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ORIGINAL RESEARCH

Impact of Documented Fall-Risk, Self-Reported Health and Confidence to Prevent Falls on Concern About Falling Among Community-Dwelling Older Adults: Secondary Analysis of a Randomized Clinical Trial

Hiroko Kiyoshi-Teo[1], Bryanna De Lima[2], Nathan F Dieckmann[1], Jennifer L Vincenzo[3], Elizabeth Eckstrom[2]

[1]School of Nursing, Oregon Health & Science University, Portland, OR, USA; [2]Division of General Internal Medicine & Geriatrics, Department of Medicine, Oregon Health & Science University, Portland, OR, USA; [3]Department of Physical Therapy, Center for Implementation Research, University of Arkansas for Medical Sciences, Fayetteville, AR, USA

Correspondence: Hiroko Kiyoshi-Teo, School of Nursing, Oregon Health & Science University, 3455 S.W. U.S. Veterans Hospital Road, Portland, OR, 97239, USA, Email kiyoshi@ohsu.edu

Purpose: Individuals identified as high fall risk are expected to have high concern about falling. However, perception and individual factors that influence concern about falling have yet to be thoroughly studied. We aimed to understand factors that influence concern about falling among older adults with increased risk for falling.

Patients and Methods: This was a secondary analysis of a clinical trial among community-dwelling older adults (age ≥65 years old) at high risk for falls (n = 178). Descriptive and regression analyses were used. We analyzed the relationship between participants' baseline concern about falling – categorized into three groups: low (7–8), moderate (9–13), and high (≥14) – and factors that may impact their concern. Exploratory factors included age, sex, self-reported health status and confidence to address fall risks, fall risk scores, and physical performance measures.

Results: Among these individuals, 15.2% reported low concern about falling. On average, individuals in higher concern about falling groups had higher fall risk scores (low [5.7], moderate [6.4], and high [8.0]; $p < 0.001$). Our regression model showed that the odds of being in a higher concern group increased by 21% for every one unit increase in fall risk score and increased by 67% for every one unit increase toward poorer health rating. Conversely, for every one unit increase in self-reported confidence, the odds of being in a higher concern group decreased by 27.5%.

Conclusion: Knowledge of older adults' fall risk, health status, and concerns about falling can be used to assist in the personalization of fall prevention interventions for a more holistic approach.

Keywords: accidental falls, risk factors, perception, regression analysis

Introduction

Rates of falls, fall-related injuries and deaths are rising.[1] Although evidence-based strategies to reduce falls are known,[2] older adults (age ≥65 years old) do not consistently participate in fall prevention activities.[3] Older adults' adherence to fall prevention activities is often low even after their healthcare team makes fall prevention recommendations.[4–6] Among older adults who had a fall within the past year – a known risk factor for future falls[7] – over one-third are undecided about or disagree that fall prevention interventions would benefit them.[8] Additionally, up to 70% of older adults have increased concerns or worries about falling.[9] Many older adults believe that falls are an unavoidable part of aging[7] and cannot be prevented,[5] presenting a challenge for fall prevention efforts.

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The Stopping Elderly Accidents, Deaths, and Injuries (STEADI)[10] initiative created by the Centers for Disease Control and Prevention includes fall risk assessment tools (self-report and physical function), risk-based recommendation algorithms, and resources that have been implemented in the primary care setting.[11–13] Self-reported STEADI Stay Independent fall risk questionnaires (12-item dichotomous questions) are used to calculate a fall risk score that serves to identify individuals who are high fall risk (0–14 possible score; ≥4 indicates high fall risk).[10] Being identified as high fall risk is expected to prompt further assessments such as physical function performance tests and risk-specific interventions such as a referral to physical therapy. Estimated 31–37% of older primary care patients screen as high fall risk using the STEADI assessment.[10] Older individuals who are at increased risk for falling may have self-awareness about their fall risks and have concern about falling (CaF),[7] "fear of falling", or anxiety about falling.[14] Various disciplines have promoted the importance of addressing CaF,[15–18] and it is now recommended as part of routine fall risk screening.[7] In this manuscript, we will use the term CaF, which is socially acceptable to older adults and aligns with the most commonly used tool, Falls Efficacy Scale-International, to assess perception about falls.[19]

High CaF may lead to concern and anxiety about falls,[20] impair attention and gait, and may limit physical activities.[19] Heightened concern is a known independent risk factor for falls[9] and should be addressed as a risk factor.[7] On the other hand, low or moderate CaF may indicate an inappropriate response to being at risk for falling especially if fall risk is high. It is currently unknown whether there is an "optimal" CaF score in those at risk for falls that would motivate older adults to change behavior to reduce fall risk without causing undue anxiety or restricted mobility.

