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Original Research

The relationship between symptoms of depression and falls in older adults: A case-control study

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ABSTRACT

Background: Fall is one of the most common and severe syndromes of older adults that causes disability. Depression is one of the disorders that can lead to many problems, but the results have been contradictory.
Objectives: This study aimed to determine the relationship between symptoms of depression and falls in older adults.
Design: This observational study.
Setting: We collected the data from the health records of older adults in comprehensive health service centers.
Participants: We selected two groups of older adults (60 years and above) as the case group (400 older adults with a history of falling) and the control group (400 older adults without a history of falling).
Measurements: The history of falling was based on the report of old people during a month ago. Symptoms of Depression has been assessed using the Goldberg General Health Questionnaire (GHQ-28).
Results: 62.5 % of the sample were old women. The elderly males were 74.6 ± 0.47 years, and the elderly women were 72.9 ± 0.34 years. There was no significant relationship between symptoms of depression and falls in older adults (OR = 1.321, $P = 0.203$). Age (over 75 years) (OR = 4.391, $P < 0.001$) and living alone (OR = 2.924, $P < 0.001$), and high school education (OR = 3.947, $P = 0.008$) are risk factors.
Conclusions: The symptoms of depression are not related to falls in older adults. However, being above 75 years old and living alone increases the risk of falls, and higher education reduces the risk of falls.

1. Introduction

The increase in the aging population is one of the most important changes in the social structure of societies in the last century [1]. The prevalence of some diseases and syndromes increases with age. Falling is one of the common syndromes that occur with age in older adults, which can cause many physical, psychological, social, and economic complications [2].

Frequent and unwanted falls are one of the common complaints of elderly people, which lead to movement and social restrictions and a drop in daily activities in older adults [3]. Falling means a person landing on a lower level (floor or on an object) with physical and psychological damage [4]. Falling can cause disability and dependency in the elderly and increase their mortality. >20 % of old people experience falls at least once a year [5]. Falling is the second cause of unintentional injury death in the world [6]. Various studies have estimated 20 to 30 % of the prevalence of falls in older adults [5,7]. The results of studies show that 42.4 % of people suffer from walking problems after a fall [8].

Psychological status undergoes age-related changes with increasing age, just like physical status. This leads to an increase in the prevalence of one of the common problems in old age, that is, depression [9]. It has been estimated that the prevalence of depression symptoms is about 30

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% with the use of GDS in older adults [10,11]. Depression is a complex syndrome. The most common manifestations of this disorder are insomnia, fatigue, anorexia, weight loss, apathy, hopelessness, communication problems, and changes in sleep and motor activity [12]. Depression is a disorder that can lead to many problems in older adults in a cascade manner [13]. It has been proposed that depressive symptoms predict basic activities of daily living" (BADLs) in elderly people [14]. Depression has also been found to be associated with impaired gait and balance [15].

Psychomotor slowing and gait velocity are some symptoms of depression that can affect balance and walking [16]. Depression can lead to falls through mediated pathways based on logical reasoning. Depression increases fall risk through cognitive impairment, particularly in executive function and dual-tasking [17]. Additionally, medication side effects (e.g., SSRIs causing dizziness) [18], autonomic dysfunction (such as orthostatic hypotension) [19].

However the relationship between depression and falls has had conflicting results; some studies have stated that falls and depression are related [20,21] and others have stated that there is no relationship between them [22,23]. Therefore, this study aimed to determine the relationship between symptoms of depression and falls in older adults. We hypothesize that depressive symptoms are significantly associated with falls in this study.

2. Methods

2.1. Research design

This study is an observational study that assessed the data of old people referred to Comprehensive Health Service Center (CHSC) in October 2021. Baharestan is one of the cities of Tehran province (with a population of about 300 thousand people). The CHSC consist of the health centers and health houses in Baharestan city, which record the information of all the people under their coverage in the integrated health system (SIB). We extracted information from SIB. Therefore, old people were included in this study, including two groups with a history of falling and without a history of falling during a month ago.

2.2. Sample

We selected case and control samples based on the criteria of falls, age over 60 years, and no cognitive impairment in the medical record (mini-cog). Therefore, we calculated 800 old people for the minimum number of samples ($P = 0.50$; $\alpha = 0.05$; $\beta = 0.2$; Assumed odds ratio$= 1.5$; Ratio $_{\text{non-case/case}} = 1$). We selected 400 old people with a history of falls during a month ago as the case group (the falling was based on self-report) and 400 old people without a history of falls as the control group at the same time. Inclusion criteria: age above 60 years, complete information, no cognitive impairment based on medical records. We tried to adjust the confounding variables in the case and control groups (including underlying diseases such as diabetes, hypertension, and heart disease).

