Article

Perceived Balance, Balance Performance, and Falls Among Community-Dwelling Older Adults: A Retrospective, Cross-Sectional Study

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Abstract

Objectives: To examine the extent to which older adults' perceived balance, a balance performance test, and fear of falling (FOF) were associated with falls in the last month. **Methods:** The Health Belief Model served as the theoretical framework. A retrospective, cross-sectional, secondary analysis using data from the National Health and Aging Trends Study was conducted (N = 7499). **Results:** Multiple logistic regression analysis revealed that the odds of reporting a fall in the past month were 3.3 times ($p < .001$) greater for participants who self-reported having a balance problem compared to those who did not. The Short Physical Performance Battery and FOF were not uniquely associated with falls. **Discussion:** Our findings support limited evidence suggesting that older adults' perceived balance is a better predictor of falls than balance performance. Assessing older adults' perceived balance may be a new way to assess older adults' fall risk to prevent future falls.

Keywords

balance performance, fear of falling, health belief model, older adults, perceived balance

Background

In the last 20 years, fatal falls among adults age 65 and older in the United States (US) have doubled (Santos-Lozada, 2023) and falls are the leading cause of injury and injury-related death among this population (Bergen et al., 2016). With the number of older adults increasing in the US, the problem of accidental falls is growing. Effective identification of older adults who are at risk for falling is paramount in primary care in order to help decrease falls among this population and enroll at-risk older adults in fall prevention interventions.

To identify older adults at risk for falling during primary care visits, older adults are generally assessed for (1) a history of falls in the last year, (2) feeling unsteady when standing or walking, and (3) fear of falling (FOF) (Stevens & Phelan, 2013). If patients provide positive responses to any of these questions, then their gait, strength, and balance are evaluated by physical performance measures, such as the Short Physical Performance Battery (SPPB) (Guralnik et al., 1994), which has shown prospective evidence for predicting falls (Hars et al., 2018; Welch et al., 2021). While identification of fall risk in community-dwelling older adults mainly relies on self-report, up to 72% of Medicare beneficiaries have been found not to report falls or fall-related injuries to their healthcare providers (Hoffman et al., 2018). Among older adults, the topic of falls is often associated with embarrassment, frailty, and loss of dignity (Dolan & Taylor-Piliae, 2020; Jacelon, 2014), fueling a reluctance to discuss falls with their healthcare providers (Dollard et al., 2014). Understanding older adults' perceptions of their own fall risk and how they prefer to talk about accidental falls is vital in the effort to increase their self-report of falls.

Findings from a recent phenomenological study showed that the older adult participants did not use the term "fall risk" to describe their own perceived risk for falling. Instead, they preferred the phrase "having a balance problem" (Dolan et al., 2022). Moreover, limited evidence to date suggests that perceived balance confidence is a better predictor of fall risk

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among older adults than balance performance (Landers et al., 2016). Assessing older adults' perceived balance problems may help identify perceived (self-reported) fall risk among older adults and improve their self-report of falls to their healthcare providers. Subsequently, this may improve enrollment into appropriate fall prevention interventions among older adults.

The National Health and Aging Trends Study (NHATS) is a longitudinal cohort study of a national representative sample of Medicare beneficiaries age 65 and older. The NHATS dataset include variables such as self-reported falls, FOF, and self-reported balance problem that allow an initial retrospective exploration of associations between the variables among a large sample of community-dwelling older adults (Montaquila et al., 2012). This insight is needed for further longitudinal research involving perceived balance and fall risk among older adults, which is foundational for developing assessment methods and person-centered interventions to decrease falls among older adults.

Theoretical Framework

The Health Belief Model (HBM) guided the study, postulating that individuals wish to avoid illness and that health actions help prevent health threats (Rosenstock, 1974). Within the HBM, the concept of perceived susceptibility refers to an individual's acceptance of personal susceptibility to a health threat such as accidental falls. Demographic variables are included in the HBM because they are associated with preventative health behavior. The HBM posits that health beliefs are modifiable through health education and interventions (Rosenstock, 1974). For the current study, the HBM guided the analysis, where self-reported falls was the outcome variable (health threat). Socio-demographics, health factors, and individual perceptions were grouped as independent variables (see Figure 1).

