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Prevalence and Associated Factors of Falls Among Iranian Older Adults: Findings from the Neyshabur Longitudinal Study on Ageing (NeLSA)

Ramin Raoufinia[1,2], Ali Shakerimoghaddam[1], Mitra Hariri[1], Seyed Reza Mirhafez[2], Ali Hadianfar[1,3*]

[1] *Noncommunicable Diseases Research Center, Neyshabur University of Medical Sciences, Neyshabur, Iran*
[2] *Healthy Ageing Research Centre, Neyshabur University of Medical Sciences, Neyshabur, Iran*
[3] *Workplace Health Research Center, Neyshabur University of Medical Sciences, Neyshabur, Iran*

Corresponding Author

Ali Hadianfar, Ph.D.

Noncommunicable Diseases Research Centre, Neyshabur University of Medical Sciences, Neyshabur, Iran

✉ hadianfar69@gmail.com

✆ +985143353211

0000-0002-2765-9396

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ABSTRACT

Background: Falls are a major cause of disability, loss of independence, hospitalization, and mortality among older adults. Despite the growing burden of falls in Iran, population-based evidence on their prevalence and associated factors remains limited. To determine the prevalence of falls and identify factors associated with fall occurrence in the Neyshabur Longitudinal Study on Ageing (NeLSA).

Methods: This cross-sectional study used baseline data from the NeLSA cohort. A total of 3,452 adults aged ≥60 years were included, of whom 3,319 had available information on falls during the previous 12 months. Standardized questionnaires and clinical assessments were used to assess demographic, socioeconomic, clinical, and psychological measures. Multivariable logistic regression analyses were performed to identify factors independently associated with falls.

Results: Among 3,319 participants, 744 reported at least one fall during the previous 12 months, corresponding to a prevalence of 22.4%. In the model excluding fear of falling, older age (AOR=1.022, 95% CI: 1.008–1.037), urinary incontinence (AOR=1.589, 95% CI: 1.086–2.326), poorer sleep quality (AOR=1.047, 95% CI: 1.023–1.072), depressive symptoms (AOR=1.081, 95% CI: 1.039–1.125), and lower income status were independently associated with falls. After adjustment for fear of falling, model fit improved, and fear of falling showed the strongest independent association with fall occurrence. Participants with some fear (AOR=1.646, 95% CI: 1.338–2.025) and high fear (AOR=2.414, 95% CI: 1.847–3.155) were significantly more likely to fall. Older age, urinary incontinence, poor sleep quality, depressive symptoms, and lower income status remained significant factors in the fully adjusted model.

Conclusions: Falls affected more than one-fifth of participants in the NeLSA and were associated with a combination of clinical, psychological, and socioeconomic factors. Fear of falling showed the strongest independent association with fall occurrence, supporting the integration of psychological assessment into routine fall-risk screening and prevention programs.

Introduction

Population aging has become one of the most important demographic developments in the world, and the increase in life expectancy in recent decades has led to a significant increase in the number of elderly people in many countries, including Iran. These demographic changes have caused health systems to pay more attention to problems and diseases related to aging than in the past. Among them, falls are one of the most common problems of aging that can have widespread consequences on the health of the individual and society (1). Falls in the elderly are one of the most important causes of physical injuries, reduced ability to perform daily activities, hospitalization, and mortality. International

evidence shows that a significant percentage of people over 65 years of age fall at least once a year, and the likelihood of this event increases with age. Also, a large part of deaths from falls occur in low- and middle-income countries, which highlights the importance of this issue in developing countries (2).

Iran is also facing challenges due to the rapid increase in the elderly population. The results of studies conducted in the country have shown that falls are relatively common among Iranian elderly people, and many of these accidents occur in the home environment. In addition, women and older adults are at greater risk. Since falls can lead to various physical injuries, it is of particular importance to understand the factors affecting them (3, 4). The consequences of falls are not limited to physical injuries. After experiencing a fall, many elderly people experience fear of falling again, reduced social participation, depression, and a decrease in quality of life. On the other hand, the costs of treatment, hospitalization, rehabilitation, and long-term care impose a significant economic burden on the health system and families. It is predicted that these costs will increase in the coming years as the number of elderly people increases (5, 6).

