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Association of Loneliness With Falls: A Study of Older US Adults Using the National Social Life, Health, and Aging Project

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Abstract

Objectives: Falls represent a significant cause of morbidity and mortality in older adults, and are more common among those living alone. We aimed to determine if there is an association between loneliness and falls. **Methods:** Participants were surveyed in three waves separated by 5 years. We used the three-item UCLA Loneliness Scale to measure loneliness. **Results:** Data from 2337 respondents, with both loneliness and fall data in at least two consecutive waves, were included. Over three waves, 51% respondents reported a fall and 23% reported ≥ two falls. In multivariate analysis, the odds of having ≥ one fall 5 years later increased by a factor of 1.11 per one point increase on the loneliness scale (OR = 1.11, 95% CI 1.04, 1.19; $p < .01$). **Discussion:** Lonely older adults have increased odds of future falls. Strategies for combating loneliness in older adults may help reduce fall-related morbidity and mortality.

Keywords

falls, loneliness, older adults, comorbidity, mortality, depression

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Introduction

Each year in the United States, more than one-quarter of adults older than 65 fall and 3 million older adults are treated in emergency departments for fall-related injuries (Centers for Disease Control and Prevention, 2017). In 2015, estimated medical costs attributable to non-fatal and fatal falls were $50 billion (Florence et al., 2018). Falls are associated with increased morbidity, mortality, reduced functioning, and high rates of admission to long-term care facilities (Cosman et al., 2014; Panel on Prevention of Falls in Older Persons, American Geriatrics Society and British Geriatrics Society, 2011; Tinetti, 2003). Psychological consequences of falls include post-fall anxiety, depression, and decreased socialization (Jørstad et al., 2005; Tinetti, 2003). Identifying new co-morbidities and risk factors for falls in older adults has the potential to improve the individual health and overall economic burden imposed by falls.

Loneliness is a good candidate risk factor for falls because of its association with geriatric syndromes and conditions that increase risk for falls. For instance, loneliness has been associated with lower levels of physical activity (Hawkley et al., 2009), increased risk for cardiovascular disease (Valtorta et al., 2016), higher hemoglobin A1c levels (O'luanaigh et al., 2012), diminished sleep quality (Cacioppo & Cacioppo, 2018b; Hawkley & Cacioppo, 2010), limitations in the activities of daily living (Shankar et al., 2017), cognitive decline (Shankar et al., 2013), Alzheimer's disease (Wilson et al., 2007), and morbidity and mortality in older age (Luo et al., 2012). Loneliness also predicts poorer mental health, including greater depressive symptomatology (Cacioppo & Cacioppo, 2018a; Courtin & Knapp, 2017). However, the association between loneliness and geriatric conditions often persists even when adjusting

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for psychological factors such as depression (Lara et al., 2019; Shankar et al., 2013; Wilson et al., 2007).

Loneliness, which is not the same as being alone or isolated, is common among older adults. Loneliness is defined as a discrepancy between desired and achieved social relationships that is experienced as unpleasant and distressing (Peplau, 1982). It is more closely related to relationship quality than to objective isolation (Pinquart & Sorensen, 2001). Thus, people can be alone but not lonely, and conversely can feel lonely even when with others. Forty percent or more of adults over 60 to 65 years old report feeling lonely at least some of the time (Hawkley & Cacioppo, 2010; Hawkley & Kocherginsky, 2018; National Academies of Sciences, Engineering, and Medicine, 2020; Pinquart & Sorensen, 2001). Risk factors for loneliness in older age include a decline in the number and quality of social relationships, disruptive life events such as loss of a spouse, stressors such as spousal caregiving, and an increased prevalence of functional limitations (Beeson et al., 2000; Hsieh & Hawkley, 2018; Hughes et al., 2004). Recent events, such as the global COVID-19 pandemic, where social distancing has been utilized as a critical public health measure for reducing viral transmission, have also highlighted the need to address potential health consequences of increasing social isolation and loneliness in older adults. Morbidity and mortality from COVID-19 have disproportionately affected older adults and in the setting of multiple chronic medical conditions, older adults may be less likely to have enough reserve for adapting to increased loneliness occurring as a consequence of greater social isolation during the pandemic (Steinman et al., 2020).