Objectives

This study is a follow-up study to our recent work, where we used a nationally representative sample of community-dwelling older adults to explore perceived balance problems in relation to self-reported falls. In contrast, the aim of this study, using the same dataset, was to examine the extent to which older adults' perceptions about their own balance ability and the commonly used fall risk assessment methods of the balance performance test (SPPB) and self-rated FOF were associated with falls in the last month. Although we hypothesize that perceived susceptibility variables are related to falls in the last month, the primary hypothesis (H1) is that perceived balance is more strongly associated with self-reported falls in the last month than SPPB and FOF. We also hypothesize that health factors (H2) and socio-demographic variables (H3) will be associated with self-reported falls. Note that these assessments will control for socio-demographic variables, health-related factors known to be associated with fall risk among older adults, and perceived susceptibility variables that include FOF, perceived health status, and perceived memory problems.

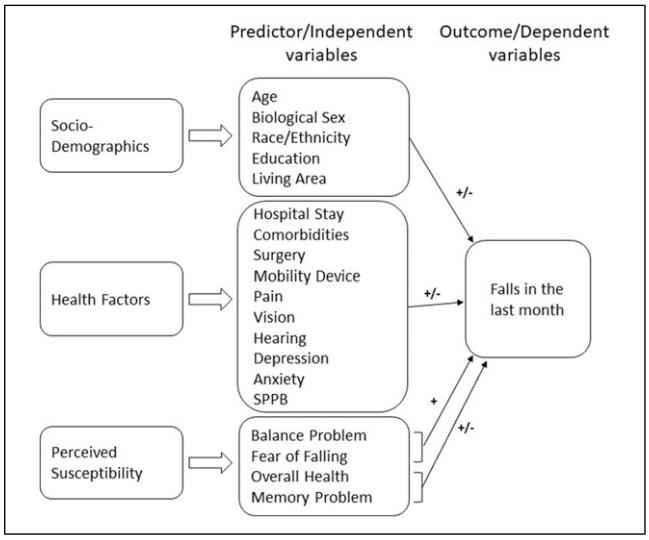

Figure 1. *Note.* Theoretical Framework. The Health Belief Model and the concept of perceived susceptibility guided the statistical analysis with socio-demographic, health factor, and perceived susceptibility variables as the independent (predictor) variables and falls in the last month as the dependent (outcome) variable.

Methods

Design

This study was a cross-sectional secondary analysis using the NHATS data from the year 2015 ($N = 8334$) (National Health and Aging Trends Study, n.d.-a). The NHATS is a longitudinal cohort study of a nationally representative sample of Medicare beneficiaries age 65 and older to explore disability trends and individual trajectories (Montaquila et al., 2012). Functional test and survey data are collected yearly. The ongoing study is being conducted by the Johns Hopkins University Bloomberg School of Public Health (DeMatteis et al., 2016), and sponsored by the National Institute on Aging (grant number NIA U01AG32947).

Study Setting and Sampling

The sampling frame for NHATS is the Medicare enrollment database where 96% of adults age 65 and older in the United States (US) are enrolled. The oldest age groups, particularly those over the age of 90, were oversampled as were Black/non-Hispanic participants (Montaquila et al., 2012). The NHATS sample was replenished in 2015, with 4152 participants remaining from Round 1 in 2011, and 4182 new

participants added in 2015 for Round 5 replacing the youngest age group (ages 65–69) and those who had either died or been lost in follow-up in other age groups (DeMatteis et al., 2016).

Inclusion Criteria

In this secondary analysis, participants included were those who were living independently in the community and able to respond to survey questions on their own. Round 5 in 2015 was selected due to being the most recent round that included individuals from age 65 and up when this study was conducted. Additionally, Round 5 was the most recent round with the largest sample of participants due to sample replenishment.

Instruments

A subset of NHATS data was selected for this analysis. The outcome variable was self-reported falls, and the independent variables were the participants' perceptions regarding their balance, FOF, health status, and memory status. Additionally, known predictors (socio-demographic and health factor variables) of falls among older adults were included in the study.

Outcome Variable. The outcome variable was self-reported falls in the last month. NHATS participants responded either "yes" or "no" to the question; "In the last month, have you fallen down?" The definition of a fall used in the NHATS is "any fall, slip, or trip in which you lose your balance and land on the floor or ground or lower level" (Guralnik et al., 1995).

Independent Variables

Socio-Demographic Variables. The socio-demographic independent variables include age, biological sex, race, ethnicity, living area, and education level. Race and ethnicity were categorized into Black non-Hispanic, Hispanic, and White non-Hispanic. American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islander, and Other were categorized into Underrepresented Groups. Living area was included as Metropolitan or non-Metropolitan area. The nine levels of education were categorized into No Schooling to 12th Grade Without Diploma, High School Graduate to High School and Some College, and Associate to Graduate Degree.