The incidence of falls in the elderly is influenced by a set of individual, clinical, psychological, and social factors (7). Factors such as increasing age, muscle weakness, balance disorders, chronic diseases, simultaneous use of multiple medications, visual impairments, obesity, diabetes, depression, cognitive disorders, and poor socioeconomic status are among the most important known risk factors. Also, some studies conducted in Iran have shown that economic problems, low literacy level, multiple diseases and use of sedative drugs can increase the likelihood of falling (8). Despite the importance of this issue, comprehensive evidence based on population cohort studies on the prevalence of falls and its associated factors in Iranian elderly people is still limited (9, 10). A significant part of previous studies has been conducted in specific regions or on relatively small samples, and the simultaneous examination of various individual, social, and clinical factors has received less attention (11-14).

The Neyshabur Longitudinal Study of Aging, as one of the largest population-based studies in the field of aging in the country, provides a suitable platform for accurately assessing the prevalence of falls and identifying its associated factors. The results of this study can play an important role in identifying modifiable risk factors, planning preventive interventions, and developing effective policies to promote the health of the elderly. Accordingly, considering the increasing trend of population aging in Iran, the physical, psychological, and economic effects of falls, as well as the lack of local evidence based on cohort studies, it seems necessary to investigate the prevalence of falls and its associated factors in the Iranian elderly using data from the Neyshabur Longitudinal Study of Aging.

Methods

This cross-sectional study draws on data from the baseline assessment of the Neyshabur Longitudinal Study on Ageing (NeLSA), a large-scale, population-based prospective cohort focused on individuals aged 50 years and older in Neyshabur, northeast Iran (15). NeLSA is one of the aging-specific components of the Prospective Epidemiological Research Studies in Iran (PERSIAN), a national multi-center initiative launched in 2014 to investigate the burden and determinants of non-communicable diseases across the country's diverse populations (16). The NeLSA cohort is designed to monitor a broad spectrum of aging-related outcomes, encompassing demographic, socioeconomic, lifestyle, physical, and psychological factors, as well as clinical examinations, mobility assessments, anthropometric measurements, and biological samples. Consequently, from the initial NeLSA registration phase (2016-2018, n=7,462 aged 50-94), the analysis was restricted to participants aged ≥ 60 years yielding a final analytical sample of 3,452 individuals.

The data were collected through a comprehensive interviewer-administered questionnaire. The questionnaire covered a variety of demographic details, such as age, sex, marital status, education level, job status, and economic status. It also explored lifestyle factors like physical activity, smoking, tobacco use, and drinking habits. The medical history part looked into conditions like diabetes, high blood pressure, osteoporosis, and urinary problems. The psychological variables examined included depression, sleep quality, and fear of falling. Anthropometric measurements, including body mass index (BMI), were also recorded. The physician carried out a series of investigative procedures. First, the physician performed clinical examinations. Next, the physician obtained the medical histories of the participants. Finally, the physician cross-checked the participants' medical records. The dependent variable was defined as any self-reported fall experienced within the 12 months preceding the interview, with a binary response option of "yes" or "no." The study protocol was approved by the Ethics Committee of Neyshabur University of Medical Sciences (IR.NUMS.REC.1404.081).

Data were collected through a comprehensive interviewer-administered questionnaire covering demographic characteristics (age, sex, marital status, educational level, occupational status, economic status), lifestyle factors (physical activity, smoking, other tobacco use, alcohol consumption), medical history (diabetes, hypertension, osteoporosis, urinary disorders), and psychological variables (depression, sleep quality, fear of falling). Anthropometric measurements, including body mass index (BMI), were also recorded. A physician performed clinical examinations, took medical histories, and cross-checked participants' medical records. The dependent variable was any self-reported fall in the 12 months preceding the interview (yes/no). The study protocol was approved by the Ethics Committee of Neyshabur University of Medical Sciences (IR.NUMS.REC.1404.081), and written informed consent was obtained from all participants.

Statistical analysis

All statistical analyses were performed using SPSS version 27. Due to the failure of the assumption of normality for continuous variables, as determined by the Kolmogorov–Smirnov test, these variables were summarized as median (interquartile range, IQR). Subsequent comparisons between fall experiences within the 12-month period and non-fallers were conducted using the non-parametric Mann–Whitney U test. Categorical variables were presented as frequencies

(percentages) and compared using the chi-square test (or Fisher's exact test when appropriate). To identify factors independently associated with falls and to control for potential confounders, binary logistic regression analysis was employed. Given the established role of fear of falling as both a risk factor and a consequence of previous falls, two distinct logistic regression models were developed: Model 1 excluded fear of falling, while Model 2 additionally included this variable to evaluate its impact on the magnitude and significance of other associations. All demographic, socioeconomic, lifestyle, clinical, sleep quality, and depressive symptom variables (as presented in Table 1) were entered simultaneously into both models using the forced entry (Enter) method. The model fit and comparison were assessed using the –2 Log Likelihood and Nagelkerke's pseudo R^2. The results of the logistic regression analyses are reported as adjusted odds ratios (AOR) with 95% confidence intervals. A two-sided p-value of less than 0.05 was considered statistically significant.

