

Fear of Falling in Elderly Persons: Association With Falls, Functional Ability, and Quality of Life

Fuzhong Li,¹ K. John Fisher,¹ Peter Harmer,² Edward McAuley,³ and Nicole L. Wilson¹

¹Oregon Research Institute, Eugene, Oregon.

²Department of Exercise Science, Willamette University, Salem, Oregon.

³Department of Kinesiology, University of Illinois at Urbana-Champaign.

This study examined heterogeneity in response patterns of the participants of the Survey of Activities and Fear of Falling in the Elderly (SAFFE) and their relationships to falls, functional ability, quality of life, and activity restriction measures in a cohort of 256 older people (mean age = 77.5 years). Participants recruited from local primary care clinics were administered the SAFFE instrument, an activity restriction measure, a combination of self-reported and performance-based functional ability tests, and quality-of-life measures. Latent class analyses identified two classes: Class 1 ($n = 209$), which had a low SAFFE fear of falling, and Class 2 ($n = 47$), which had a high SAFFE fear of falling. Subsequent analyses of variance indicated that the two-class (low fear and high fear) SAFFE fear of falling profiles discriminated fallers from nonfallers, and low and high levels of functional ability, activity restriction, and quality of life. The findings from this study suggest that variations in the SAFFE response patterns on a single dimension of fear of falling and that high levels of fear of falling measured by the SAFFE are linked to a range of adverse health consequences.

FALLS are among the most common and serious health problems facing elderly persons (American Geriatrics Society [AGS], British Geriatrics Society, & American Academy of Orthopedic Surgeons, 2001; Howland, Peterson, & Lachman, 2001; Sattin, 1992; Stevens et al., 1999). From a public health perspective, there is increasing awareness of the impact of falls and fall-related injury morbidity in terms of rising health care costs and reductions in the quality of life for elderly people (AGS, 2001; Howland et al., 2001; Tinetti, 1994, 2003; Tinetti, Doucette, Claus, & Marottoli, 1995; Tinetti & Williams, 1997). A concomitant psychological symptom of falls is the fear of falling, which is common among older adults whether or not they have sustained a fall (Chandler, Duncan, Sanders, & Studenski, 1996; Lawrence et al., 1998; Myers et al., 1996; Tinetti, Speechley, & Ginter, 1988). A key public health concern is that fear of falling can result in self-induced restrictions in activity that could lead to muscle and lower-extremity strength depletion, thus restricting mobility and consequently reducing physical functioning (Arfken, Lach, Birge, & Miller, 1994; Bruce, Devine, & Prince, 2002; Chandler et al., 1996; Howland et al., 2001; Lachman et al., 1998; Maki, Holliday, & Topper, 1991; Tinetti, 1995; Vellas, Wayne, Romero, Baumgartner, & Garry, 1997).

Of particular interest in the current study are issues surrounding measures that assess fear of falling and capture heterogeneity corresponding to qualitatively different response patterns to the fear of falling. Much of the extant research on fear of falling has relied on either a direct (single-item) measure of fear of falling or fall-related efficacy measures based on a social cognitive model of self-efficacy (Lachman et al., 1998; Legters, 2002). However, limitations of these measurement approaches have been noted. Lachman and colleagues (1998) noted that the widely used direct, single-item operationalization of fear of falling may underestimate fear of falling incidence

and is unable to detect possible variations in levels of fear across a variety of situations (Howland et al., 1993). Similarly, fall-related self-efficacy measures (Powell & Myers, 1995; Tinetti, Richman, & Powell, 1990) tend to be limited by the scope of mobility tasks or physical activities assessed. An additional conceptual limitation is that measures of fall-related self-efficacy are based on self-efficacy theory (Bandura, 1986), which defines the degree of confidence in performing activities *without falling* rather than the actual fear of falling (Mendes de Leon, Seeman, Baker, Richardson, & Tinetti, 1996). In their effort to distinguish between the constructs of fall-related self-efficacy and fear of falling, Li and colleagues (2002) tested the hypothesis that fall-related self-efficacy acts as a mediator between fear of falling and functional ability with respect to balance and physical functioning. The results supported their hypothesis that fall-related self-efficacy mediated the effects of fear of falling on functional outcomes and, moreover, suggested that fear of falling and fall-related self-efficacy are related but not isomorphic constructs.

Several authors have taken additional steps to modify or extend current measures of fear of falling by including broader activities involving activities of daily living (ADLs) and instrumental ADLs (IADLs), as well as social and exercise activities (Lachman et al., 1998; Lusardi & Smith, 1997; Velozo & Peterson, 2001). In this study, we focus on the Survey of Activities and Fear of Falling in the Elderly (SAFFE) measure developed by Lachman and colleagues (1998). A unique feature that differentiates SAFFE from contemporary fear-of-falling measures is the premise that there are negative consequences to the fear of falling (i.e., restricting important activities or reducing quality of life) that should be considered in the assessment of fear of falling. By using a sample drawn from public housing facilities, Lachman and colleagues provided initial evidence of concurrent and criterion validity of the

Table 1. Descriptive Statistics on the Sample Characteristics ($N = 256$)

Characteristic	Value
Age (mean)	77.48 \pm 5
Women (%)	70
White (%)	90
Marital status (% married)	49
High school graduate or higher (%)	92
Household income (%)	
Under \$4,999	11
\$5,000–14,999	29
\$15,000–29,999	24
\$30,000–70,000 and over	36
Perceptions of health (mean)	3.24 \pm 0.8
Living alone (%)	48
Use of walking aids (% yes)	20
Fear of falling (% yes)	38
Arthritis (%)	54
Osteoporosis (%)	20
Use of health care in the past 3 months	
Visit to health care provider (%)	79
Nights stayed in a hospital overnight (%)	7
Seek alternative or complementary treatment (%)	90
Leisure activities over the past 7 days	
Sitting activities, 5–7 days a week (%)	82
Walking activities, 5–7 days a week (%)	8
Light exercise or recreational activities, 5–7 days a week (%)	0.4

SAFFE by examining SAFFE scores in relation to quality-of-life variables.