The relationship between STEADI fall risk score and individuals' perception of fall risks and CaF is important to understand. When asked to estimate their fall risks, older adults often minimize their actual risk of falling.[21,22] Increased understanding about the relationship between clinical fall risk and CaF will guide future fall prevention efforts. Our objective was to understand factors that impact CaF. The specific aims of this paper were to identify 1) characteristics of older adults at increased risk of falls who described themselves as having low/moderate/high CaF and 2) factors that impact CaF among community-dwelling older adults who are at increased risk for falls.

Materials and Methods

Design

This was a secondary analysis of a parent clinical trial that tested the feasibility and impact of a motivational interviewing (MI) intervention on older adults' engagement in fall prevention. Participants were informed about the purpose of the study and verbal consent was obtained prior to the primary study's commencement. This study, including the informed consent process, was approved by the Oregon Health & Science University Institutional Review Board (#8993) and conducted in accordance with the Declaration of Helsinki. The study was registered in clinicaltrials.gov (#NCT04612842).

Setting

Data from all participants who completed the baseline and 6-month data collection in the parent clinical trial were included. Participants for the parent clinical trial were recruited from the Oregon Health & Science University's Internal Medicine and Geriatrics Clinic in the Pacific Northwest, U.S.A. for a clinical trial between September 2020 and September 2022.[23]

Participants

Eligible participants were aged 65 years or older, community-dwelling, ambulatory, identified as high fall risk using the STEADI Stay Independent fall risk screening tool,[10] and had received documented fall prevention recommendations from their healthcare clinician (eg, physician, nurse practitioner).[23] Exclusion criteria included a known diagnosis of dementia or cognitive impairment, inability to communicate with the study staff in English, and severe hearing impairment.

Sample Size

The sample size for the parent clinical trial was estimated based on the primary efficacy outcome measure, Falls Efficacy Scale International-Short (FESI-S),[24] using a previously published estimated effect size of 0.31,[3] power of 80%, and

alpha of 0.05. The calculated sample size for the parent study was 200 participants, which was met. Details are described elsewhere.[23]

Variables

Participant Characteristics

Demographic variables (age, sex, number of select diagnoses, and zip code) were collected via electronic health record. Participants' 5-digit zip code was used as a proxy to determine the area deprivation index (ADI)[25] for ranking neighborhoods by socioeconomic disadvantage based on income, education, employment, and housing quality on a scale of 0–100. The most disadvantaged areas are ranked 100. General health status and participants' readiness to engage in fall prevention were collected via survey questions. General health status was obtained using the single general health question, "How would you rate your health?", with 5-point Likert scale responses (1: Excellent; 5: Poor) from the 36-item Short Form Survey (SF-36).[26] Participants' readiness to engage in fall prevention was obtained using the "importance and confidence ruler" commonly used in behavior change research studies.[23,27–29] Participants were asked about their level of importance (or confidence) to reduce their fall risk and responded on a 10-point scale (10 being most important/confident). Higher levels of importance and confidence are known to be associated with an increased rate of behavior change.[27,28]

Concern About Falling

FESI-S is a validated, 7-item version of the tool to assess CaF during daily activities (4-point Likert scale).[24] FESI-S data were collected at baseline and 6-month post intervention via telephone-based surveys. Participants were grouped into three categories based on their baseline FESI-S score using established criteria:[19] low (7–8), moderate (9–13), and high (14+).

STEADI Fall Risk Indicators

The STEADI Stay Independent fall risk screening questionnaire[10] was conducted during the routine clinical visit at participating primary care clinics. STEADI results were collected via electronic health record review. As part of the parent clinical trial, participants performed two physical function tests, the 4-Stage Balance Test and 30-second Sit-to-Stand Test,[10] at baseline and at 6 months. These tests were conducted via video call with a few in-person exceptions. The 4-Stage Balance Test[10] consists of participants standing in four different positions (ie, feet together, semi-tandem stand, tandem stand, and stand on one foot) for up to 10 seconds to test their balance. Inability to maintain each stance for 10 seconds indicates a risk for falls. The 30-second Sit-to-Stand Test assesses balance, leg strength, and endurance by having participants stand from a seated position as many times as they can in 30 seconds.[10] Performing lower than age and sex normative values indicates increased risk for falls. Due to COVID-19 pandemic-related restrictions and concerns about safety measuring via video call, we did not include the Timed-Up-and-Go Test.[10]