Results

A total of 3,452 older adults (aged ≥60 years) participated in the study. Data on falls during the previous 12 months was available for 3,319 participants. Among these, 744 individuals (22.4%) reported at least one fall, while 2,575 (77.6%) reported no history of falling.

Table 1 presents the characteristics of participants according to fall status. The median age of participants who experienced a fall within the 12-month was significantly higher than that of those who did not fall (66.6 years [IQR: 62.9–73.3] vs. 65.9 years [IQR: 62.5–72.0], p = 0.005). There was also a significant difference in the prevalence of falls between males and females (52.0% vs. 48.0%, p=0.006). Furthermore, significant associations were found with employment status (p=0.010) and income status (p<0.001). Older adults experiencing financial problems exhibited a higher propensity for falling compared with those who reported no financial issues.

In terms of health-related factors, falls occurred more frequently among participants with a history of diabetes (22.6% vs. 19.0%, p=0.029), urinary incontinence (7.3% vs. 3.6%, p<0.001), and osteoporosis (13.8% vs. 8.1%, p<0.001). There was a strong connection between a history of falls and fear of falling. Participants with a history of falls were more likely to report moderate or high levels of fear of falling than those without falls (p < 0.001). Furthermore, patients with falls exhibited significantly lower sleep quality, as evidenced by a median PSQI score of 7.0 compared to 5.0 (p < 0.001). Additionally, these patients reported a higher prevalence of depressive symptoms, as indicated by a median CESD-10 score of 10.0 (interquartile range [IQR]: 9.0–12.0) compared to 10.0 (IQR: 9.0–11.0) (p < 0.001).

No significant differences were found between those who fell and those who did not regarding marital status, educational level, smoking status, addiction, alcohol consumption, hypertension, or BMI (all p>0.05). Two multivariable logistic regression models were constructed to identify factors associated with falls during the previous 12 months. In Model 1, the following variables were included: demographic, socioeconomic, lifestyle, clinical, sleep quality, and depressive symptoms. Given the potential of fear of falling to serve as both a predictor and a consequence of previous falls, a second model (Model 2) was fitted, with the additional inclusion of fear of falling to assess its impact on the observed associations.

As illustrated in Table 2, the findings reveal the outcomes of two multivariable logistic regression models, which were utilized to investigate the factors associated with falls among the elderly population. Model 1 incorporated all independent variables with the exception of fear of falling, while Model 2 additionally adjusted for fear of falling.

In Model 1 (without fear of falling), older age (AOR = 1.022, 95% CI: 1.008–1.037, p = 0.002), urinary incontinence (AOR = 1.589, 95% CI: 1.086–2.326, p = 0.017), poorer sleep quality (PSQI score: AOR = 1.047, 95% CI: 1.023–1.072, p < 0.001), higher depressive symptoms (CESD 10 score: AOR = 1.081, 95% CI: 1.039–1.125, p < 0.001), and having sufficient income for basic needs (AOR = The results of the study indicated a significant association between the presence of falls and the following variables: 0.741, 95% CI: 0.571–0.962, p = 0.024. The findings revealed a counterintuitive protective association between osteoporosis and the primary outcome (AOR = 0.748, 95% CI: 0.563–0.996, p = 0.047).