Instead of taking a variable-centered approach in which the focus is on relationships among variables, this study extends the work of Lachman and colleagues (1998) by considering a person-centered approach, identifying distinct subgroups of individuals responding differentially to SAFFE fear-of-falling scores, and relating these subgroups to a set of important correlates of fear of falling. The study had two specific objectives. The first objective was to determine heterogeneity of the underlying SAFFE response patterns by identifying homogeneous subgroups within the sample population. This was accomplished by identifying heterogeneous groups of individuals who had various levels of susceptibility (i.e., were prone) to fear of falling on the SAFFE items. The second objective was to profile the characteristics of the resulting group membership and relate their SAFFE fear-of-falling status to a range of important correlates involving history of falls, functional ability (operationalized by balance, mobility, and IADL measures), quality-of-life indicators (operationalized by SF-12 mental and physical health scores), and activity restriction.

METHODS

Participants

Participants were recruited through local primary care clinics in Portland, Oregon, to participate in a physical activity program. Eligibility criteria for the study were as follows: Participants had to (a) be 70 years of age or older; (b) not be participating in a regular program of physical activity (i.e., not involved in any moderate or strenuous activity lasting ≥ 20 min

per session in the previous 3 months); (c) have the ability to ambulate with minimal use of an assistive device; (d) have no progressive or debilitating conditions (metastatic cancer, major stroke, or crippling arthritis) that would limit participation in moderate-intensity exercise; and (e) have no cognitive impairment as measured by the Pfeiffer Mental Status Questionnaire (Pfeiffer, 1975).

Recruitment occurred through the use of a patient database available within a local health system. An initial pool of 2,308 individuals from the patient database was contacted. Of those, 669 people met the initial age eligibility criteria and were screened. Two hundred fifty-six individuals were found to be eligible by the study criteria, just listed in (a) through (e), and were enrolled in the study. The primary reasons for exclusion from the study were (a) poor health, (b) ineligibility, (c) refusal, (d) language barriers, (e) transportation problems, (f) lack of interest, (g) unable to make a commitment, and (h) other unknown reasons.

Participants ($N = 256$) in this study were older ($M = 77.5$ years, $SD = 5.0$, and range 70–92 years) male ($n = 77$) and female ($n = 179$) community dwellers. Characteristics of the study sample are shown in Table 1. Participants were primarily White (90%), 49% were currently married, and about half of the participants reported living alone (48%). The majority had at least a high school education (92%), and 40% reported an annual income below \$15,000. On a self-rated health status measure using a 5-point scale (poor = 1, fair = 2, good = 3, very good = 4, and excellent = 5), 84% rated their health as good or better ($M = 3.24$; $SD = .78$). From a possible nine common medical conditions (i.e., diabetes, osteoporosis, depression, chronic back pain, cancer, arthritis, heart disease, high blood pressure, and chronic lung disease), the sample had a mean of 2.4 ($SD = 1.4$) conditions. Fifty study participants reported using a walking aid, such as a cane or walker. Of these 50 participants, 86% were nonfrequent users, and the 14% who were frequent users were not dependent on walking aids to ambulate. Approximately 30% of the participants had hearing impairment in both ears, and their visual acuity was of an average range, that is, 20/9 to 20/800 in both eyes. With respect to falls information, 36% of the participants ($n = 92$) in the study reported one or more falls in the 3 months prior to entering the study, and 38% of the participants reported a substantial fear of falling on a 2-point scale (1 = very afraid; 0 = not very afraid).

Procedures

Participants received a letter signed by their primary care physician encouraging participation in a physical activity trial. Two weeks after the physician letters were mailed, research staff made an initial phone contact with potential subjects to establish their interest in participating and their appropriateness for the study. Those who met the eligibility criteria and agreed to participate were scheduled for an assessment. After informed consent was obtained, trained research assistants administered baseline assessments, which included a battery of demographic, medical history, physical health, falls and fear of falling, and physical function measures. The Oregon Research Institute Institutional Review Board approved the research protocol.

Measures

Demographic.—Demographic information included age, gender, marital status, education, race or ethnicity, income,

medical conditions, current medications (including prescription and nonprescription medication), and use of alternative medical services (e.g., visits to acupuncturist, massage therapist, or naturopath).

Fear of falling.—The SAFFE (Lachman et al., 1998) was used to assess fear of falling. The SAFFE contains 11 activities representing ADLs and IADLs (e.g., taking a tub bath or shower), mobility (e.g., walking for exercise), and social activities (e.g., visiting friends or relatives). For each activity, several questions are asked: (a) “Do you currently do it?”; (b) “If you do the activity, when you do it how worried are you that you might fall?”; (c) “If you do not do the activity, do you not do it because you are worried?”; (d) “If you do not do the activity because of worry, are there also other reasons that you do not do it?”; and (e) “If you are not worried, what are the reasons that you do not do it?” The SAFFE contains two indicators: (a) fear of falling and (b) levels of activity. A total SAFFE fear-of-falling score was generated based on a 5-point Likert (0–4) item response format, with higher scores indicating a greater fear of falling. The internal consistency (α coefficient) for this measure was .70.