Despite the prevalence of loneliness and risk for loneliness in older adults, and a growing body of evidence demonstrating an association between loneliness and other geriatric syndromes, the relationship between loneliness and falls surprisingly has only rarely been assessed. A number of studies have demonstrated that living alone, social isolation, and reduced integration with family networks predict falls (Ek et al., 2019; Faulkner et al., 2003; Noh et al., 2017; Petersen et al., 2020; Pohl et al., 2018). Few studies look specifically at loneliness as a predictor of falls. In a recent systematic review on the link between falls, social isolation, and loneliness, the authors highlight the need for further research to address this association (Petersen et al., 2020). Our study aimed to extend these limited works by determining if perceived loneliness predicted an increase in falls in older adults and whether this association remains after adjustment for other risk factors.

Methods

Subjects

We used data from the National Social Life, Health, and Aging Project (NSHAP), a longitudinal, nationally-representative cohort of older adults (Waite, Cagney, Dale, Hawkley, et al., 2019; Waite, Cagney, Dale, Huang, et al., 2019; Waite, Laumann, et al., 2019). The goal of the NSHAP study was to evaluate the social, biological, emotional, and environmental factors that influence health and aging. Data used for this secondary data analysis was collected in three waves. Wave 1 (2005–2006) included 3005 adults born 1920 to 1947 (mean 69 years, range 57–85) who were interviewed in their home. All respondents were deemed sufficiently cognitively intact to complete the approximately 2-hour interview. Wave 2 (2010–2011) included interviews with 3377 adults. The second wave included respondents from Wave 1 ($n=2{,}261$), cohabiting spouses and partners of these Wave 1 respondents irrespective of their age ($n=955$), and respondents who were sampled, but not interviewed in Wave 1 ($n=161$). Wave 3 (2015–2016) included interviews with returning respondents ($n=2{,}409$) and a new cohort of Baby Boomers born 1948 to 1965 ($n=2{,}368$). For these analyses, the Baby Boomer cohort was not included since they only had one wave of data collection.

Data Collection

NSHAP data collection for all three waves consisted of three components: an in-person questionnaire conducted by a field interviewer in the subject's home, bio-measure collection, and a leave-behind, self-administered questionnaire. Upon completion of the in-person interview and bio-measure collection, subjects were given a leave-behind questionnaire (LBQ) that included the items constituting the loneliness scale and a question about the number of falls experienced in the last 12 months. The LBQ was completed and returned by ~84% of respondents in Wave 1, ~87% in Wave 2, and ~85% in Wave 3.

Outcomes and Covariates

The outcome of interest was incident falls (none versus ≥ 1; self-reported) in the 12 months before the subject was surveyed for Wave 2 or Wave 3. The primary predictor variable, measured in the preceding Wave was perceived loneliness as measured by the Three-Item UCLA Loneliness Scale, which has been validated and used for measurement of loneliness in multiple large population surveys. This scale consists of three questions: "How often do you feel that you lack companionship?", "How often do you feel left out?", and "How often do you feel isolated from others?" Response choices are hardly ever (1 point), some of the time (2 points), or often (3 points). The composite score sums all three responses and ranges from 3 to 9 points, with a higher score indicating greater loneliness.