Health Factors. Physical comorbidities were measured by the summed number of diseases participants reported, including arthritis, heart attack, heart disease, high blood pressure, osteoporosis, diabetes, lung disease, stroke, dementia/Alzheimer's, and cancer. A mobility device used to go outside in the last month was categorized into a binary variable (i.e., use or not) and included a cane, walker, wheelchair, or scooter. The original SPPB was used for measuring participants' physical lower extremity function (Guralnik et al., 1994; Welch et al., 2021). The SPPB is a summary score of balance tests (side by side, semi-tandem, and full-tandem), five repeat chair stands, and walking speed on a three-meter course, where walking aids are allowed. The summary score ranges from 0 (not attempted) to 12, which indicates the best performance.

Additional variables report if the participants had a hospital stay within the last year, and if they experienced pain, or used glasses, contacts or hearing aids in the last month. Participants' surgery in the last year was categorized into a binary variable (i.e., surgery or not) and included either cataract, knee, hip, back/spine, or heart surgery.

Mental health factors were represented in the analysis with symptoms of anxiety and depression (Deandrea et al., 2010). The Patient Health Questionnaire-2 (PHQ-2) was used to measure symptoms of depression (Löwe et al., 2010). Symptoms of anxiety were measured using the Generalized Anxiety Disorder Screener (GAD-2) (Kroenke et al., 2007). We created composite variables for the GAD-2 and the PHQ-2 by computing the means across the respective items, with a mean computed for a composite variable if a participant had a response to at least one of two items. The PHQ-2 and the GAD-2 have well-established reliability and validity (Kroenke et al., 2003, 2007; Löwe et al., 2010). Higher scores indicated higher symptom levels of depression and anxiety.

Perceived Susceptibility. The perceived susceptibility variables included perceived balance problems, FOF, perceived health status, and perceived memory problems. These variables were associated with perceptions of fall risk among older adults (Dolan et al., 2022; McInnes et al., 2011). For perception of balance, participants were asked if they had problems with balance or coordination in the last month with a response of "yes" or "no." Likewise, for FOF, the participants were asked if they in the last month had worried about falling down, with a "yes" or "no" response. Participants were asked to rate their health and memory in the last month as either "excellent," "very good," "good," "fair," or "poor." Higher scores indicate poorer perceived health status and poorer memory. Note that in the NHATS questionnaires (National Health and Aging Trends Study, n.d.-b), the participants are first asked about falls in the last month, and worry about falling in the "Health Conditions" section. The participants are then asked a series of other questions, including about housing, service environment, children, and social networks. Towards the end of the questionnaire, the participants are asked about having a balance problem. Thus, the participants are not asked about falls and FOF at the same time as being asked about having a balance problem.

Data Analysis

We first examined basic descriptive statistics and frequencies to identify if implausible or outlying values were present for

the study variables as well as determine the extent of incomplete data. There were no implausible or outlying values, but there were missing data, particularly for the predictors used in the regression analysis, which we will describe below. We also examined values of the variance inflation factor to assess multicollinearity and found excessive multicollinearity was not present (as the value of each variance inflation factor was less than 2.2).

To describe the sample, we obtained descriptive statistics and conducted bivariate statistical tests (i.e., the complex samples adjusted Wald F test or the complex samples likelihood ratio chi-square test) with fall status (i.e., reported fall vs. no fall in the past 30 days) and each study variable. Weighted estimates that use Taylor series linearization to obtain standard errors and adjust for features in the NHATS study design were obtained with the SPSS complex analysis procedure, version 28. The NHATS Round 5 survey weights used in the analysis account for differential probabilities of selection and unit non-response.