Activity level.—The activity level score was computed by counting the number of activities the individuals performed out of the 11 activities included in the SAFFE.

Falls.—Participants were asked about their number of falls in the past 3 months. Falls were defined as landing on the ground or floor, or falling and hitting an object such as a stair or a piece of furniture by accident. Participants were classified as fallers (coded as 1) or nonfallers (coded as 0).

Functional ability.—Functional ability was measured by using a number of assessments, including balance, lower extremity functional mobility, and IADLs.

Three balance-based measures were used to assess balance: the Berg Balance Scale (BBS; Berg, Wood-Dauphinee, Williams, & Maki, 1992), the Dynamic Gait Index (DGI; Shumway-Cook & Wollacott, 1995), and the Functional Reach (FR) test (Duncan, Weiner, Chandler, & Studenski, 1990). The BBS test consists of 14 items that individuals would normally perform in their daily routines. Trained research assistants observed each participant’s performance and rated it on a scale from 0 to 4 (0 = maximum support to perform the task; 4 = safe and independent performance). Total scores for all 14 items ranged from 0 to 56, with higher scores indicating better balance. The internal consistency for this measure was .74.

The DGI evaluates an individual’s ability to modify gait in response to changing task demands. Subjects were evaluated on their walk performance on a 4-point scale from 0 (severe impairment) to 3 (normal) on eight different gait tasks: on even surfaces, changing speeds, with head turns in a vertical or horizontal direction, while stepping over or around obstacles, and with pivot turns and steps. Scores on the DGI range from 0 to 24, with higher scores indicating better balance. The internal consistency for this measure was satisfactory at $\alpha = .65$ (Nunnally, 1978).

The FR test assesses the maximal distance an individual can reach forward beyond arm’s length while maintaining a fixed

base of support in the standing position (Duncan et al., 1990). It correlates well with established force platform measures of dynamic balance and has been shown to predict falls in community-dwelling male veterans ≥ 70 years of age (Tinetti et al., 1988). The test uses the “yardstick method” described by Duncan and colleagues (1990) to measure functional reach. The average of three trials was used, with higher values indicating better balance.

Two performance-based tests were used to assess lower extremity functional mobility: 50-ft (or approximately 15.2 m) walk (Reuben & Siu, 1990) and Up & Go (Podsiadlo & Richardson, 1991). The 50-ft walk speed was defined as the time required to walk a 50-ft course as fast as possible. The timed Up & Go measures the time taken, in seconds, for an individual to stand up from a standard armchair, walk a distance of 3 m, turn, walk back to the chair, and sit down again.

The IADLs were assessed by using an adaptation of Lawton and Brody’s (1991) IADL scale, which is designed to measure basic self-care activities, including the following functions: (a) bathing, (b) dressing, (c) eating, (d) going to the toilet, and (e) walking. Participants were asked to rate the extent to which they could successfully perform 20 basic ADLs on a 7-point Likert scale (1 = cannot do, 4 = can do with moderate difficulty, and 7 = can do easily). The items were averaged, with higher scores indicating better physical functioning. Internal consistency for this measure was high at .84.

Quality of life.—Quality of life was operationalized by use of the SF-12 scale (Ware, Kosinski, & Keller, 1995). SF-12 items reflect what respondents are able to do functionally, how they feel, and how they evaluate their health status. Two scores, referred to as the mental and physical health summary scores, were calculated. With the use of the SF-12 scoring procedure, each subscale was transformed into 0–100, in which higher scores indicate better mental and physical health. The internal consistency for this measure was high at $\alpha = .88$.

Statistical Analyses

Descriptive statistics for the SAFFE fear-of-falling scale of the sample were computed. These include the percentage of participants reporting activities in each of the 11 SAFFE items, the mean fear score, and its corresponding standard deviations. Latent class analysis (LCA; Clogg, 1995; McCutcheon, 1987) was conducted next to determine whether homogeneous subgroups of fear of falling could be identified from responses to the SAFFE within the sample population. LCA is a statistical technique generally used to segregate groups of individuals from empirical data into mutually exclusive classes based on their patterns of response to categorical items. This statistical procedure was chosen because the focus of the study was on relationships among individuals—a person-centered approach—where the SAFFE data were expected to be inclusive of heterogeneous groups of individuals who had various levels of susceptibility to the SAFFE fear of falling. In the context of this study, the unobserved (latent) classes (groups) of individuals in the sample were referred to as SAFFE fear-of-falling latent classes, with each class having a distinctive “profile” of SAFFE item endorsement probabilities that was constant for all members of that particular class.

Table 2. Frequencies of Activities and Mean SAFFE Fear of Falling Scores ($N = 256$)

Activity	Those Who Do Activity (%)	Fear of Falling Score	
		<i>M</i>	<i>SD</i>
Go to the store	95	1.21	1.46
Prepare simple meals	93	1.63	1.48
Take a tub bath	35	1.70	1.43
Get out of bed	100	1.29	1.46
Take a walk for exercise	64	1.90	1.38
Go out when it is slippery	57	2.14	1.19
Visit a friend or relative	94	1.17	1.43
Reach for something over your head	96	1.83	1.46
Go to a place with crowds	87	1.40	1.47
Walk several blocks outside	77	1.64	1.46
Bend down to get something	98	1.65	1.45

Note: SAFFE = Survey of Activities and Fear of Falling in the Elderly.