Covariates considered included both demographics (age, gender, race/ethnicity), BMI, education, marital status (married or living with partner versus not), and well-established risk factors for falls in older adults (Cosman et al., 2014; Panel on Prevention of Falls in

Older Persons, American Geriatrics Society and British Geriatrics Society, 2011; Tinetti, 2003) and were based on previous wave measures to temporally precede incident falls in the 12 months prior to Waves 2 and/or Wave 3. Well-established risk factors considered were: depression (anti-depressant use), polypharmacy (use of 4 or more medications), arthritis (self-report of doctor diagnosis), impaired vision (self-rated eyesight on scale from 1 = poor to 5 = excellent), urinary incontinence (self-report), and falls (coded as 0, 1, and 2 +). Additional co-variates used were self-rated physical health (1 = poor to 5 = excellent), self-reported exhaustion (response of occasionally or most of the time to either of the two exhaustion related questions from the Center for Epidemiologic Studies Depression (CES-D) scale), and activities of daily living (# having at least some difficulty performing, range 0–6).

Statistical Analysis

The relationship between incident falls (none versus 1 +) at Wave T + 1, loneliness and individual covariates at Wave T were assessed separately in univariate analysis using logistic regression. Results are presented as odds ratios with 95% confidence intervals. Multivariate models adjusted for the established fall risk factors described above that were also significantly associated ($p < .05$) with falls in univariate analysis (age, race/ethnicity, polypharmacy, use of anti-depressant medication, arthritis, urinary incontinence, self-rated physical health, self-rated eyesight, ADL difficulties, self-rated exhaustion, and falls). In both univariate and multivariate analyses, loneliness was assessed as a continuous predictor. Robust standard errors were used to account for the fact that individuals with data at all three waves would be included twice in these models. It was hypothesized that the effect of loneliness on fall risk may vary depending on age—with the oldest adults having more fall risk factors that might diminish the effect of loneliness on falls. This hypothesis was tested by evaluating the age by loneliness interaction, as well as the gender by loneliness interaction, using a Wald test. The multivariate model was re-estimated using multiple imputation utilizing chained equations to examine the potential impact of bias related to missing data. All analyses adjusted for the complex survey design with the weights provided with the Wave 2 dataset. Analyses were performed using Stata 16 (StataCorp. LLC, College Station, TX, USA).

Results

There were 2,917 respondents interviewed in at least two consecutive waves. A total of 580 respondents had missing fall and/or loneliness data, and were therefore excluded. The remaining 2,337 respondents constitute our analytic sample. Of these, 1,008 had loneliness and falls data from all three Waves, 634 from Wave 1 to Wave 2 only, and 695 for Wave 2 to Wave 3 only.

Sample Characteristics

Based on respondents in the analytic sample, 51% ever reported a fall over the three waves of data collection; 23% ever reported two or more falls. The correlation of loneliness at Wave T and Wave T + 1, as measured by the three item UCLA loneliness scale, was 0.52. The correlation of falls (none, 1, >1) at Wave T and Wave T + 1 was 0.25. Demographic and fall risk factors are presented in Table 1.

Univariate Analysis

Table 2 shows the unadjusted association of falls and loneliness as a continuous predictor and other covariates. Using the continuous UCLA loneliness score, a one-point increase on the loneliness scale was associated with a 1.18 greater odds of falling (OR 1.18; 95% CI 1.11, 1.26; $p < 0.01$) 5 years later.

Multivariate Analysis

A multivariate model adjusted for age, race/ethnicity, use of anti-depressant medication, arthritis, urinary incontinence, polypharmacy, self-rated physical health, self-rated eyesight, ADL difficulties, self-rated exhaustion, and prior falls. Results are presented in Table 2. The odds of having at least one fall 5 years later increased by a factor of 1.11 per one-point increase on the loneliness scale (OR = 1.11, 95% CI 1.04, 1.19; $p < .01$; Figure 1). As expected, falls also increased with older age, arthritis, urinary incontinence, antidepressant use, exhaustion, worse overall physical health, and history of falls. Our multivariate analysis also tested for an interaction between age and loneliness and between gender and loneliness, but neither was statistically significant and were not included in the final model (interaction $p = .38$ and .63, respectively). Re-estimation of the model using multiple imputation produced similar results (OR per one-point increase in loneliness = 1.10, 95% CI 1.03, 1.17; $p < .01$; Table 1).