At first, we selected 400 older people with a history of falling and 400 old people without a history of falling during the last month in the comprehensive health center system. Then, we checked the history of depression in the last three years of the samples (Fig. 1).

2.3. Data collection

We collected the data from the information recorded in the files of older adults referred to comprehensive health service centers (files that had complete information from October 2018 to October 2021). Healthcare workers collected data from the older adults at the time of referral and during a comprehensive assessment. The data are recorded in the Integrated Health System (SIB).

- The history of falling was based on the report of old people during a month ago (once or more). The 1-month recall of falls has been validated in prior studies [24,25].
- Symptoms of Depression has been assessed using the Goldberg General Health Questionnaire (GHQ-28). The GHQ is one of the most well-known screening tools for mental health disorders, which is used to measure mental health status. This questionnaire has four subscales as follows: A) Physical symptoms; B) anxiety; C) disorders in social behavior and function; and D) symptoms of depression. The total score is obtained from the sum of the scores of the four subscales. The scoring method is the Likert scale (not at all: zero, somewhat: one, little: two, very little: three). A total score of 19.2 and above indicates a lack of general health and a score below 19.2 indicates mental health. Cronbach's alpha was 0.94, and test-retest reliability was 0.65 in previous study [26]. We examined symptoms of depression through the total score and the depression subscale score. The GHQ has four subscales: physical symptoms, anxiety, cognitive and social functioning impairment, and depression. We used the depression subscale in this study (seven items). It should be noted that this depression subscale was used for depression in older adults in the SIB system.
- Mini-Cog consists of two parts. First, we ask the participant to remember three words (e.g., chicken, pomegranate, and suitcase). After a few minutes, we asked again what the three words were. The second part is to draw a clock that shows us the time at 11:10. The scoring for the first section is one point for each correct word, and the complete score is three. The clock part, the numbers one to twelve, is in a circle, in the clockwise direction. There are 2 hands. One points to the elven and the other to two. Any watch that does not have these elements will receive an abnormal score [27]. This tool is commonly used in the Persian language due to its simplicity and ease of understanding. Cases with cognitive impairment were replaced based on the Mini-Cog.

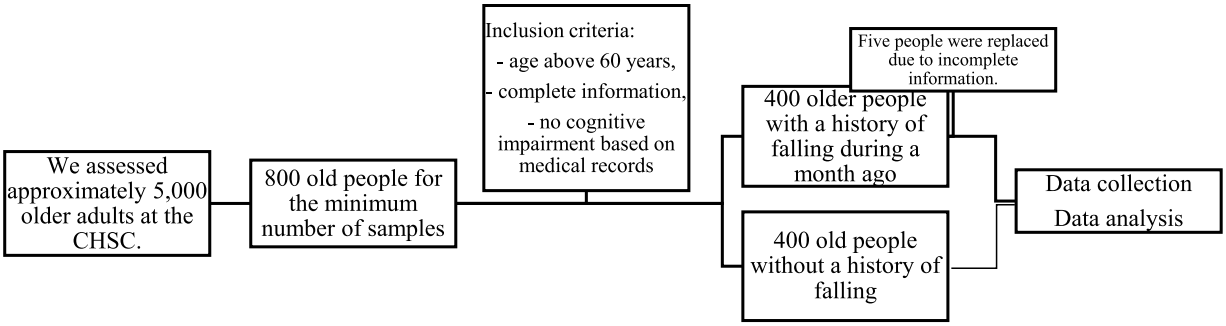

Fig. 1. Consort flow diagram of case-control study (CHSC: Comprehensive Health Service Center).

2.4. Data analysis

We analyzed the data using SPSS v.21 software and descriptive statistics (mean and standard deviation) inferential chi-square statistics and logistic regression analysis. We checked all variables of the study with the Logistic Regression Method (Enter method). The Enter method forces all hypothesized predictors into the model, ensuring: Theoretical coherence (variables are included based on prior research or subject-matter expertise). Avoidance of data dredging (reducing false positives from multiple testing). There were no dropouts or missing data.

3. Results

The samples included 37.5 % old men (300 people) and 62.5 % old women (500 people). The mean age of elderly men was 74.6 ± 0.47 years, and the elderly women was 72.9 ± 0.34 years. The average height and weight of the study samples are 165 cm and 73.4 kg, respectively. Other descriptive information is shown in Table 1. It was estimated that the number of elderly people with symptoms of depression was about 22.63 %.

We identified the relationship between independent variables with falls; independent variables include age ($P < 0.001$), education level ($P < 0.001$), occupation ($P < 0.013$), living arrangement ($P < 0.001$), body mass index ($P = 0.01$), and symptoms of depression ($P < 0.001$) in univariate analysis (Table 1).