In Model 2 (with fear of falling), the model fit improved markedly (−2 Log Likelihood decreased from 3060.07 to 2989.49). Older age (AOR = 1.017, 95% CI: 1.002–1.032, p = 0.022), urinary incontinence (AOR = 1.549, 95% CI: 1.052–2.278, p = 0.026), PSQI score (AOR = 1.036, 95% CI: 1.012–1.061, p= 0.003), CESD-10 score (AOR = 1.068, 95% CI: 1.026–1.112, p = 0.001), and sufficient income (AOR = 0.742, 95% CI: 0.570–0.967, p = 0.027) remained significant. Fear of falling emerged as the strongest predictor: compared to no fear, some fear (AOR = 1.646, 95% CI: 1.338–2.025, p < 0.001) and high fear (AOR = 2.414, 95% CI: 1.847–3.155, p < 0.001) significantly increased the odds of falling. Notably, osteoporosis lost its statistical significance after adjusting for fear of falling (p = 0.101), suggesting that fear of falling may partially account for the observed association between osteoporosis and falls. Sex, living arrangement, job status, BMI, diabetes, and hypertension were not significantly associated with falls in either model. Although female sex was associated with falls in the univariate analysis, the association was no longer statistically significant after adjustment for other covariates, indicating that the observed crude association may be explained by differences in socioeconomic, clinical, and psychological characteristics between men and women.

Overall, inclusion of fear of falling improved model fit and revealed a clear dose–response association between fear of falling and fall occurrence. Older age, urinary incontinence, poor sleep quality, depressive symptoms, and lower income status remained independently associated with falls after adjustment for potential confounders. These findings suggest that both physical and psychological factors contribute to fall risk among Iranian older adults and should be considered in fall-prevention strategies. Inclusion of fear of falling increased the Nagelkerke R^2 from 0.046 to 0.071 and reduced the −2 Log Likelihood from 3060.07 to 2989.49, indicating an improved model fit.

Table 1. Characteristics of participants according to fall status during the previous 12 months

Variable		Total (n=3319)	Fall		p-value
			No (n=2575)	Yes (n=744)	
Age, years, Median (IQR)		66.17 (62.58–72.25)	65.92 (62.5–72.0)	66.6 (62.92–73.25)	0.005
Sex, n (%)					0.006
	Male	1740 (52.4)	1383 (53.7)	357 (48.0)	
	Female	1579 (47.6)	1192 (46.3)	387 (52.0)	
Marital status, n (%)					0.109
	Living alone	465 (14.1)	347 (13.6)	118 (15.9)	
	Living with others	2824 (85.9)	2202 (86.4)	622 (84.1)	
Education, n (%)					0.725
	Illiterate	1201 (36.4)	928 (36.2)	273 (36.9)	
	Literate	2099 (63.6)	1633 (63.8)	466 (63.1)	
Current job status, n (%)					0.010
	Full- or part-time employment	482 (14.6)	389 (15.2)	93 (12.6)	
	Housewife	1376 (41.7)	1039 (40.6)	337 (45.7)	
	Retired	1072 (32.5)	857 (33.5)	215 (29.1)	
	Unemployed	367 (11.1)	274 (10.7)	93 (12.6)	
Income status, n (%)					<0.001
	Have difficulties	641 (19.5)	465 (18.2)	176 (23.8)	
	No problem	590 (17.9)	485 (19.0)	105 (14.2)	
	Sufficient for basic needs	2064 (62.6)	1606 (62.8)	458 (62.0)	
BMI, kg/m², median (IQR)		27.10 (24.30–30.10)	27.10 (24.20–30.1 0)	27.2 (24.55–30.30)	0.200
Current smoking, n (%)					0.263
	No	2832 (90.5)	2200 (90.8)	632 (89.4)	
	Yes	298 (9.5)	223 (9.2)	75 (10.6)	
Addiction, n (%)					
	No	2538 (81.1)	1977 (81.6)	561 (79.3)	0.180
	Yes	592 (18.9)	446 (18.4)	146 (20.7)	
Alcohol consumption, n (%)					0.786
	No	2754 (88.0)	2134 (88.1)	620 (87.7)	
	Yes	376 (12.0)	289 (11.9)	87 (12.3)	
History of Diabetes, n (%)					0.029
	No	2663 (80.2)	2087 (81.0)	576 (77.4)	
	Yes	656 (19.8)	488 (19.0)	168 (22.6)	
History of Hypertension, n (%)					0.082
	No	1625 (51.2)	1282 (52.0)	343 (48.3)	
	Yes	1550 (48.8)	1183 (48.0)	367 (51.7)	
Urinary incontinence, n (%)					<0.001
	No	2995 (95.6)	2344 (96.4)	651 (92.7)	
	Yes	139 (4.4)	88 (3.6)	51 (7.3)	
Osteoporosis, n (%)					<0.001
	No	3007 (90.6)	2366 (91.9)	641 (86.2)	
	Yes	312 (9.4)	209 (8.1)	103 (13.8)	
Fear of Fall, n (%)					<0.001
	Somewhat	875 (26.5)	631 (24.7)	244 (33.1)	
	Very much	385 (11.7)	243 (9.5)	142 (19.3)	
	Not at all	2036 (61.8)	1685 (65.8)	351 (47.6)	
PSQI score, Median (IQR)		5.0 (3.0 –9.0)	5.0 (3.0–8.0)	7.0 (4.0–10.0)	<0.001
CESD-10 score, Median (IQR)		10 (9.0–11.0)	10.0 (9.0–11.0)	10.0 (9.0–12.0)	<0.001

