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Analysis Of Risk Factors For Falls Among The Elderly

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Abstract

Falls are a major health problem among older adults and may result in injuries, functional limitations, loss of independence, and increased healthcare utilization. Fall risk is multifactorial and may involve intrinsic and extrinsic factors, including age, previous falls, balance impairment, muscle weakness, visual impairment, medication use, comorbidities, and environmental hazards. To analyze factors associated with fall risk among older adults. A quantitative analytic study with a cross-sectional design was conducted in August 2026 in the working area of Sukamaju Public Health Center. A total of 78 older adults were selected using purposive sampling. Independent variables included age, history of falls, muscle strength, balance, visual impairment, use of fall-risk medications, comorbidities, and home environmental conditions. Fall risk was assessed using the Timed Up and Go (TUG) test and categorized into low and high risk. Bivariate analysis used the chi-square test, while multivariate analysis used logistic regression. Of the 78 older adults, 43 (55.1%) were classified as having high fall risk and 35 (44.9%) as having low fall risk. Significant associations were found between fall risk and history of falls ($p=0.002$), muscle strength ($p=0.011$), balance impairment ($p<0.001$), visual impairment ($p=0.019$), use of fall-risk medications ($p=0.028$), comorbidities ($p=0.037$), and home environmental conditions ($p=0.014$). Age was not significantly associated with fall risk ($p=0.083$). Multivariate analysis showed that balance impairment was the strongest determinant of fall risk, with an odds ratio of 4.72. History of falls, muscle strength, balance, visual impairment, medication use, comorbidities, and environmental conditions are associated with fall risk among older adults. Balance impairment is the strongest determinant.

Keywords: Older Adults, Fall Risk, Balance, Muscle Strength, Visual Impairment

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1. Introduction

Aging is a physiological process accompanied by changes in physical, sensory, cognitive, and functional abilities. Older adults are at an increased risk of experiencing various geriatric conditions, one of which is falling (World Health Organization [WHO], 2025). The WHO identifies falls as a major public health concern. Globally, approximately 684,000 deaths occur annually due to falls, and adults aged over 60 years are at a higher risk of death or serious injury resulting from falls (WHO, 2021).

Falls among older adults can cause bruises, wounds, fractures, head injuries, mobility limitations, and reduced ability to perform activities of daily living. These consequences are not limited to physical health but may also lead to a fear of walking or engaging in daily activities, resulting in reduced physical activity and subsequent muscle weakness (Rubenstein, 2006; Tinetti & Kumar, 2010). The WHO emphasizes that fall prevention among older adults should address strength and balance training as well as environmental factors (WHO, 2021).

The risk of falling is multifactorial. Factors commonly associated with falls include a history of previous falls, gait impairment, the use of assistive devices, vertigo, neurological disorders, the use of certain medications, muscle weakness, balance impairment, and sensory deficits (Deandrea et al., 2010; Lord et al., 2007). A systematic review and meta-analysis by Deandrea et al. (2010) identified a history of previous falls and gait impairment among the important factors associated with falls in community-dwelling older adults.

A history of falls is an important risk factor because older adults who have previously experienced a fall may develop reduced self-confidence, fear of falling again, and activity restriction. These conditions may lead to decreased physical activity and further deterioration in gait and balance (Tinetti & Kumar, 2010). Therefore, a history of falls should be included in routine fall risk assessments (Montero-Odasso et al., 2022).

Balance and mobility are also essential components of fall risk assessment. The Centers for Disease Control and Prevention (CDC), through its Stopping Elderly Accidents, Deaths, and Injuries (STEADI) initiative, recommends assessing gait, strength, and balance using several functional tests, including the Timed Up and Go, 30-Second Chair Stand, and 4-Stage Balance Test (Centers for Disease Control and Prevention [CDC], 2025a).

Visual impairment can further compromise older adults' ability to identify obstacles and adjust their body position to their surroundings. Vision problems are recognized as an important consideration in fall prevention, and appropriate interventions include vision assessment, suitable footwear, improved lighting, and modifications to the home environment (CDC, 2025a; Montero-Odasso et al., 2022).

Medication use is another important consideration in fall prevention. Certain medications may cause drowsiness, dizziness, balance disturbances, or orthostatic hypotension, thereby increasing the risk of falls. Medication review is therefore recommended for older adults at risk of falling, particularly to identify potentially

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inappropriate medications and medications associated with falls (American Geriatrics Society Beers Criteria Update Expert Panel, 2023; CDC, 2025b).