We used logistic regression analysis to create an equation to identify the factors affecting the fall. There was no significant relationship between symptoms of depression and falls in older adults (OR = 1.321, $P = 0.203$). Table 2 shows that age: 60–74 yrs., OR = 0.229, $P < 0.001$; age >75 yrs., OR = 4.391, $P < 0.001$; high school education: OR = 3.947, $P = 0.008$, and Living with family: OR = 0.366, $P < 0.001$; living alone: OR= 2.924, $P < 0.001$ (Table 2). We checked Spearman's correlation before the regression and there was no collinearity ($|r_s|$[1]< 0.5 and VIF[2] <1).

4. Discussion

The results showed that there is a significant relationship between ages, living alone, and high school education with falls in older adults.

A study has found that both depression and antidepressant use are associated with the risk of falls [16]. Also, the other study stated that physical slowness was associated with greater symptoms of anxiety and depression, cognitive impairment, and falls. Slow gait speed is a risk factor for depression [28]. The discrepancy between the results of the past studies and the present study may be that most studies have considered psychomotor slowing as a predictor of depression and, accordingly, depression as a cause of falls. This relationship may be such that depression does not have a direct effect on falling, and psychomotor slowing is its direct cause (this requires more detailed studies).

Previous findings suggested that depression increases the risk of falls, but we did not find this finding. This could indicate that other factors play a role in fall risk and depression that needs to be explored in future studies. Factors like fatigue, cognitive impairment, functional decline, and side effects of some medications which are also linked to depression, can contribute to an increased risk of falling. Therefore, if there are other symptoms in addition to depression, we should be more concerned about the risk of falls in older adults.

William et al. found that age over 80 years was a risk factor for falls [3]. A study showed that the prevalence of falls in older people over 80 years old was 67 %, in the age group of 70–79 years old 33 %, and in the age group <70 years old 15 % [29]. Frailty increases with age [30] and this seems to explain more falls at older ages.

The study found that the odds ratio of fall are about three times higher for seniors living alone. A study of 113,000 seniors (above 60 years) found that the rate of falls was higher in seniors who lived alone than in seniors who lived with family [31]. Some studies have considered the important role of living with family in preventing falls and symptoms of depression in older adults [32–34]. Living with family can justify these findings for reasons such as increasing cognitive activities and physical function and family support. Living with family and receiving their care is crucial in preventing falls in community-dwelling seniors [35]. A protective factor is any condition or intervention that reduces the likelihood of fall in this study [36]. Sun et al. found that a well-functioning family is a protective factor for falls in old age. Living with family increases the sense of security and support in older adults [37].

Past studies showed that falls in older adults with lower education were higher than in older people with higher education [38,39]. However, this study found that higher education was a predictor of more falls. This finding could be the higher activity of older adults with higher education or due to lower referral or reporting of older adults with lower education.

Sex did not affect falls in this study. This finding was also obtained in other studies [38,40]. A longitudinal study showed that sex affects falls with the association of different risk factors [41]. The type of study may be the reason for not finding sex differences in falls. Several studies have found a significant association between obesity and the risk of falling [42,43]. However, this study did not show a relationship between obesity and falls.

Studies have reported an inconsistent relationship between depression and falls; some studies have found a significant relationship between depression and falls [20,21] and others have not found such a relationship [22,23]. The study also found that symptoms of depression did not affect falls.

It is important to manage depression in older adults, but perhaps what is more important in falls is psychomotor slowing, and depression alone is not a predictor of falls. But the important finding was the increased risk of falls in those living alone and those over 75. This study suggests that there are other variables (e.g., fatigue, functional decline, psychomotor retardation, etc.) between depression and fall risk that need to be examined more closely. Healthcare providers and clinicians should pay more attention to psychomotor function in older adults at risk of falls, in addition to symptoms of depression. These findings can be helpful for researchers in future studies. Also, show caregivers that living with family can prevent falls, and the young-old are less at risk of falls.

4.1. Limitations

The design of this study was retrospective and it was not possible to control all the confounding factors and have close access to the participants, so there may be limitations in the results. These were also limitations of the study: potential recall bias in self-reported falls; use of a general rather than geriatric-specific depression instrument; sampling bias from only including individuals with complete records; lack of stratification by severity of depression or number of falls. We did not test interactions depression × age or × living conditions in the study.

It is recommended that studies be conducted with a prospective design and depression classification using a more accurate tools.

5. Conclusion

This study showed that symptoms of depression is not related to falls in older adults. However age above 75 years and living alone leads to an increase in the risk of fall and higher education reduces the risk of fall. Falls are a common and multifactorial problem among older adults. The aging population is increasing and there is a need to develop fall prevention programs in the healthcare system.