Statistical Analysis

Descriptive analyses were used to identify differences between CaF levels grouped by reported cut-off of FESI-S scores[19] and demographics (age, sex, number of select diagnoses, and area deprivation index), STEADI fall risk score, level of self-reported confidence and importance to address fall risks, and objective physical performance tests. Continuous variables were reported as means and standard deviations and categorical variables were reported as counts and percentages. One-way ANOVA tests, Kruskal–Wallis tests, or chi-square tests were used to compare variables by group as appropriate. Ordinal logistic regression models were used to investigate the impact of significant risk factors on baseline CaF groups. R version 4.1.3 (R Core Team 2022) was used for all statistical analyses and $p < 0.05$ was considered statistically significant.

Results

Characteristics of Participants

Among 178 participants with a baseline CaF FESI-S score, the average age was 80.1 ± 7.8 years and 120 (67.4%) were female. Table 1 displays the characteristics and fall risk factors according to CaF grouping. Approximately 40.4% reported high CaF (n = 72), 44.4% (n = 79) reported moderate CaF, and 15.2% (n = 27) reported low CaF. On average, participants

Table 1 Characteristics of Participants According to Their Concern About Falling

Variables	Overall n=178	Concern About Falling Groups (Based on Falls Efficacy Scale International-Short [FESI-S])			*p*-value
		Low (7–8) n=27	Moderate (9–13) n=79	High (14+) n=72	
Age in years, mean (SD)	80.1 (7.8)	81.7 (8.1)	79.3 (7.4)	80.3 (8.0)	0.35
Female, n (%)	120 (67.4)	19 (70.4)	52 (65.8)	49 (68.1)	0.90
Health status, mean (SD)	2.7 (1.0)	2.2 (1.2)	2.5 (0.9)	3.1 (1.0)	<0.001
Confidence to prevent falls, mean (SD)	7.6 (1.7)	9.0 (1.4)	7.4 (1.6)	7.2 (1.6)	<0.001
Number of selected diagnoses, mean (SD)	1.2 (1.1)	1.2 (1.0)	1.1 (1.0)	1.4 (1.2)	0.12
Area Deprivation Index, mean (SD)	18.4 (11.8)	21.2 (15.8)	16.9 (11.3)	19.0 (10.4)	0.23
STEADI score, mean (SD)	6.9 (2.6)	5.7 (2.1)	6.4 (2.2)	8.0 (2.7)	<0.001
STEADI physical function performance tests, duration in seconds, mean (SD)[a]					
Feet together stand[b]	10.0 (0.2)	10.0 (0.0)	10.0 (0.0)	10.0 (0.3)	0.47
Semi-tandem stand[b]	10.0 (0.4)	10.0 (0.0)	9.95 (0.3)	9.9 (0.5)	0.78
Tandem stand[b]	8.8 (2.6)	8.9 (2.7)	9.1 (2.3)	8.5 (2.9)	0.67
One-legged stand[b]	6.4 (3.9)	6.7 (3.9)	7.5 (3.7)	4.8 (3.7)	0.01
STEADI physical function performance tests, counts, mean (SD)[c]					
Sit-to-stand	10.2 (3.8)	11.3 (3.5)	10.3 (3.9)	9.8 (3.8)	0.48

Notes: STEADI: Stopping Elderly Accidents, Deaths, and Injuries. For outcomes that were ordinal, we tested with non-parametric (Kruskal–Wallis) tests and ended with similar results to one-way ANOVA. Reported mean and standard deviation for simplicity. [a]n= 96 for feet together stand and semi-tandem stand, n=93 for tandem stand, n=87 for one-legged stand, and n=90 for sit-to-stand. [b]Maximum duration is 10 seconds. [c]Number of sit-to-stand counts in 30-seconds.

with high CaF rated their baseline health status poorer than low and moderate CaF groups (3.1 vs 2.2, d = 0.86; 3.1 vs 2.5, d = 0.60; $p < 0.001$) and rated lower self-confidence to prevent future falls than low and moderate CaF groups (7.2 vs 9.0, d = −1.15; 7.2 vs 7.4, d = 0.15; $p < 0.001$). There were no other significant differences in demographic data between groups.