Discussion

In our longitudinal analysis of a nationally representative cohort of community-dwelling older adults, increasing loneliness was associated with an increased risk of falls 5-years later, independent of other established fall risk factors and regardless of gender. When considering the prevalence of loneliness in older adults and the potential morbidity and mortality from falls, these findings have significant public health relevance.

It has been reported that social isolation and loneliness occur after falls, but less is known about whether these social experiences contribute to fall risk (Hajek & König, 2017; Jørstad et al., 2005; Petersen et al., 2020). This study attempted to evaluate how antecedent loneliness could predict an increased risk for future falls.

Table 1. Loneliness as a Predictor of Falls, Using Multiple Imputation to Account for Missingness.

	Adjusted OR (95% CI)	*p*-value
Loneliness[a]	1.10 (1.03, 1.17)	<.01
Age (per year)	1.03 (1.02, 1.05)	<.01
Race/ethnicity (vs. White)		<.01
Black	0.65 (0.49, 0.87)	
Hispanic	0.99 (0.74, 1.31)	
Other	0.45 (0.25, 0.80)	
Polypharmacy	1.05 (0.87, 1.27)	.60
Arthritis	1.24 (1.04, 1.48)	.02
Urinary incontinence	1.28 (1.07, 1.53)	<.01
Antidepressant use	1.51 (1.20, 1.92)	<.01
Exhausted	1.37 (1.11, 1.68)	<.01
# ADL difficulties[b]	1.08 (0.99, 1.17)	.10
Self-reported physical health[c]	0.89 (0.81, 0.98)	.02
Self-reported eyesight[c]	1.05 (0.96, 1.15)	.30
Prior falls (vs. none)		<.01
1	1.69 (1.34, 2.13)	
2+	2.49 (1.84, 3.36)	

Note. OR = odds ratio from survey-weighted logistic regression models.
[a]Range 3 to 9.
[b]Range 0 to 6.
[c]On 5 point scale with 1 = poor to 5 = excellent.

Table 2. Loneliness as a Predictor of Falls.

	Unadjusted OR (95% CI)	*p*-value	Adjusted OR (95% CI)	*p*-value
Loneliness[a]	1.18 (1.11, 1.26)	<.01	1.11 (1.04, 1.19)	<.01
Gender (vs. male)		.21	—	
Female	1.11 (0.94, 1.31)			
Age (per year)	1.04 (1.03, 1.05)	<.01	1.04 (1.02, 1.05)	<.01
BMI (kg/m^2)	1.01 (0.99, 1.02)	.27	—	
Race/ethnicity (vs. White)		<.01		.02
Black	0.68 (0.53, 0.87)		0.72 (0.53, 0.99)	
Hispanic	1.02 (0.78, 1.33)		1.08 (0.77, 1.51)	
Other	0.53 (0.27, 1.03)		0.46 (0.23, 0.90)	
Education (vs. <HS)		.07	—	
HS/equiv	0.72 (0.55, 0.94)			
Voc cert	0.89 (0.69, 1.13)			
Bachelor+	0.80 (0.62, 1.04)			
Married or living with partner	0.87 (0.72, 1.05)	.16	—	
Polypharmacy	1.48 (1.23, 1.78)	<.01	0.94 (0.75, 1.16)	.56
Arthritis	1.59 (1.34, 1.88)	<.01	1.25 (1.03, 1.52)	.02
Urinary incontinence	1.78 (1.49, 2.11)	<.01	1.25 (1.03, 1.52)	.03
Antidepressant use	2.02 (1.59, 2.56)	<.01	1.41 (1.08, 1.82)	.01
Exhausted	1.84 (1.52, 2.22)	<.01	1.38 (1.10, 1.74)	<.01
# ADL difficulties[b]	1.27 (1.17, 1.38)	<.01	1.11 (1.00, 1.23)	.06
Self-reported physical health[c]	0.77 (0.70, 0.83)	<.01	0.87 (0.78, 0.97)	.01
Self-reported eyesight[c]	0.92 (0.84, 0.99)	.03	1.10 (0.99, 1.21)	.07
Prior falls (vs. none)		<.01		<.01
1	2.20 (1.73, 2.78)		1.86 (1.44, 2.40)	
2+	4.29 (3.22, 5.71)		3.43 (2.50, 4.72)	

Note. OR = odds ratio from survey-weighted logistic regression models.
[a]Range 3 to 9.
[b]Range 0 to 6.
[c]On 5 point scale with 1 = poor to 5 = excellent.