[1] Spearman's correlation coefficient.
[2] Variance Inflation Factor.

Table 1
Demographic characteristics in older adults with fall and without fall.

Variables		F (%)	Fall	Without fall	P
Age	60 −75 yrs.	414 (51.75)	134 (33.5)	280 (70)	$\chi^2 = 106.71$
	>75 yrs.	386 (48.25)	266 (66.5)	120 (30)	$P < 0.001$
Sex	Male	300 (37.5)	150 (50)	150 (50)	$\chi^2 = 0.000$
	Female	500 (62.5)	250 (50)	250 (50)	$P = 1.00$
Education	Illiterate	512 (64)	276 (69)	236 (59)	$\chi^2 = 22.68$
	Primary education	252 (31.5)	119 (29.75)	133 (33.25)	$P < 0.001$
	High school	36 (4.5)	5 (1.25)	31 (7.75)	
Marriage	Single	8 (1)	4 (1)	4 (1)	$\chi^2 = 7.01$
	Married	662 (82.8)	318 (79.5)	344 (86)	$P = 0.07$
	Divorced	25 (3.1)	13 (3.25)	12 (3)	
	Widow/widower	105 (13.1)	65 (16.25)	40 (10)	
Occupation	Employed	56 (7)	18 (4.5)	28 (7)	$\chi^2 = 8.66$
	Unemployed	507 (63.4)	254 (63.5)	253 (63.25)	$P = 0.013$
	Retired	237 (29.6)	128 (32)	109 (27.25)	
Symptoms of Depression	Yes	181 (22.6)	118 (29.5)	63 (15.75)	$\chi^2 = 21.60$
	No	619 (77.4)	282 (70.5)	337 (84.25)	$P < 0.001$
Living arrangement	With family	724 (90.5)	345 (86.25)	379 (94.75)	$\chi^2 = 16.81$
	Alone	76 (9.5)	55 (13.75)	21 (5.25)	$P < 0.001$
BMI index	Underweight = <18.5	1 (0.1)	1 (0.25)	0	$\chi^2 = 13.35$
	Normal weight = 18.5–24.9	124 (15.5)	41 (10.25)	72 (18)	$P = 0.01$
	Overweight = 25–29.9	601 (75.1)	315 (78.75)	297 (74.25)	
	Obesity (Class I) = 30.0 – 34.9	73 (9.1)	43 (10.75)	30 (7.5)	
	Obesity (Class II) = 35.0 – 39.9	1 (0.1)	0	1	

Table 2
Logistic regression of independent variables and falls.

Variables		B	S.E.	P-value	Exp. (B) or β	95 % C.I. for Exp. (B)	
						Lower Limit	Upper Limit
Age (60–74 yrs.)		−1.476	0.176	<0.001	0.229*	0.162	0.323
Sex (Male)		−0.213	0.240	0.375	0.808	0.505	1.294
Education (Illiterate)	Primary	0.032	0.170	0.851	1.032	0.740	1.441
	High school	1.373	0.519	0.008	3.947*	1.427	10.914
Marriage (Single)	Married	0.684	0.803	0.395	1.981	0.411	9.557
	Divorced	0.048	0.897	0.957	1.049	0.181	6.090
	Widow/widower	0.867	0.827	0.295	2.380	0.470	12.047
Occupation (Employed)	Unemployed	0.065	0.362	0.858	1.067	0.525	2.171
	Retired	−0.078	0.344	0.820	0.925	0.472	1.813
Symptoms of Depression (Yes)		0.278	0.219	0.203	1.321	0.861	2.028
Living arrangement (with family)		−1.004	0.284	<0.001	0.366*	0.210	0.638
Constant		21.817	40,210.689	1.000	2986,294,826.616	–	–
Hosmer and Lemeshow Test: $P = 0.471$, Chi-square= 6.602, Pseudo-R^2= 0.19							

*: Significant.

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Ethics approval

Names or identity details of old people remained confidential because the statistical analysis was performed only on the electronic data file. This research was approved by the ethics committee of Iran University of Medical Sciences, with the code of ethics approval number IR.IUMS.REC.1400.850.

CRediT authorship contribution statement

Manizheh Moshtaghi: Data curation, Conceptualization. **Sadegh Kargarian-Marvasti:** Methodology, Formal analysis. **Pouya Farokhnezhad Afshar:** Writing – review & editing, Writing – original draft. **Seyedeh Melika Kharghani Moghaddam:** Writing – original draft, Conceptualization. **Fatemeh Bahramnezhad:** Validation, Software, Methodology.

Declaration of competing interest

The authors declare that they have no conflicts of interest.

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