To test the study hypotheses, three hierarchical logistic regression models were estimated with the participant-reported outcome of having a fall in the last month (fall = 1; no falls = 0). The first model included a block of demographic variables: age, male (male = 1; female = 0), race/ethnicity (with three dummy-coded variables: Black non-Hispanic, Hispanic, and Underrepresented Groups, with White non-Hispanic serving as the reference group), educational attainment (with two dummy-coded variables: high school and some college, did not graduate high school, with college graduates as the reference group), and living area (metropolitan = 1; otherwise = 0). The second regression model added a set of binary health-related variables: whether a participant reported being hospitalized in the past year, having surgery in the last year, using a mobility device, wearing glasses or contacts, wearing a hearing aid, or being bothered by pain (each variable coded as yes = 1; 0 = no). This second block of variables also included a self-reported number of comorbidities, PHQ-2, and GAD-2 items. The third regression model added the perceived susceptibility variables: the SPPB, whether a participant reported having balance issues in the last month (yes = 1; 0 = no), worried about falling in the last month (yes = 1; 0 = no), as well as self-rated overall health and memory problems. In addition to using z tests to assess the statistical significance of the logistic regression coefficients, we conducted z tests to assess the difference between logistic regression coefficients that link balance problems to falls and FOF to falls and then balance problems to falls and SPPB to falls. Note that for this latter comparison of regression coefficients, we standardized SPPB to obtain a fairer comparison to the binary balance problems variable. We also obtained estimates of model-based probabilities of reporting a fall for participants who reported having a balance problem or FOF or had a score on SPPB that is one standard deviation above its mean. These model-based probabilities were obtained holding all other regression predictors constant at their mean, that is, for the participant having "typical" values for all other predictors. Odds ratios (OR) were also obtained to describe the degree to which each variable was related to reporting a fall, and R^2 and ΔR^2 were used to describe the strength of association between a given set of variables and the outcome. Note that the R^2 for logistic regression represents the proportion of variance explained in the latent outcome that underlies the binary observed falls outcome (Long, 1997).

Although we used the NHATS survey weights for the logistic regression analysis to adjust for design features, these weights do not address incomplete survey responses. Unlike the bivariate analysis, where a small proportion of data was missing for each pair of variables, 1299 cases (17%) would have been discarded from the logistic regression analysis had we used listwise deletion, with the removal of nearly all cases due to data missing generally across the predictors. Given that exclusion of cases with complete data on an outcome but missing on predictors can lead to biased parameter estimates (Muthén et al., 2016), we used multiple imputation (Lang & Little, 2018) to impute 100 data sets, exceeding the recommended number of 20 imputed data sets (Graham et al., 2007). Using the Markov Chain Monte Carlo algorithm in Mplus software (Muthén & Muthén, 1998–2023), we generated an imputed data set at every 20,000th iteration of the process, with this interval suggested by values of less than 1.01 of the potential scale reduction factor for each parameter, indicating model convergence (Gelman & Rubin, 1992). The data imputation model included all of the variables involved in the regression analyses, as well as the NHATS weighting variables. Note that Rubin (1987) formulas were used to combine the parameter estimates and standard errors from the 100 imputed data sets into a final set of results.

Ethical Considerations

The NHATS was approved by the Institutional Review Board (IRB) at Johns Hopkins University, and all participants provided informed consent. IRB approval for this analysis (IRB ID STUDY00017753) was obtained from Arizona State University.

Results

Characteristics of the Sample

This study included 7499 participants, and 55.3% were female. The mean age was 74.9 (ranging from 65 to 107), and 8.1% were Black non-Hispanic, 7.3% Hispanic, 5.8 % Underrepresented Groups, and 78.8 % White non-Hispanic, and 871 (10.3%) reporting having fallen in the last month. Table 1 shows that, compared to those who did not report a fall in the last month, participants who reported a fall were, on average, older (76.22 vs. 74.75, $p < .001$) and reported more comorbidities (2.95 vs. 2.38, $p < .001$), poorer self-reported

overall health (3.17 vs. 2.62, $p < .001$), and more memory problems (2.92 vs. 2.58, $p < .001$), as well as more depressive symptoms on the PHQ-2 (1.77 vs. 1.41$p < .001$), and anxiety symptoms on the GAD-2 (1.73 vs. 1.40 $p < .001$). They also reported lower scores on the SPPB (8.68 vs. 6.77, $p < .001$). In addition, Table 1 shows that a greater percentage of participants reported having fallen in the last month if they reported being hospitalized within the last year versus not (15.4% vs. 9.5%, $p < .001$), using a mobility device versus not (19.8% vs. 8.2%, $p < .001$), using a hearing aid versus not (12.6% vs. 10.4%, $p = .023$), having pain versus not (14.2% vs. 6.7%, $p < .001$), and having FOF versus not (16.6% vs. 8.5%, $p < .001$) and having an issue with balance versus not (23.0% vs. 5.7%, $p < .001$).

Logistic Regression Analysis

Table 2 shows the results of the logistic regression analysis, which indicated that each block of variables was related to the likelihood of reporting a fall in the last month. Specifically, the set of demographic variables included in the first block was related to the likelihood of reporting a fall (model $R^2 = .017$, $p < .001$). In addition, the proportion of variance explained increased significantly when the set of health-related variables was added to the model ($\Delta R^2 = .102$, $p < .001$) and when the perceived susceptibility variables were added in the model ($\Delta R^2 = .057$, $p < .001$).