Discussion

This population-based cross-sectional study of Iranian older adults from the Neyshabur Longitudinal Study on Ageing demonstrated that falls are common and are associated with a combination of demographic, clinical, psychological, and socioeconomic factors. Advancing age, urinary incontinence, poor sleep quality, depressive symptoms, and lower income status remained independently associated with fall occurrence after multivariable adjustment.

Among all examined variables, fear of falling showed the strongest independent association and a clear dose–response pattern. These findings emphasize that fall risk in older adults should not be interpreted solely as a physical or functional problem, but rather as a multifactorial condition influenced by psychological and social vulnerability as well. The fall prevalence observed in the present study (22.4%) is broadly consistent with findings from other low- and middle-income settings and large population-based cohorts, although somewhat lower than estimates reported in some Iranian and European studies(17-19).

Table 2. Multivariable logistic regression analysis of factors associated with falls among older adults

Variable	Model 1 (Without fear of falling)		Model 2 (With fear of falling)	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Age (years)	1.022 (1.008–1.037)	0.002	1.017 (1.002–1.032)	0.022
Female sex	0.731 (0.500–1.067)	0.104	0.814 (0.554–1.195)	0.293
Living with someone	0.940 (0.718–1.231)	0.654	0.939 (0.715–1.235)	0.653
Current job status (overall)	—	0.529	—	0.506
Full-/part-time employment (Ref.)	1.00	—	1.00	—
Housewife	0.93 (0.64–1.35)	0.693	0.97 (0.67–1.41)	
Retired	0.74 (0.46–1.18)	0.208	0.75 (0.46–1.21)	
Unemployed	0.98 (0.71–1.36)	0.906	1.01 (0.72–1.40)	
Income status (overall)	—	0.033	—	0.046
Have difficulties (Ref.)	1.00	—	1.00	—
No problem	1.11 (0.88–1.40)	0.366	1.09 (0.86–1.37)	
Sufficient for basic needs	0.74 (0.57–0.96)	0.024	0.74 (0.57–0.97)	
BMI (kg/m²)	1.003 (0.983–1.024)	0.740	0.999 (0.979–1.020)	0.960
Diabetes	0.837 (0.673–1.040)	0.108	0.854 (0.685–1.065)	0.161
Hypertension	0.986 (0.820–1.187)	0.884	0.979 (0.812–1.181)	0.824
Urinary incontinence	1.589 (1.086–2.326)	0.017	1.549 (1.052–2.278)	0.026
Osteoporosis	0.748 (0.563–0.996)	0.047	0.785 (0.587–1.049)	0.101
PSQI score	1.047 (1.023–1.072)	<0.001	1.036 (1.012–1.061)	0.003
CESD-10 score	1.081 (1.039–1.125)	<0.001	1.068 (1.026–1.112)	0.001
Fear of falling (overall)	—	—	—	<0.001
Some fear vs. none	—	—	1.646 (1.338–2.025)	<0.001
High fear vs. none	—	—	2.414 (1.847–3.155)	<0.001
−2 Log Likelihood	3060.07		2989.49	

These variations may be partially explained by differences in population characteristics, study design, age structure, and fall ascertainment methods.