When the LCA was conducted, the 11 SAFFE fear-of-falling 4-point scale items were first converted into a set of dichotomous fear-of-falling items, with 1 being “worried” and 0 being “not worried at all.” The SAFFE data were then subjected to the LCA to identify potential classes of fear of falling based on the endorsement patterns of SAFFE scores. In this analysis, individuals were assigned to the “most likely” class (i.e., the class for which the conditional probability of membership in this class was greatest). The output of the LCA provided estimates of the probabilities of class membership and SAFFE fear-of-falling item endorsement probabilities for each individual, which allowed us to create profiles (i.e., endorsement profiles) of group members.

Following LCA, the probability of class membership (hereafter referred to as SAFFE class status) was related to a set of variables on falls, functional ability, quality of life, and levels of activity. The extent to which fallers and nonfallers differed on the SAFFE fear-of-falling class status was examined through an analysis of variance (ANOVA). Fall status was defined by number of falls in the past 3 months. This was followed by logistic regression analyses that predicted fall status by the SAFFE fear-of-falling class status, using age, gender, living situation, medical conditions, perceptions of health, and use of a walking aid as covariates in the logistic model. Next, a set of analyses examined the SAFFE class status in relation to functional ability, IADLs, quality of life, and activity level, using a one-way (between-subjects) multivariate analysis of variance (MANOVA). In these analyses, dependent variables were measures of balance, lower extremity functional mobility, quality of life, and activity level.

The SPSS statistical package (SPSS, 1990) was used to perform most of the analyses, and *Mplus* (Muthén & Muthén, 1998) was used for the LCA. All statistical tests were two sided. The effect size (d) was calculated and reported.

RESULTS

Descriptive Data on SAFFE Fear of Falling

The frequency data for each of the 11 activities in the SAFFE instrument are displayed in Table 2. Eleven percent of the participants reported engaging in all activities assessed by the SAFFE. Seventy-five percent of participants engaged in 7 of

Table 3. LCA for SAFFE Fear-of-Falling Scale Items

Activity	LCA Solution: Categorical Factors	
	Class 1	Class 2
Go to the store	0.286	0.823
Prepare simple meals	0.545	0.518
Take a tub bath	0.265	0.871
Get out of bed	0.377	0.695
Take a walk for exercise	0.421	0.853
Go out when it is slippery	0.799	1.000
Visit a friend or relative	0.281	0.787
Reach for something over your head	0.638	0.653
Go to a place with crowds	0.373	0.655
Walk several blocks outside	0.413	0.787
Bend down to get something	0.512	0.820

Notes: The entries in the table are the probabilities of participants in a class endorsing an item (i.e., reporting yes). Probabilities are in boldface for items that differentiate the classes. LCA = latent class analysis; SAFFE = Survey of Activities and Fear of Falling in the Elderly; Class 1 = low fear, $n = 209$; Class 2 = high fear, $n = 47$.

the activities: go to the store, prepare a simple meal, get out of bed, visit a friend or relative, reach for something over the head, go to a place with crowds, and bend down to get something, with the higher scores indicating greater fear. Table 2 shows that the extent of fear of falling varied across SAFFE activities, with the greatest amount of fear being associated with “go out when it is slippery,” “take a walk for exercise,” and “reach for something over your head.”

Table 3 presents results from the LCA of the 11 dichotomous SAFFE fear-of-falling items. Class 1 (low fear) is the most prevalent class, containing 82% of the participants. Participants in Class 1 reported few fear-of-falling symptoms, except for the two items “go out when it is slippery” and “reach for something over your head.” Class 2 (high fear), containing 18% of the study participants, in contrast to Class 1, endorsed almost all items, with much higher probabilities, ranging from .52 to 1.00, suggesting that the participants in this class are most likely to report high fear in the SAFFE items. Figure 1 presents the SAFFE fear-of-falling profile for each class.

The two classes were differentiated by most SAFFE items, with the exception of (a) prepare simple meals, (b) go out when slippery, and (c) reach over head. The analysis does not appear to indicate multiple dimensions of fear of falling; instead, the two-class solution suggests a single dimension of fear of falling in the sample, with the two classes representing increasing levels of fear corresponding to the two different class profiles of high fear (Class 2) and low fear (Class 1). Because Class 2 had higher probabilities compared with Class 1, we considered Class 2 as being the “high fear” group relative to Class 1 (“low fear”).

The ANOVA showed a significant difference in SAFFE mean scores between the high-fear group and low-fear group, that is, $F(1,254) = 85.06$ and $p < .001$; the high-fear group ($M = 2.15$) had a significantly higher mean SAFFE score compared with the low-fear group ($M = 1.44$). A cross-tabulation analysis showed that 64% of participants in Class 2 reported one fall or more, compared with 30% of participants in Class 1.