For the primary hypothesis of interest (H1), balance problem was significantly associated with falls (b = 1.19, SE = .11, OR = 3.28, $p < .001$), with the odds ratio indicating that the odds of reporting a fall were approximately 3.3 times greater for those who reported having a balance problem than not having a balance problem. Note that neither SPPB (b = −.03, SE = .09, OR = 0.97, $p = .13$) nor FOF (b = −.22, SE = .12, OR = .81, $p = .07$), each significantly related to falls in the bivariate analysis, were uniquely associated with falls in the multivariable regression analysis. In addition, the logistic regression coefficients linking balance problems to falls (b = 1.187) and SPPB to falls (b = −.105) significantly differed, 1.187- - .105 = 1.292, SE = .101, OR = 3.640, $p < .001$ (H1). Similarly, the logistic regression coefficients linking balance problems to falls (b = 1.187) and FOF to falls (b = −.217) significantly differed, 1.187 - - .217 = 1.404, SE = .175, OR = 4.072, $p < .001$. These results indicate that self-reported balance problems are more strongly associated with self-reported falls than SPPB or FOF. The corresponding probabilities of self-reported falls, as shown in Figure 2, indicate that participants who reported having a balance problem were more than twice as likely to report having a fall compared to participants who were one standard deviation above the mean for SPPB or those who reported FOF. Note that the only other perceived perceptibility variable related to falls was overall health, with those reporting poorer overall health having a greater likelihood of reporting a fall ($b = .11$, $SE = .04$, $OR = 1.11$, $p = .013$).

After all variables were included in the model, several health-related variables (H2) were related to reporting a fall. Specifically, reporting pain ($b = .31$, $SE = .09$, $OR = 1.36$, $p = .001$), the PHQ-2 ($b = .17$, $SE = .06$, $OR = 1.19$, $p = .004$), and the GAD-2 ($b = .14$, $SE = .06$, $OR = 1.15$, $p = .027$) were each positively associated with reporting a fall in the last month. For the set of demographic variables (H3), the only variable significantly associated with falls involved the comparison of Black non-Hispanic and White non-Hispanic participants, where Black non-Hispanic participants were less likely to report having fallen in the last month compared to White participants ($b = -.51$, $SE = .12$, $OR = .60$, $p < .001$).

Discussion

The findings from this study supported our hypotheses, generated by our theoretical model that participants' self-reported falls in the past month, were associated with each of the sets of socio-demographic, health-related, and perceived susceptibility variables. The regression analysis was especially informative revealing that perceived balance problem was strongly associated with reporting a fall in the last month, in contrast to balance performance as measured by the SPPB and FOF. Other variables uniquely associated with reporting a fall were lower self-reported health status, using a mobility device, being in pain, feeling down or depressed, and inability to stop worrying. Additionally, White non-Hispanic participants were more likely to report a fall compared with Black non-Hispanic participants.

In a relatively small sample of 64 older adults, Landers et al. (2016) conducted a prospective cohort study to determine whether physiological or psychological measures were the most predictive of falls among older adults. They found that perceived balance confidence was a better predictor of falling than FOF, avoidance behavior, and standard balance performance tests. The researchers concluded that older adults' sense of balance and associated fall risk may be a better indicator of their balance ability than balance performance tests, and our findings support this premise. However, this premise has not been adequately explored in the literature. Even though they did not explore perceived balance, Anstey et al. (2008) found that measures of well-being (depressive symptoms, morale, and control) were independent predictors of falls among older adults compared to falls history, socio-demographics, health factors, and physical performance (vision, tandem stand, grip strength, and functional reach). How measures of perceived balance, health, and well-being compare to objective, physical performance, and balance measures in predicting falls among older adults warrant further investigation. Older adults' perceptions of their own balance, health, and well-being may be important overlooked indicators of fall risk.

Older adults' use of the term "balance" may partly be explained by the concept of "positivity effect" understood as

Table 1. Descriptive Statistics and Bivariate Test Results for the Study Variables by Self-Reported Fall Status in the Last Month.