Relationship Between CaF (FESI-S) and STEADI Fall Risk Indicators

The CaF FESI-S scores were higher for those with higher self-reported STEADI fall risk scores. Participants in higher CaF groups had higher STEADI scores, on average, although there was variability within the CaF groups (high 7.96 ± 2.72; moderate 6.41 ± 2.20; and low 5.74 ± 2.10; $p < 0.001$). The effect size was large comparing high to low CaF groups (d = 0.91) and medium comparing large to moderate CaF groups (d = 0.63). Ninety-six participants completed at least one of the physical function fall risk measures (ie, 4-Stage Balance Test and 30-Second Sit-to-Stand). Participants performed well with most tests with little variation between groups: feet together stand (mean 9.98 ± 0.20 [seconds]), semi-tandem stand (mean 9.95 ± 0.37), tandem stand (mean 8.84 ± 2.58) and 30-second sit-to-stand (mean 10.23 ± 3.79). There was a statistically significant difference in one-legged stand duration between high vs moderate and low CaF groups (4.84 vs 6.69 and 7.45 [seconds]; $p = 0.013$). The effect size was medium for both comparisons (high to low CaF, d = −0.49; high to moderate CaF, d = −0.71).

Relationship Between CaF (FESI-S) and Other Participant Factors

There were significant differences among the three CaF groups (low, moderate, high) in self-reported health and the level of confidence in addressing fall risk at baseline (Table 1). We did not find any differences among CaF groups for age, sex, number of select diagnoses, or area deprivation index.

Predictors of CaF

We created two separate ordinal regression models to predict the likelihood of increased odds of being in the higher CaF group. The first model included all 178 participants and their baseline STEADI scores, self-reported health and confidence ratings (Table 2). The odds of being in a higher CaF group increased by 21% for every one unit increase in STEADI score and increased by 67% for every one unit increase in health rating indicating poorer health, holding all other variables constant. For every one unit increase in confidence rating, the odds of being in a higher CaF group decreased by 27.5%. In a smaller model that included only participants who completed their one-legged stand performance tests (n = 87), we added one-legged stand time along with STEADI scores and self-reported health and confidence ratings. Only confidence rating remained significant. For every one unit increase in confidence rating, the odds of being in a higher CaF category decreased by 37.6%, holding all other variables constant.

Discussion

The goal of this study was to understand factors that influence CaF among older adults at increased risk for falling. Although most older adults at high risk for falling had moderate or high CaF, 15.2% of them had low CaF. Baseline self-reported health, level of confidence to address fall risks, and STEADI scores were important factors attributing to CaF levels. Our findings contribute to fall prevention practice and research by providing evidence that variability exists in individuals' perception of their fall risk even among those who are at high risk for falls according to the STEADI tool. Our findings add to prior research that older adults can have adaptive or maladaptive coping for fall risks.[30–32] Maladaptive coping indicates a potential gap in older adults' fall risk appraisal that needs to be addressed.

We also found that self-reported health status and the level confidence to address fall risks influence CaF. This finding is valuable in three ways. First, researchers must consider participants' health status or activity levels in selecting appropriate fall risk perception tools, for example, the FESI-S is aimed at individuals who conduct most of their daily activities at home. Conversely, the Activities-specific Balance Confidence (ABC) scale,[33] which includes 16-items from inside and outside of the home, may be better suited for older adults in better health and with higher functionality.[34] The ABC scale may also be useful as individuals' confidence to reduce fall risks has been associated with CaF. Further exploration into fall risk perception tools is warranted.

Second, our research indicates that numerous factors should be assessed when considering how to approach older adults at high risk for falls, including CaF, health status, physical function, and confidence in preventing falls. Future research efforts should determine appropriate individualized interventions to address these factors in older adults at increased risk for falling. We encourage efforts to assess older adults' response to their CaF and readiness to change behaviors to reduce fall risks. Current tools such as FESI-S and ABC scales only assess an individual's sense of

Table 2 Predictors of Concern About Falling Categories

Model	Independent Variables	OR	95% CI
Full Model (n= 178)			
	STEADI score	1.21	(1.07–1.39)
	Health rating	1.67	(1.21–2.32)
	Confidence to reduce falling rating	0.73	(0.60–0.87)
STEADI physical function subgroup (n=87)			
	STEADI score	1.25	(0.99–1.60)
	Health rating	1.53	(0.94–2.54)
	Confidence to reduce falling rating	0.62	(0.47–0.82)
	One-legged stand	0.92	(0.81–1.03)

Abbreviation: STEADI, Stopping Elderly Accidents, Deaths, and Injuries.