SAFFE Fear of Falling in Relation to Fall Status

The ANOVA indicated that fallers had a significantly higher mean SAFFE score ($M = 1.61$) compared with the nonfallers

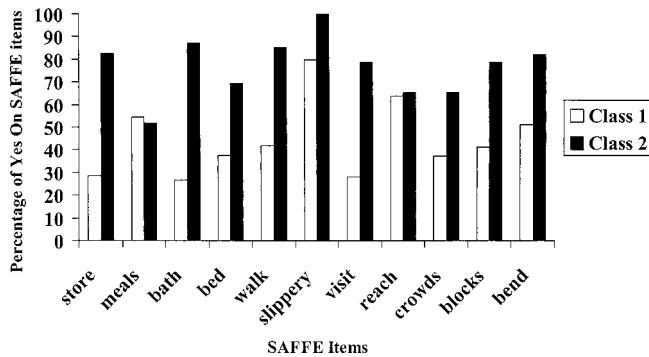


Figure 1. Class profile on the fear of falling by Survey of Activities and Fear of Falling in the Elderly (SAFFE) participants.

($M = 1.32$), that is, $F(1,254) = 21.51$ and $p < .001$. The logistic regression analysis showed that the fear-of-falling status was significantly associated with fall status, that is, β (regression weight) = 1.36 and $p < .001$, after all covariates were controlled for (Table 4). Furthermore, there was a significant Fall \times SAFFE Status interaction, that is, $F(1,254) = 10.85$ and $p < .001$, indicating that the largest difference between fallers and nonfallers on the SAFFE scores was found in the high-fear-of-falling group.

SAFFE Fear of Falling Status in Relation to Functional Ability and Quality-of-Life Measures

The MANOVA procedure revealed a significant effect, that is, Wilks's lambda = .895, $F(6,249)$, and $p < .001$, indicating that a significant difference existed between the high-fear and low-fear groups on the balance, lower-extremity functional mobility, IADLs, and quality-of-life measures. Follow-up univariate ANOVAs revealed that the high-fear group had significantly poorer scores on measures of BBT, DGI, FR test, 50-ft walk, Up & Go, IADLs, and SF-12 mental health and physical health scores. Table 5 shows the summary of mean scores and standard deviations for each of the eight outcome variables by fear of fall status.

Relationship Between SAFFE Fear of Falling and Activity Level

The correlation between the SAFFE fear of falling and activity restriction was negative ($r = -.20$) and statistically significant ($p < .001$), indicating that individuals with higher fear scores engaged in fewer activities. Further ANOVAs showed a significant group difference in activity restriction between the high-fear and low-fear groups, that is, $F(1,254) = 5.26$ and $p < .02$, showing that participants in the high-fear group had a significantly lower activity level ($M = 8.40$) compared with those in the low-fear group ($M = 8.96$).

DISCUSSION

This study attempted to delineate response patterns in the SAFFE fear-of-falling scale items in a sample of adults aged 70 years and older, and it examined the levels of the SAFFE in relation to fall status, functional ability, quality of life, and activity restriction. Through LCA, it was found that the sample in the study could be categorized into two distinct groups with

Table 4. Prediction of Fall Status by SAFFE Fear-of-Falling Status: Logistic Regression Analyses

Measure	Adjusted OR	95% CI	p
High fear of falling	3.88	3.19–4.57	.000
Age	1.01	0.952–1.06	.785
Gender	1.026	0.38–1.67	.484
Living situations	0.89	0.69–1.09	.261
Medical conditions	1.01	0.80–1.22	.962
Perceptions of health	1.32	0.93–1.71	.151
Use of walking aid	0.40	0.31–1.10	.011

Notes: SAFFE = Survey of Activities and Fear of Falling in the Elderly; OR = odds ratio; CI = confidence interval.

respect to the levels of the SAFFE measure. The two classes identified corresponded to different class profiles of high fear and low fear, indicating the presence of heterogeneous groups of individuals in the sample who were highly susceptible (i.e., were prone) to certain aspects (activities) of fear of falling contained in the SAFFE, or who were susceptible at a lower level.

The results further indicate that the SAFFE fear-of-falling status identified through the LCA was able to distinguish between fallers and nonfallers, with fallers reporting higher levels of fear. Additional analyses from the logistic regression model showed that, when related background variables were controlled for, high-fear individuals were almost four times more likely to report a fall event in the past 3 months compared with low-fear individuals. Thus, consistent with the literature (Howland et al., 1993, 1998), fear of falling, based on the response patterns in the SAFFE scores, appears to be closely related to falls, with high levels of fear associated with a high likelihood of fall history.

ANOVAs indicated that high-fear individuals tended to perform poorly on balance and lower-extremity functional mobility tasks and to have low IADL capacity and quality of life. This indicates that individuals with high levels of fear of falling are most likely to experience functional ability problems and poor quality of life. Although the results support the findings from other fear-of-falling studies (e.g., Cumming, Salkeld, Thomas, & Szonyi, 2000; Lachman et al., 1998; Tinetti, Mendes de Leon, Doucette, & Baker, 1994), they also provide support for the criterion validity of the SAFFE fear-of-falling scale. From a practical point of view, it suggests that the SAFFE may be used to classify individual fear-of-falling status and to examine linkages between varying levels of fear of falling and their associated adverse health outcomes among elderly people.

The findings also indicate that high-fear individuals engaged in fewer activities. That is, those who were classified as high-fear individuals were less likely to be involved in activities (e.g., ADLs or IADLs, mobility, and social activities) contained in the SAFFE scale. These results are consistent with those reported elsewhere (Lachman et al., 1998; McAuley, Mihalko, & Rosengren, 1997; Murphy, Williams, & Gill, 2002; Vellas et al., 1987), suggesting that fear of falling imposes constraints on daily activity tasks and social functions in elderly people, which in turn may lead to further declines in physical and mental health (Howland et al., 2001).