Characteristic	*N*	Did not fall in the past month *n* = 6622 (89.7%) (Weighted %)	Fell in the last month *n* = 871 (10.3%) (Weighted %)	*p* Value[a]
Age (years)	7493	*M* = 74.75 (*SE* = .083)	*M* = 76.22 (*SE* = .258)	<.001*
Biological sex	7493			.740
Female		3837 (89.2)	493 (10.8)	
Male		2785 (89.4)	378 (10.6)	
Race/Ethnicity	7305			.207
Black, non-Hispanic		1349 (91.8)	146 (8.2)	
Hispanic		388 (89.6)	53 (10.4)	
Underrepresented groups[b]		325 (88.3)	45 (11.7)	
White, non-Hispanic		4394 (89.1)	605 (10.9)	
Education	7311			.055
Not graduated high school		1385 (87.3)	215 (12.7)	
High school and some college		3137 (89.3)	406 (10.7)	
≥ Associate degree		1937 (90.3)	231 (9.7)	
Living area	7493			.164
Metropolitan		5389 (89.6)	678 (10.4)	
Non-metropolitan		1233 (87.9)	193 (12.1)	
Stay in hospital last year	7474			<.001*
Yes		1394 (84.6)	262 (15.4)	
No		5210 (90.5)	608 (9.5)	
Number of comorbidities	7492	*M* = 2.38 (*SE* = .023)	*M* = 2.95 (*SE* = .054)	<.001*
Surgery in the last year	7467			.058
Yes		817 (87.3)	136 (12.7)	
No		5782 (89.6)	732 (10.4)	
Use of mobility device (cane, walker, wheelchair, or scooter)	7493			<.001*
Yes		1746 (80.2)	406 (19.8)	
No		4876 (91.8)	465 (8.2)	
Vision (wears glasses or contacts)	7426			.837
Yes		4019 (89.2)	517 (10.8)	
No		2547 (89.4)	343 (10.6)	
Hearing (uses hearing aids)	7484			.023*
Yes		1028 (87.4)	163 (12.6)	
No		5586 (89.6)	707 (10.4)	
Pain	7483			<.001*
Yes		3482 (85.8)	617 (14.2)	
No		3132 (93.3)	252 (6.7)	
PHQ-2[c]	7487	*M* = 1.41 (*SE* = .010)	*M* = 1.77 (*SE* = .028)	<.001*
GAD-2[d]	7478	*M* = 1.40 (*SE* = .010)	*M* = 1.73 (*SE* = .036)	<.001*
SPPB[e]	6881	*M* = 8.68 (*SE* = .063)	*M* = 6.77 (*SE* = .176)	<.001*
Perceived problems with balance	7487			<.001*
Yes		1964 (77.0)	568 (23.0)	
No		4652 (94.3)	303 (5.7)	
Fear of falling	7486			<.001*
Yes		1847 (83.4)	389 (16.6)	
No		4770 (91.5)	480 (8.5)	
Perceived overall health (means)	7487	*M* = 2.62 (*SE* = .020)	*M* = 3.17 (*SE* = .045)	<.001*
Perceived memory problems (means)	7047	*M* = 2.58 (*SE* = .016)	*M* = 2.92 (*SE* = .044)	<.001*

[a]Represents the *p* value for the complex samples adjusted Wald F test or the complex sample likelihood ratio chi-square test.
[b]Underrepresented groups represent American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islander, and Other.
[c]The Patient Health Questionnaire-2 (PHQ-2) was used in the NHATS data set to assess depression symptoms.
[d]The Generalized Anxiety Disorder scale 2 (GAD-2) was used in the NHATS data set to assess for anxiety.
[e]The Short Physical Performance Battery (SPPB) was used in the NHATS data set to assess walking and balance ability.

Table 2. Hierarchical Logistic Regression Results for Self-Reported Fall Status in the Past 30 Days (N = 7499).

