance confidence was different in people who did and did not present a risk for falls, whereas fall history was not a contributing factor in determining balance confidence. The finding that concerns regarding ability to maintain balance during functional activities can be present irrespective of fall history is consistent with that of Myers et al.[16] People with reduced balance confidence may avoid falls, despite having impaired balance or being at risk for falls, by limiting their participation in activities.

While administering the ABC Scale, we found that many subjects needed redirection to the main question posed by the ABC Scale; these subjects needed reminders to distinguish between their level of balance confidence in performing each task and their usual level of participation in each activity. This was particularly true for the individuals who were more frail. Given this observation, it is apparent that consistent interpretation of this main question is necessary to ensure valid results. Myers et al[22] demonstrated stability of ABC Scale scores over a 1-year follow-up period. However, this finding does not account for possible seasonal influences on scores, such as slippery walking conditions on outdoor surfaces. Further examination of the ABC Scale should establish the validity of data obtained with this tool in diverse populations and across interview-based and self-administration methods, and it should establish seasonal effects on the stability of ABC Scale scores.

Although this study included subjects with a range of abilities and living situations, the study sample overall was in relative good health and may not represent the general elderly population. For example, the majority of subjects (68%) scored above the established BBS cutoff score (45).[20] We defined falls to include only those episodes of imbalance in the past year that resulted in a fall to the ground. This definition of what constituted a fall does not account for subjects who may experience some degree of instability and loss of balance during functional activities but have not experienced a fall to the ground. Studies examining the relationship between balance confidence and balance ability in a larger, more diverse population need to be done to determine whether this relationship remains constant across subjects with varied degrees of balance abilities.

More needs to be learned about other possible predictors of balance confidence. Although 57% of the variance in balance confidence was accounted for in this study, further research is needed to examine the extent to which socioeconomic, psychological, and other psychosocial and health-related factors not examined in this study explain the remaining 43% of predictors of balance confidence in order to fully understand the multidimensional nature of this phenomenon.

Future studies should aim at improving our understanding of the interaction between balance confidence and balance performance. A causal relationship cannot be inferred from the results of this cross-sectional study because it is unclear whether impaired balance has an impact on balance confidence or whether diminished balance confidence results in a deterioration of balance ability. It is possible that implicit understanding of balance limitations leads to the development of diminished balance confidence. Alternatively, deterioration of balance systems may take place as the result of activity-avoidance behaviors in people who have acquired diminished balance confidence. In this study, optimal performance on the BBS may have been hindered more by diminished balance confidence than by balance limitations. Six subjects opted not to perform the last 3 items on the BBS, which were the most challenging tasks, due to concerns that they would not be able to maintain their balance. Allowing subjects a practice trial of these more difficult tasks was an attempt to achieve the best representation of true physical ability.

Physical therapists are well prepared to address balance deficits through rehabilitation, but we cannot assume that improved balance will result in improved balance confidence until we understand the etiology of this complex problem. Understanding the dynamics of balance confidence will help to identify whether it can be effectively addressed through rehabilitation of balance impairments, modification of health-related and psychosocial factors, or a combination of strategies using a multidisciplinary team approach. Two groups of authors[12,23] thus far have explored whether fear of falling and falls-related self-efficacy can be modified by focusing on the psychosocial factors implicated as the basis for fear of falling, or by intervening at the physical level. In a study by Tennstedt and colleagues,[12] there was no long-term impact on self-reported behavior and intended activity level with falls-related self-efficacy group counseling over a 12-month period. Tinetti and Powell[23] described a multifaceted clinical intervention for an elderly man exhibiting avoidance of activity due to

a fear of falling after several hospitalizations. This subject returned to his prior level of activity after a prescribed program focused on mobility training, reduction of fall risk, and graded increases in activity level. Randomized controlled trials examining whether balance confidence can be modified through balance retraining are needed to lend insight into the dynamics of this relationship and help identify effective intervention strategies that can be delivered within the scope of rehabilitation services.

Conclusion

Although balance confidence is largely considered to be multidimensional in nature, little attention has been paid to identifying the scope of physical factors that may underlie this phenomenon. The results of this study suggest that balance impairments are present in people with diminished confidence in their balance ability and play an important role in determining balance confidence. This relationship has important implications for the development of rehabilitation programs that aim to improve balance confidence and diminish its impact on function in elderly people. An in-depth understanding of the predictors of balance confidence is necessary to identify and effectively manage those people at risk for declining balance confidence, and possibly prevent the spiraling decline of function that is a consequence of this pervasive problem in elderly people.

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