Given that fall-related self-efficacy has been a major premise for much of the work on fear of falling, the use of the SAFFE, operating under a different premise than other contemporary fear-of-falling measures, is likely to add a more comprehensive

Table 5. Mean Scores and Standard Deviations for the Dependent Outcome Variables by SAFFE Fear-of-Falling Status

Variable	Fear of Falling		MANOVA $F(1,254)$	p	Effect Size (d)
	Low Fear ($n = 209$)	High Fear ($n = 47$)			
Balance					
Berg Balance Scale	49.40 (4.24)	46.87 (3.67)	14.28	.001	1.24
Dynamic Gait Index	19.84 (2.70)	18.43 (2.43)	10.95	.001	0.87
Functional Reach test	9.28 (2.65)	8.46 (2.41)	3.83	.05	0.51
Lower-extremity functional mobility					
50-ft speed walk	14.12 (3.46)	15.21 (3.42)	3.79	.05	0.59
Up & Go	9.07 (2.32)	9.84 (2.71)	3.92	.05	0.50
Instrumental activities of daily living	5.28 (0.712)	4.75 (0.654)	21.64	.001	0.63
Quality of life					
Mental health	60.38 (20.52)	48.27 (18.42)	13.84	.001	2.70
Physical health	51.90 (19.43)	42.68 (17.58)	8.94	.003	2.11

Notes: Values in parentheses are standard deviations. SAFFE = Survey of Activities and Fear of Falling in the Elderly; MANOVA = multivariate analysis of variance.

understanding to the fear-of-falling phenomenon and its negative health impacts among elderly people. In particular, the consideration of variation in a fear-of-falling measure is a unique aspect of this study. This approach may represent a useful framework in identifying various clinical subgroups related to fear of falling in future studies.

The findings in this study also extend those reported by Lachman and colleagues (1998) and are likely to make important contributions to the extant literature in at least four respects. First, although both the study by Lachman and colleagues and this study showed that fear of falling varied as a function of the fear status, the two studies operationalized fear status quite differently. The study by Lachman and colleagues used scale items (Howland et al., 1993) that were not part of the SAFFE scores in their formation of the fear-activity restriction status variable, whereas this study defined fear of falling by using information directly derived from the SAFFE. The latter was accomplished through LCA. It sorted individuals into clusters who were homogeneous with respect to the SAFFE items responses and therefore provided identification of (unobserved) group membership (i.e., low-fear, high-fear groups) that was directly inferred from the SAFFE fear-of-falling measure. The LCA approach of delineating varying response patterns is important in a practical sense in that it allows SAFFE to be used as a tool to (a) identify various clinical subgroups and (b) develop and tailor appropriate interventions targeted to at-risk subgroups.

Second, the results show that, with the exception of the item “prepare simple meals,” the probabilities of SAFFE items increased from Class 1, or low fear, to Class 2, or high fear (see Figure 1), representing increasing levels of severity on this dimension from low to high. The findings suggest that fear of falling operationalized by the SAFFE is unidimensional. This outcome is interesting because even though the SAFFE includes a broad range of social and physical activities, it continues to provide a general measure of fear of falling. Given that the causes of fear of falling are considered multifactorial (Legters, 2002), with physical, psychological, environmental, and functional influences included, further development of an instrument that fully reflects a comprehensive view of fear of falling may be warranted.

Third, by relating the SAFFE (low-fear, high-fear) fear-of-falling status (identified through LCA) to falls status,

predictions about falls can be made more precisely. In the case of the high-fear group, the study was able to classify 64% as fallers compared with 30% in the low-fear group. Additional evidence came from our logistic model, which had a sensitivity of 78% (70 of the 92 fallers were correctly classified). These findings provide evidence for the sensitivity of the SAFFE in discriminating between fallers and nonfallers.

Finally, understanding the meaning of high and low SAFFE scores is greatly enhanced by the ability to relate these scores to relevant and meaningful outcomes. In this respect, the study incorporated both performance-based and subjective assessments of functional ability and quality of life. The ANOVA provided a link between the SAFFE fear-of-falling status and multiple health outcomes, which enabled us to come to more precise conclusions about which groups of individuals are more likely to be prone to poor physical and mental health problems as a result of their concern about falling.

Study Limitations

The results of our study should be interpreted in the context of several limitations. First, the analyses on fear of falling and its relation to health, functional ability, and quality of life were based on cross-sectional data. Therefore, inferences about causal relationships among these variables cannot be drawn.

It is also important to consider other possible directional effects in the data presented. For example, it is plausible that declines in health status, functional ability, and quality of life could affect older adults' sense of their own abilities, which in turn could lead to fear of falling. Longitudinal analysis of the relationships examined in this study would improve the confidence with which one could make causal inferences. Second, a substantial proportion of screened individuals (62%) did not meet the entry criteria or were not recruited. Thus, the results of the study should be considered in the context of the specific eligibility criteria set by the study. Third, participants in this study were recruited to participate in an exercise intervention. Therefore, this sample may tend to be selective in relation to fear of falling (i.e., less fearful) than the general population of primary care patients. Fourth, although they were primarily clinical referrals to a physical activity study, participants in this sample were demographically comparable with those of Lachman and colleagues (1998). Future studies

on fear of falling using the SAFFE should attempt to capture more diverse, vulnerable samples of older adult populations in the broader community. Other limitations of the study include the fact that the sample was primarily White and well educated, possibly limiting the generalizability of the results for more ethnically diverse elderly populations.