Our result that urinary incontinence is an independent predictor of falls (AOR ≈ 1.55) is in line with the finding from the Bushehr Elderly Health Program in Iran, where Khalagi et al. (2024) reported that urinary incontinence increased the odds of falls 1.78-fold (95% CI: 1.21–2.62) in multivariable analysis (20). Additionally, a recent systematic review and meta-analysis by Moon et al. showed that urinary incontinence was significantly associated with falls among older adults (OR = 1.59, 95% CI: 1.31–1.93) (21). Our results for sleep quality are consistent with earlier research demonstrating a distinct association between sleep disruptions and an increased risk of falls in older adults (22, 23). There are multiple possible mechanisms underlying this association. Poor sleep quality is related to slower reaction times, diminished attention, daytime sleepiness, and reduced cognitive capacities, all of which can compromise the ability to detect and respond to environmental hazards (24, 25). Additionally, persistent sleep problems may negatively affect gait stability, postural control, and neuromuscular coordination, thereby increasing the fall risk in older adults (26, 27). The association between depressive symptoms and falls found in this study is in agreement with prior evidence indicating that depression results in impaired physical function, reduced mobility, and a higher fall risk in older adults. Fear of falling demonstrated the strongest association with fall occurrence in the present study (28, 29). This finding is consistent with recent systematic reviews and meta-analyses that reported concern about falling was strongly associated with both current and future falls in older adults (30, 31). Several mechanisms may explain this strong association.

Older adults with fear of falling often use protective behavioral strategies such as reducing walking speed, limiting outdoor activities, and avoiding situations that are perceived as risky. Although these adaptations may seem protective at first, persistent restriction of activity may lead to muscle deconditioning, diminished physical performance, impaired balance and loss of mobility. Furthermore, a decrease in balance confidence may potentially impair an individual's ability to respond appropriately to environmental challenges, leading to a greater risk of future falls. These mechanisms may partially explain the dose-response association observed between fear of falling and fall incidence in the present study (32, 33). A striking result of the present study was the apparent protective association between osteoporosis and falls in Model 1 (AOR = 0.748, 95% CI: 0.563–0.996). This paradoxical finding should not be taken as evidence that osteoporosis per se decreases fall risk. Older adults diagnosed with osteoporosis are often advised to practice protective behaviors, such as increased caution during mobility, avoidance of high-risk activities, and appropriate use of assistive devices (34, 35). They may also be advised to undergo more frequent medical follow-up, fall-prevention counselling, calcium and vitamin D supplementation, and osteoporosis-specific treatment to reduce fracture risk. Such interventions may indirectly increase awareness of fall risk and promote safer behaviors.

Furthermore, fear of falling is common among individuals with osteoporosis because of concerns regarding fracture-related consequences, which may further encourage behavioral adaptation and activity modification)35, 36).Consistent with this interpretation, the association between osteoporosis and falls was attenuated and no longer statistically significant after adjustment for fear of falling (AOR = 0.785, p = 0.101), suggesting that fear-related behavioral responses may partially account for the initial finding. Nevertheless, given the cross-sectional design of the present study, causality cannot be established, and prospective studies are needed to clarify the temporal

relationships among osteoporosis, fear of falling, protective behaviors, and fall occurrence. Several variables that showed significant bivariate associations—female sex, diabetes, and hypertension—lost significance after multivariable adjustment. This is consistent with the view that these factors are not direct causes of falls but operate through intermediate mechanisms. For example, female sex was associated with falls in univariate analysis (52.0% of fallers were women, p = 0.006), but became non-significant in both models (Model 2 AOR = 0.814, p = 0.293). This attenuation may indicate that the observed association between female sex and falls was partially explained by factors that are more prevalent among women, including osteoporosis, fear of falling, depressive symptoms, and urinary incontinence, all of which were adjusted for in the multivariable models (30, 36).

Similarly, diabetes lost significance after adjustment (Model 2 AOR = 0.854, p = 0.161), suggesting that its association with falls may be influenced by diabetes-related complications such as peripheral neuropathy, visual impairment, impaired balance, and hypoglycaemic events, which were not directly assessed in the present study but have been identified as important contributors to fall risk among older adults with diabetes (37). Overall, the present findings are broadly consistent with previous Iranian and international studies showing that falls in older adults are associated with clinical, psychological, and functional vulnerabilities, including urinary incontinence, depressive symptoms, fear of falling, and multimorbidity (38). However, the present study adds population-based evidence from an Iranian aging cohort and highlights the particularly strong association of fear of falling with fall occurrence after adjustment for multiple clinical and psychosocial factors.