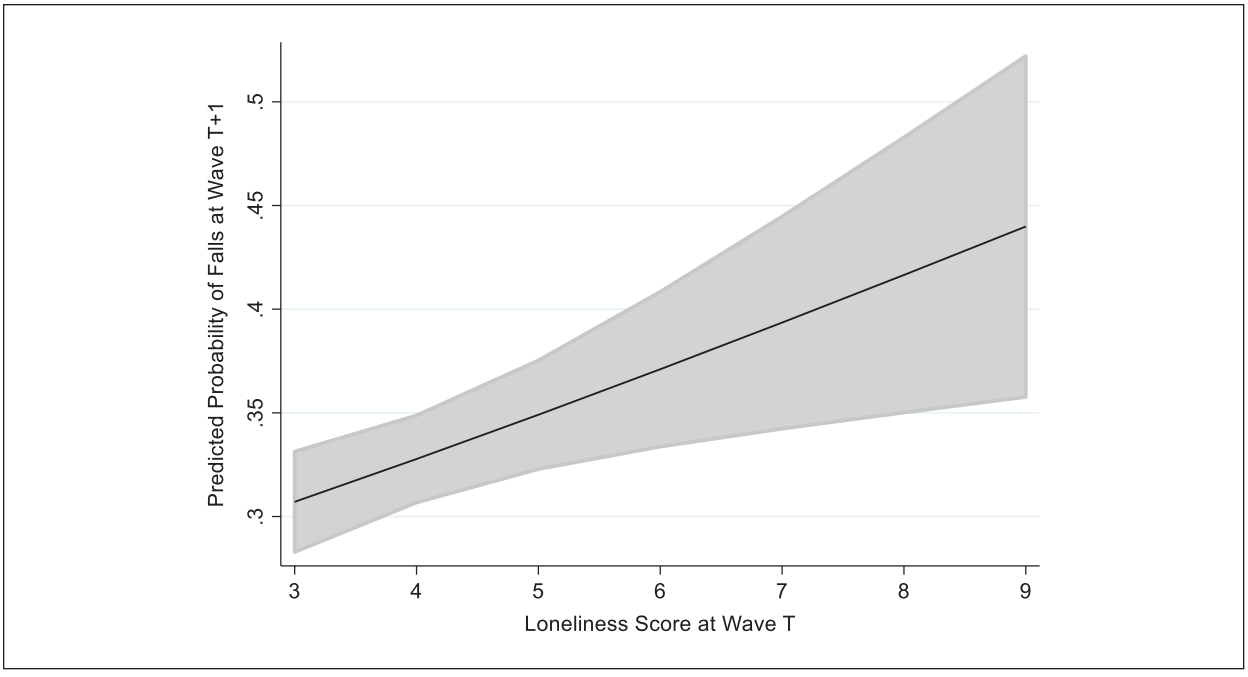

Figure 1. Association between loneliness and falls 5 years later, based on adjusted logistic regression from Table 2. Gray shaded area represents 95% confidence bounds.