In conclusion, the overall findings of this study provide additional support for the use of SAFFE as a fear-of-falling measure. More important, findings from this study suggest that variation in response patterns from the SAFFE may help to identify individuals with different levels of fear of falling, thus providing vital information for the design of tailored intervention programs to prevent or reduce falls and fear of falling. In addition, the finding that fear of falling operated as a single dimension points to the need for considering the multidimensional nature of this common and serious health problem among older adults. Finally, the link between SAFFE and its relation to functional ability, quality of life, and activity restriction further reinforces the idea that fear of falling can lead to a range of adverse health consequences for older adults. As a fear-of-falling measure, the SAFFE may provide researchers and practitioners with a useful tool with which to intervene, with appropriate remediation strategies to reduce fall-related morbidity.

ACKNOWLEDGMENTS

Preparation of this manuscript was supported by Grant AG18394, and in part by Grants AG17053, AG17510, and AG105302, from the National Institute on Aging, and by Grant MH62327, from the National Institute of Mental Health. We thank Karen Hooker and three anonymous reviewers and for their useful comments on earlier versions of the article.

Address correspondence to Fuzhong Li, PhD, Oregon Research Institute, 1715 Franklin Boulevard, Eugene, OR 97403. E-mail: fuzhongli@ori.org

REFERENCES

- American Geriatrics Society, British Geriatrics Society, & American Academy of Orthopaedic Surgeons Panel on Falls Prevention. (2001). Guideline for the prevention of falls in older persons. *Journal of the American Geriatrics Society*, 49, 664–672.
- Arfken, C. L., Lach, H. W., Birge, S. J., & Miller, J. P. (1994). The prevalence and correlates of fear of falling in elderly persons living in the community. *American Journal of Public Health*, 84, 565–570.
- Bandura, A. (1986). Self-efficacy mechanism in human agency. *American Psychologist*, 37, 122–147.
- Berg, K. O., Wood-Dauphinee, S. L., Williams, J. I., & Maki, B. (1992). Measuring balance in the elderly: Validation of an instrument. *Canadian Journal of Public Health*, 83, S7–S11.
- Bruce, D. G., Devine, A., & Prince, R. L. (2002). Recreational physical activity levels in healthy older women: The importance of fear of falling. *Journal of the American Geriatrics Society*, 50, 84–89.
- Chandler, J. M., Duncan, P. W., Sanders, L., & Studenski, S. (1996). The fear of falling syndrome: Relationship to falls, physical performance, and activities of daily living in frail older persons. *Topics in Geriatric Rehabilitation*, 11, 55–63.
- Clogg, C. C. (1995). Latent class models. In G. Arminger & C. C. Clogg (Eds.), *Handbook of statistical modeling for the social and behavioral sciences* (pp. 311–359). New York: Plenum Press.
- Cumming, R. G., Salkeld, G., Thomas, M., & Szonyi, G. (2000). Prospective study of the impact of fear of falling on activities of daily living, SF-36 scores, and nursing home admission. *Journal of Gerontology: Medical Sciences*, 55A, M299–M305.
- Duncan, P. W., Weiner, D. K., Chandler, J., & Studenski, S. A. (1990). Functional reach: A new clinical measure of balance? *Journal of Gerontology: Medical Sciences*, 45, M192–M197.
- Howland, J., Lachman, M. E., Peterson, E. W., Cote, J., Kasten, L., & Jette, A. (1998). Covariates of fear of falling and associated activity curtailment. *The Gerontologist*, 38, 549–555.
- Howland, J., Peterson, E. W., & Lachman, M. E. (2001). Falls among elderly persons. In S. E. Levkoff, Y. K. Chee, & S. Noguchi (Eds.), *Aging in good health: Multidisciplinary perspectives* (pp. 221–245). New York: Springer.
- Howland, J., Peterson, E. W., Levin, W. C., Fried, L., Pordon, D., & Bak, S. (1993). Fear of falling among the community-dwelling elderly. *Journal of Aging and Health*, 5, 229–243.
- Lachman, M. E., Howland, J., Tennstedt, S., Jette, A., Assmann, S., & Peterson, E. W. (1998). Fear of falling and activity restriction: The Survey of Activities and Fear of Falling in the Elderly (SAFFE). *Journal of Gerontology: Psychological Sciences*, 53B, P43–P50.
- Lawrence, R. H., Tennstedt, S. L., Kasten, L. E., Shih, J., Howland, J., & Jette, A. M. (1998). Intensity and correlates of fear of falling and hurting oneself in the next year: Baseline findings from a Royal Center fear of falling intervention. *Journal of Aging and Health*, 10, 267–286.
- Lawton, M. P., & Brody, E. M. (1991). Assessment of older people: Self-maintaining and instrumental activities of daily living. *The Gerontologist*, 31, 179–186.
- Legters, K. (2002). Fear of falling. *Physical Therapy*, 82, 264–272.
- Li, F., McAuley, E., Fisher, K. J., Harmer, P., Chaumeton, N. R., & Wilson, N. (2002). Self-efficacy as a mediator between fear of falling and functional balance, physical functioning in elderly persons. *Journal of Aging and Health*, 14, 452–466.
- Lusardi, M. M., & Smith, E. V. (1997). Development of a scale to assess concern about falling and applications to treatment programs. *Journal of Outcome Measurement*, 1, 34–55.
- Maki, B. E., Holliday, P. J., & Topper, A. K. (1991). Fear of falling and postural performance in the elderly. *Journal of Gerontology: Medical Sciences*, 46, M123–M131.
- McAuley, E., Mihalko, S. L., & Rosengren, K. (1997). Self-efficacy and balance correlates of fear of falling in the elderly. *Journal of Aging and Physical Activity*, 5, 329–340.
- McCutcheon, A. L. (1987). *Latent class analysis*. Newbury Park, CA: Sage.
- Mendes de Leon, C. F., Seeman, T. E., Baker, D. I., Richardson, E. D., & Tinetti, M. E. (1996). Self-efficacy, physical decline, and change in functioning in community-living elders: A prospective study. *Journal of Gerontology: Social Sciences*, 51B, S183–S190.
- Murphy, S. L., Williams, C. S., & Gill, T. M. (2002). Characteristics associated with fear of falling and activity restriction among community-living older persons. *Journal of the American Geriatrics Society*, 50, 516–520.
- Muthén, L. K., & Muthén, B. (1998). *Mplus user's guide* [Computer software and manual]. Los Angeles: Author.
- Myers, A. M., Powell, L. E., Maki, B. E., Holliday, P. J., Brawley, L. R., & Sherk, W. (1996). Psychological indicators of balance confidence: Relationship to actual and perceived abilities. *Journal of Gerontology: Medical Sciences*, 51A, M37–M43.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
- Pfeiffer, E. (1975). Short Portable Mental Status Questionnaire. *Journal of the American Geriatrics Society*, 23, 433–441.
- Podsiadlo, D., & Richardson, S. (1991). The timed “Up & Go”: A test of basic functional mobility for frail elderly persons. *Journal of the American Geriatrics Society*, 39, 142–148.
- Powell, L. E., & Myers, A. M. (1995). The Activities-Specific Balance Confidence scale. *Journal of Gerontology: Medical Sciences*, 50A, M28–M34.
- Reuben, D. B., & Siu, A. L. (1990). An objective measure of physical function of elderly outpatients: The Physical Performance Test. *Journal of the American Geriatrics Society*, 38, 1105–1112.
- Sattin, R. W. (1992). Falls among older persons: A public health perspective. *Annual Review of Public Health*, 13, 489–508.
- Shumway-Cook, A., & Wollacott, M. (1995). *Motor control: Theory and practical applications*. Baltimore: Williams & Wilkins.
- SPSS. (1990). *SPSS reference guide* [Computer software and manual]. Chicago: Author.
- Stevens, J. A., Hasbrouck, L., Durant, T. M., Dellinger, A. M., Batabyal, P. K., Crosby, A. E., et al. (1999). Surveillance for injuries and violence among older adults. *Morbidity and Mortality Weekly Reports*, 48, 27–50.
- Tinetti, M. E. (1994). Falls. In W. R. Hazzard, E. L. Bierman, J. P. Blass, W. H. Ettinger, & J. B. Halter (Eds.), *Principles of geriatric medicine and gerontology* (3rd ed., pp. 1313–1320). New York: McGraw-Hill.