	Model 1			Model 2			Model 3		
	b (SE)	OR	p	b (SE)	OR	p	b (SE)	OR	p
Intercept	−3.864 (.442)			−4.166 (0.453)			−3.210 (0.608)		
Age	0.024 (.005)	1.024	<.001[S]	0.008 (0.006)	1.008	0.176	−0.003 (0.007)	.997	0.668
Male[a]	0.006 (.082)	1.006	0.944	0.168 (0.083)	1.183	0.042[S]	0.139 (0.089)	1.150	0.116
Black[b]	−0.347 (0.112)	0.707	0.002[S]	−0.447 (0.112)	0.640	<.001[S]	−0.513 (0.115)	0.599	<.001[S]
Hispanic[c]	−0.145 (0.190)	0.866	0.445	−0.235 (0.196)	0.791	0.232	−0.292 (0.201)	0.748	0.148
Underrepresented[d]	0.089 (0.169)	1.094	0.599	−0.034 (0.188)	0.968	0.856	−0.082 (0.178)	0.922	0.646
High school and some college[e]	0.081 (0.091)	1.084	0.374	−0.108 (0.093)	0.898	0.244	−0.145 (0.097)	0.865	0.136
Did not graduate high school[f]	0.273 (0.137)	1.315	0.046[S]	−0.095 (0.140)	0.910	0.501	−0.230 (0.143)	0.795	0.109
Living area[g]	−0.147 (0.119)	0.863	0.216	−0.109 (0.116)	0.896	0.346	−0.083 (0.108)	0.920	0.440
Stay in hospital last year[h]				0.155 (0.105)	1.167	0.140	0.104 (0.108)	1.110	0.336
Number of comorbidities				0.063 (0.028)	1.065	0.025[S]	−0.013 (0.030)	0.987	0.675
Surgery in last year[i]				−0.021 (0.143)	0.980	0.886	0.002 (.148)	1.002	0.989
Use of mobility device[j]				0.630 (0.11)	1.879	<.001[S]	0.259 (0.144)	1.296	0.071
Vision[k]				−0.019 (0.086)	0.982	0.830	−0.062 (0.085)	0.939	0.461
Hearing[l]				0.100 (0.111)	1.106	0.366	0.095 (0.112)	1.100	0.394
Pain[m]				0.489 (0.092)	1.631	<.001[S]	0.310 (0.092)	1.363	0.001[S]
PHQ[n]				0.318 (0.059)	1.374	<.001[S]	0.171 (0.060)	1.187	0.004[S]
GAD[o]				0.248 (0.068)	1.281	<.001[S]	0.142 (0.064)	1.152	0.027[S]
SPPB[p]							−0.028 (.019)	0.972	0.131
Balance problem[q]							1.187 (0.108)	3.276	<0.001[S]
Fear of falling[r]							−0.217 (0.120)	0.805	0.070
Overall health							0.106 (0.042)	1.111	0.013[S]
Memory problem							0.087 (0.050)	1.091	0.082
R^2	.017		<.001	.119		<.001	.176		<.001
R^2 change	.017		<.001	.102		<.001	.057		<.001

Note. OR = odds ratio.
[a]is coded as male = 1, female = 0;
[b]is coded as Black = 1, Otherwise = 0;
[c]is coded as Hispanic = 1; Otherwise = 0;
[d]is coded as Underrepresented groups = 1, Otherwise = 0;
[e]is coded as High School and some college = 1, Otherwise = 0;
[f]is coded as Did not graduate High School = 1, Otherwise = 0;
[g]is coded as Metropolitan Area = 1, Non-metropolitan area = 0;
[h]is coded as a stay in the hospital the last year = 1, No stay in the hospital the last year = 0;
[i]is coded as Had surgery in the last year = 1, Did not have surgery in the last year = 0;
[j]is coded as Use a mobility device (cane, walker, scooter, or wheelchair) = 1, Does not use mobility device = 0;
[k]is coded as Wears glasses or contacts = 1, Does not wear glasses or contacts = 0;
[l]is coded as Wears hearing aid = 1, Does not wear hearing aid = 0;
[m]is coded as Bothered by pain = 1, No bothered by pain = 0;
[n]Patient Health Questionnaire – 2;
[o]General Anxiety Disorder;
[p]Short Physical Performance Battery;
[q]is coded as Had balance issues in the last month = 1, Did not have balance issues in the last month = 0;
[r]is coded as Worried about falling the last month = 1, Not worried about falling the last month = 0.
[s]Indicates a significant logistic regression coefficient.

older adults' preference for positive information in both attention and memory (Mather & Carstensen, 2005). 'Balance problem' may be a more positive and acceptable term among older adults than "fall risk." Asking older adults about their balance may decrease their reluctance to discuss falls with their healthcare providers, and addressing balance may be a target for future fall prevention interventions. How older adults' sense of their own balance ability better captures their actual physical balance and risk of falling over balance performance tests such as the SPPB must be further explored.

FOF is associated with activity avoidance and postural changes that increase fall risk, and assessing for FOF is a commonly used method to determine fall risk among older adults (Scheffer et al., 2008; Stevens & Phelan, 2013). FOF affects 20%–39% of older adults (Scheffer et al., 2008), yet, not all older adults who consider themselves as having