confidence and concern. These are limiting unless they are used as ways to facilitate avoidance of at-risk behaviors or engagement in prevention behaviors.[35,36] An interprofessional approach will be critical to improve confidence and concern related to multi-factorial fall risks by providing options and action steps to minimize fall risks. For example, pharmacists can help with eliminating high fall risk medications by decreasing the dose or exploring alternative ways to address the condition.[18] Physical therapists can help older adults to regain balance control[16] through balance-focused exercises or the use of assistive mobility aids. Geriatricians and primary care providers can help detect and treat changes in cardiovascular or neurological changes critical to maintaining balance.[10]

Third, exploration of theoretical frameworks to assess individuals' perceptions related to falls is critical. One promising theory is the Protection Motivation Theory.[37] The two tenants of Protection Motivation Theory that may explain behavior change are perceived threat and coping appraisal.[37] In this theory, the uptake of a health behavior is influenced by the relevancy and impact of risks (ie, threat appraisal) and by perceived ability to cope, adapt, and minimize risks. Qualitative findings from prior research about older adults' experience with fall prevention support the use of Protection Motivation Theory.[32,38] In a study in which researchers explored and identified factors that influenced their uptake of fall prevention interventions, they found that older adults engage in fall prevention more when they acknowledge physical and mental limitations (eg, "I have always been clutzy" and realization that the likelihood of injurious falls increases with age) and access to resources (eg, buy walking sticks).[38] Another study found that older adults reflect deeply on their self-identity and factors that influence coping such as their values, skill set, knowledge, and experience to determine what actions they will take to address their fall risks.[32]

Our findings add to insights about future interventions to reduce CaF. Perceived health needs to be considered to potentially identify those who would most benefit from an intensive intervention to reduce CaF. In this study, we saw a potential impact of self-reported health on CaF in our full model. However, in the model limited to individuals who were able to complete the physical function tests, confidence was the only significant predictor. This suggests that individuals with more complex health conditions may have higher CaF. This aligns with knowledge that multiple chronic health conditions are known to be associated with increased rate of falls.[39,40] Other studies also provide insight that CaF changes differently for individuals who have more vulnerable health conditions.[41,42] In a study that examined the impact of a motivational interviewing intervention on fall risk reduction, CaF decreased significantly after the intervention for hospitalized adults with high fall risk factors.[3] These hospitalized patients had a mean of 10.4 ± 4.8 diagnoses and a mean FESI-S score of 17.8 ± 6.6 (high CaF).[3] Self-reported health status data were not reported from this study. However, among community-dwelling older adults who were identified as at high risk for falls,[23] the impact of motivational interviewing on CaF was not significant. These participants had a mean STEADI score of 7.0 ± 2.6, a mean of 1.1 ± 1.1 diagnoses, 80% rated their health as good to excellent, and had baseline FESI-S of 13.6 ± 5.1 (moderate CaF). The hospitalized group had complex health with more diagnoses suggesting multi-morbidity compared to the community-dwelling older adults. Future exploration into how health status and multi-morbidity impact baseline and changes in CaF, falls, and fall-related injury is warranted.

Limitations

Our study had several limitations to consider. First, older adults in this study had access to a primary care clinic in an urban setting in the Northwest US, and our findings may not be generalizable to individuals living in rural settings or without access to primary care. Participants were assessed for fall risks as part of routine clinical care and provided with fall prevention recommendations by their clinicians. However, even among those identified as high fall risk individuals, only 32.4–51.2% were given fall prevention recommendations.[23] Our participants, therefore, exemplify ideal clinical practice for fall prevention. Second, only half of participants were able to have their physical function assessed by video call. Some participants were unable to have a support person close by for safety, had technological challenges, or declined for personal or physiologic reasons. Third, we evaluated only one aspect of older adults' perception about CaF, and findings from qualitative studies are essential to understand gaps in fall prevention research and practice, and can tailor existing fall prevention programs and interventions to meet individuals' needs.

Conclusion

Knowledge of both older adults' fall risk and CaF levels will help clinicians better personalize fall prevention interventions. Personalization can be made considering older adults' overall health to address their symptoms, preferred treatment

modalities, and impact on their mobility. Individual risk factors for falls, such as vision, medication, loss of balance control, and environmental hazards, can be personalized through an interprofessional team approach. Personalized behavior interventions (eg, motivational interviewing) to improve older adults' confidence to engage in fall prevention can be helpful. A holistic person-centered approach is an essential element to engage older adults in fall prevention.

Data Sharing Statement

Deidentified data are available from the corresponding author upon request.

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Disclosure

The authors report no conflicts of interest in this work.

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