A direct pathway by which loneliness contributes to falls remains unclear. Two fall risk factors that are well established, and which could lead to an indirect mechanism for falls—frailty and depression—did not appear to eliminate the excess risk of falls seen in those who were lonely. It appears likely that the biologic plausibility of the relationship between loneliness and falls may be mediated by a combination of neuropsychiatric, hypothalamic-pituitary-adrenal, neuromuscular, and other physiologic processes, which are sufficiently and collectively enhanced by loneliness to produce a fall outcome. As one author noted, "Although a few falls have a single cause, the majority result from interactions between long-term or short-term predisposing factors and short-term precipitating factors in a person's environment (Tinetti, 2003)." Further research may help to clarify the direct biologic pathways contributing to fall risk in individuals with loneliness.

Given that fall risk increases substantially with aging, and that exposure to other fall risk factors increases with aging, it is possible that the independent effect of loneliness on fall risk is mitigated by the accumulation of comorbidities and chronic conditions with aging which also affect fall risk. In order to optimize fall prevention strategies and target to specific populations, future studies should again test variation in the relationship between loneliness and falls by age.

Indeed, interventions to reduce loneliness have been widely studied. Examples of these include those that enhance social support, social skills, and opportunities for social contact, and those that target behavioral adaptation to the maladaptive social cognition associated with loneliness (Masi et al., 2011). Cacioppo and Hawkley proposed a model of loneliness whereby individuals who are lonely have increased sensitivity to and surveillance for social threats, with preference to focus on negative social information, recall the more negative parts of social events, have more negative expectations for social interactions, and behave in a manner that confirms these negative social expectations (Cacioppo & Hawkley, 2009). They hypothesize that over time, the increased cognitive load of managing negative social perceptions and experiences (i.e., self-protective strategies) reduces executive functioning and adversely influences both physical and mental health and well-being. A multi-component intervention, where maladaptive social cognition is addressed and then older adults are given opportunities to enhance social support may be considered. One strategy for this may be shared medical appointments where older adults have the opportunity to meet peers with similar risk for chronic conditions. Shared medical appointments (group visits) have been demonstrated to enhance screening of geriatric syndromes and improve care for multiple chronic diseases including osteoporosis (Ayoub et al., 2009; May et al., 2014). In addition to loneliness, these visits may also address other fall risk factors such as frailty and strength and increase motivation for interventions like physical activity (Gold et al., 2004).

Our study has several limitations. The NSHAP cohort included in this study was surveyed at three different time points, Wave 1 in 2005 to 2006, Wave 2 in 2010 to 2011, and Wave 3 in 2015 to 2016. Our study included only individuals who were surveyed in at least two consecutive waves. Those who died between the two surveys, or were too sick to participate in a second

consecutive wave were not included in the subsequent survey(s). Our analysis therefore, likely underestimates falls in the initial cohort. Our study also relied upon self-report of falls within the last 12 months on a leave-behind questionnaire. This may result in recall bias. There has been some literature suggesting that the interval over which individuals are asked to remember their falls affects fall reporting (Ganz et al., 2005). However, other studies have also used the 12 months window (Hajek & König, 2017). Due to the nature of the NSHAP study design, falls could only be assessed at discrete time points occurring 5 years apart; more frequent capture of falls was not feasible. Similarly, loneliness being measured at a single time-point 5 years prior to the assessment of falls (versus more frequent measurement of loneliness) precludes more fine-grained analysis. Future studies assessing loneliness at baseline and at follow-up intervals with prospective collection of fall data (e.g., monthly) can provide a better assessment of the association between loneliness and falls. Finally, given that a key clinical outcome of falls is osteoporotic fractures, a critical question is to determine if perceived loneliness is a predictor of osteoporotic fractures. There were too few osteoporotic fractures in our cohort to test if there is an association between loneliness and osteoporotic fractures. A future prospective study is needed to investigate this potential association.

Falls represent a significant source of morbidity and mortality in older adults. Identifying fall risk factors in older adults has the potential to enable interventions aimed at mitigating these risks. Our study showed that older adults reporting perceived loneliness have an increased risk of future falls, independent of other fall risk factors such as physical function and depression.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: TJV is an investigator, advisor and speaker for Radius Health, an advisor and investigator for Takeda, and an investigator for Ascendis. All other authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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