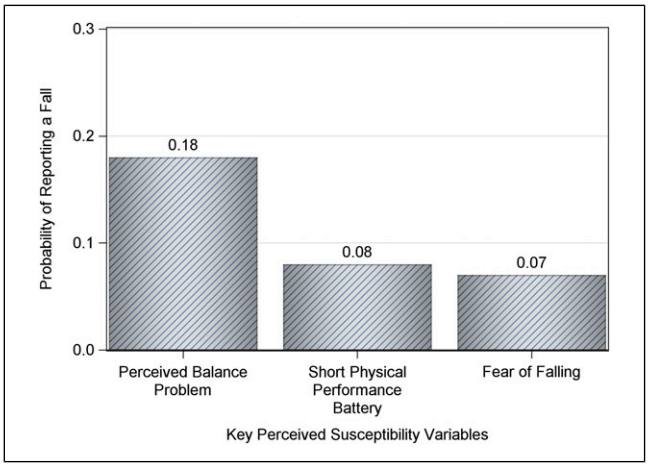

Figure 2. Model Estimated probabilities. The model estimated probabilities for self-reported falls were obtained separately for participants who (1) reported a balance problem, (2) had a score for SPPB that was 1 SD above the mean, and (3) reported fear of falling, with all other variables held constant at their mean value when a given probability was computed.

a balance problem have FOF (Dolan et al., 2022). Thus, assessing for FOF does not capture the older adults who are not fearful of falling but have a perceived balance problem. As supported by our findings, assessing for balance problems in addition to FOF may increase the identification of fall risk among older adults.

Consistent with findings in previous studies, we found that Black non-Hispanic participants had fewer self-reported falls than White non-Hispanic participants (Garbin & Fisher, 2023; Santos-Lozada, 2023). Ethnic and racial differences in falls among older adults have been established in the literature (Moreland et al., 2020; Wehner-Hewson et al., 2022), yet the reasons for these differences are unexplored. Limited evidence suggests that there may be differences in cultural beliefs and behaviors influencing fall prevention behavior (Horne et al., 2008; Horton & Dickinson, 2011), and these underlying cultural beliefs and behaviors need further investigation. Higher levels of depression and anxiety symptoms were associated with self-reported falls in this sample, as well as self-reported pain, which previous research has indicated (Deandrea et al., 2010; Hallford et al., 2017). Medications to treat depression, anxiety, and pain increase older adults' risk for falls (Ming & Zecevic, 2018; Stubbs et al., 2014). As such, assessing and treating older adults for depression, anxiety, and pain are important components of fall prevention interventions (Choi et al., 2019; Stubbs et al., 2014).

The HBM and the concept of perceived susceptibility provided the theoretical frame for this study (Rosenstock, 1974). While the HBM and the concept of perceived susceptibility's predictive ability has been inconsistent for long-term behavior change (Carpenter, 2010), the framework was selected due to its subjective focus. Older adults' perceived susceptibility to accidental falls is an often-overlooked aspect in fall prevention research, yet highly important, since identification of fall risk among community-dwelling older adults rely mainly on older adults' self-report of falls (Hoffman et al., 2018). The findings of this study highlight that older adults' subjective experience of their own balance may be an important indicator of fall risk among older adults. Thus, assessing older adults' perceived balance problems may be important in identification of fall risk and enrollment into fall prevention interventions. Moreover, our findings suggest that older adults' perceptions and experiences of their own health status, depression, anxiety, and pain, as well as their race and ethnicity, are associated with self-reported falls. These are all individual subjective aspects of fall prevention research that need further investigation.

Limitations

Some factors associated with fall risk in older adults are not included in the NHATS dataset, such as polypharmacy (Deandrea et al., 2010). However, participants' comorbidities may indirectly indicate potential polypharmacy, in that participants with more comorbidities may use more medications. The limitation of cross-sectional designs is that causality cannot be determined. As such, this study alone cannot determine if perceived balance issues predict future falls, although our findings are consistent with Landers et al. (2016), who reported that balance confidence predicted falls. Further investigation into this issue, with particularly at-risk populations, is needed. Self-report data is prone to recall bias and older adults are known to underreport accidental falls (Hoffman et al., 2018). Lastly, measures of perceived balance and FOF were single-item questions, which may not capture all relevant aspects of these variables.

Conclusion

This study explored the relationship between self-reported falls in the last month and socio-demographic, health factor, and perceived susceptibility variables in a large sample of community-dwelling older adults in the NHATS. After controlling for other fall-related variables, perceived balance problems were significantly associated with self-reported falls in the last month, and the SPPB and FOF were not. Exploring balance problems among older adults in primary care may increase their self-report of accidental falls, improve identification of fall risk among older adults, and foster enrollment in fall prevention interventions.

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Data used in this study can be accessed through https://nhats.org/.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical Statement

Ethical Approval

The NHATS was approved by the Institutional Review Board (IRB) at Johns Hopkins University, and all participants provided informed consent. IRB approval for this analysis (IRB ID STUDY00017753) was obtained from Arizona State University.

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Data Availability Statement

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