- Tinetti, M. E. (2003). Preventing falls in elderly persons. *New England Journal of Medicine*, 348, 42–49.
- Tinetti, M. E., Doucette, J., Claus, E., & Marottoli, R. (1995). Risk factors for serious injury during falls by older persons in the community. *Journal of the American Geriatrics Society*, 43, 1214–1221.
- Tinetti, M. E., Mendes de Leon, C. F., Doucette, J. T., & Baker, D. I. (1994). Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. *Journal of Gerontology: Medical Sciences*, 49, M140–M147.
- Tinetti, M. E., Richman, D., & Powell, L. (1990). Falls efficacy as a measure of fear of falling. *Journal of Gerontology: Psychological Sciences*, 54, P239–P243.
- Tinetti, M. E., Speechley, M., & Ginter, S. F. (1988). Risk factor for falls among elderly persons living in the community. *New England Journal of Medicine*, 319, 1701–1707.
- Tinetti, M. E., & Williams, C. S. (1997). Falls, injuries due to falls and the risk of admission to a nursing home. *New England Journal of Medicine*, 337, 1279–1284.
- Vellas, B., Cayla, F., Bocquet, H., de Pemille, F., & Albarede, J. L. (1987). Prospective study of activity in old people after falls. *Age and Ageing*, 16, 189–193.
- Vellas, B. J., Wayne, S. J., Romero, L. J., Baumgartner, R. N., & Garry, P. J. (1997). Fear of falling and restriction of mobility in elderly fallers. *Age and Ageing*, 26, 189–193.
- Veloze, C. A., & Peterson, W. W. (2001). Developing meaningful fear of falling measures for community dwelling elderly. *American Journal of Physical Medicine and Rehabilitation*, 80, 662–673.
- Ware, J. E., Kosinski, M., & Keller, S. D. (1995). *SF-12: How to score the SF-12 physical and mental health summary scales* (2nd ed.). Boston: The Health Institute, New England Medical Center.

Received February 12, 2002

Accepted April 29, 2003