These findings have several important implications for fall-risk assessment and prevention among older adults. First, fall risk screening in Iranian older adults should routinely include assessment of fear of falling (e.g., using the Falls Efficacy Scale International), sleep quality (PSQI), urinary symptoms, and depressive symptoms (CESD 10 or PHQ 9), in addition to traditional physical assessments. Second, the strong independent effect of fear of falling (AOR >2.4 for high fear) supports the implementation of multicomponent fall-prevention strategies that include psychological assessment, balance training, graded activity exposure, and confidence-building interventions (39, 40). Third, the loss of significance for osteoporosis after adjusting for fear of falling suggests that fracture prevention programs should integrate psychological interventions; simply prescribing bone active medications without addressing fear may be insufficient. Fourth, the protective effect of sufficient income highlights the need for targeted fall prevention subsidies for low income older adults, including home safety modifications, vision correction, and exercise programs (41).

Strengths and Limitations

The key strengths of this study include its large, population-based sample (over 3,300 older adults) from the NeLSA cohort, which enhances the generalizability of findings for Iranian older adults. The use of two separate multivariable logistic regression models—with and without fear of falling—provides a clear and rigorous assessment of the independent contribution of psychological factors, particularly highlighting the strong dose-response association of fear of falling with fall occurrence. Additionally, the comprehensive evaluation of demographic, clinical, psychological, and socioeconomic factors, along with a thoughtful discussion of paradoxical findings (e.g., the apparent protective effect of osteoporosis), adds depth and clinical relevance to the results.

Several limitations should be considered when interpreting these findings. First, the cross-sectional design precludes causal inference and prevents the determination of the temporal relationship between the examined variables and fall occurrence. Therefore, the observed findings should be interpreted as associations rather than evidence of causal relationships. Second, fall history was assessed based on 12-month self-reported recall, which may introduce recall bias—particularly among older adults with potential cognitive impairment—leading to under- or over-reporting of falls. Third, fear of falling and fall history were assessed simultaneously, which may result in same-source bias and bidirectional associations. Finally, residual confounding cannot be ruled out as several potentially relevant factors, such as polypharmacy, use of sedatives, antidepressants, antihypertensive medications, cognitive status, physical performance, visual impairment, and environmental hazards, were not available for analysis. To address this limitation, future studies should incorporate comprehensive geriatric assessments and prospective data collection, including validated measures of cognitive function (e.g., MMSE), medication burden (polypharmacy indices), physical performance (e.g., gait speed and grip strength), visual assessment, and standardized evaluation of environmental hazards, in order to improve confounder control Moreover, the relatively low Nagelkerke R^2 values indicate that a substantial proportion of fall variability remained unexplained, highlighting the multifactorial and complex nature of falls among older adults. Despite these limitations, the large population-based sample and comprehensive assessment of demographic, clinical, psychological, and socioeconomic factors strengthen the robustness of the findings.

Conclusion

Falls remain a common and clinically important problem among Iranian older adults, affecting more than one-fifth of participants in this population-based study. Advancing age, urinary incontinence, poor sleep quality, depressive symptoms, lower income status, and fear of falling were independently associated with fall occurrence. Among these factors, fear of falling showed the strongest independent association, emphasizing the importance of psychological factors in fall-risk assessment. These findings highlight the multifactorial nature of falls and suggest that prevention strategies should not only focus on physical and clinical conditions but also on psychological and socioeconomic determinants. Routine assessment of fear of falling, sleep disturbances, depressive symptoms, and urinary symptoms could allow an earlier identification of high-risk subjects and support more targeted interventions. Given the cross-sectional nature of the study, these findings should be viewed as associations and not as evidence of causal relationships. Future longitudinal analyses of the subsequent NeLSA waves are needed to better understand temporal relationships and to

identify causal pathways linking modifiable risk factors to fall occurrence.

List of Abbreviations

AOR: Adjusted Odds Ratio, **BMI:** Body Mass Index, **CESD-10:** 10-item Center for Epidemiologic Studies Depression Scale, **CI:** Confidence Interval, **IQR:** Interquartile Range, **NeLSA:** Neyshabur Longitudinal Study on Ageing, **OR:** Odds Ratio, **PERSIAN:** Prospective Epidemiological Research Studies in Iran, **PSQI:** Pittsburgh Sleep Quality Index, **SD:** Standard Deviation, **WHO:** World Health Organization.

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Ethical Approval

The Neyshabur Longitudinal Study on Ageing (NeLSA) was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval for the study was obtained from the Ethics Committee of Neyshabur University of Medical Sciences (Approval No. IR.NUMS.REC.1404.081). Written informed consent was obtained from all participants prior to enrollment.

Conflict of Interests

The authors declare that they have no competing interests.

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