Comorbidities, such as cardiovascular disorders, neurological conditions, diabetes, and musculoskeletal disorders, may affect mobility and balance in older adults. Environmental hazards, including slippery floors, inadequate lighting, loose rugs, stairs without handrails, and unsafe bathrooms, may also increase the risk of falls (Lord et al., 2007; Montero-Odasso et al., 2022).

Previous studies and international guidelines indicate that fall risk factors interact with one another; therefore, assessments should not focus on a single factor alone. The World Guidelines for Falls Prevention and Management recommend a multifactorial approach that evaluates fall history, gait, balance, medication use, sensory impairment, comorbidities, and environmental factors (Montero-Odasso et al., 2022).

Given these circumstances, identifying the determinants of fall risk is important in primary healthcare settings. Information regarding the factors that contribute most significantly to fall risk can serve as a basis for developing more targeted fall prevention interventions, including individualized exercise programs, medication review, and environmental modifications (Montero-Odasso et al., 2022; Sherrington et al., 2019).

This study aims to analyze the determinants of fall risk among older adults based on age, history of falls, muscle strength, balance, visual impairment, use of fall-risk-increasing medications, comorbidities, and home environmental conditions..

2. Methods

This study employed a quantitative analytical cross-sectional design to examine the associations between fall risk and its determinants among older adults in the working area of Sukamaju Public Health Center in August 2026. The study involved 78 older adults selected through purposive sampling from the population registered in elderly healthcare services. Eligible participants were aged ≥60 years, resided within the study area, were able to communicate effectively, provided informed consent, and could undergo mobility assessments with assistance when necessary.

Individuals with acute medical conditions, impaired consciousness, inability to complete the assessment procedures, or acute lower-limb injuries were excluded. Data were collected through interviews, observations, physical assessments, and relevant healthcare records using respondent characteristics questionnaires, fall history forms, muscle strength and balance assessments, vision assessments, medication and comorbidity checklists, and home environmental assessment forms.

Fall risk was assessed using the Timed Up and Go (TUG) test, in which participants were instructed to stand up from a chair, walk a predetermined distance, turn around, return to the chair, and sit down while completion time was recorded using a stopwatch. Longer completion times indicated slower mobility and potentially increased fall risk. Univariate analysis was used to describe the distribution of study variables, bivariate analysis was conducted using the chi-square test with a significance level of \(p<0.05\), and multivariate logistic regression was performed to identify the factors most strongly associated with fall

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risk. Ethical principles, including informed consent, confidentiality, respect for participants' rights, and the right to withdraw at any time, were observed throughout the study.

3. Result And Discussion

a. Result

Table 1. Characteristics of Older Adults

Characteristics	n	%
Age		
60–69 years	42	53.8
70–79 years	27	34.6
≥80 years	9	11.5
Sex		
Male	31	39.7
Female	47	60.3
Education level		
No formal Education/Elementary school	29	37.2
Junior high school	22	28.2
Senior high school	19	24.4
Higher education	8	10.3
Living arrangement		
Living with family	67	85.9
Living alone	11	14.1

Based on Table 1, most respondents were aged 60–69 years (42; 53.8%) and female (47; 60.3%). The majority of older adults lived with their families (67; 85.9%).

Table 2. Distribution of Factors Associated with Fall Risk

Factor	n	%
History of falls	31	39.7
No history of falls	47	60.3
Poor muscle strength	34	43.6
Good muscle strength	44	56.4
Balance impairment	37	47.4
Good balance	41	52.6
Visual impairment	29	37.2
Good vision	49	62.8
Using fall-risk-increasing medication	27	34.6
Not using	51	65.4
Two or more comorbidities	35	44.9
Fewer than two comorbidities	43	55.1
Hazardous home environment	32	41.0
Relatively safe home environment	46	59.0

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Balance impairment was found in 37 respondents (47.4%), while 31 respondents (39.7%) had a previous history of falls.

Table 3. Distribution of Fall Risk Based on the TUG Assessment

Fall risk	n	%
Low	35	44.9
High	43	55.1
Total	78	100

A total of 43 older adults (55.1%) were classified as having a high risk of falling based on mobility assessments and risk factor evaluations.

Table 4. Associations Between Determinants and Fall Risk

Factor	Low risk, n (%)	High risk, n (%)	p
Age ≥70 years	12 (33,3)	24 (66,7)	0.083
Age 60–69 years	23 (54,8)	19 (45,2)	
History of falls	7 (22,6)	24 (77,4)	0.002
No history of falls	28 (59,6)	19 (40,4)	
Poor muscle strength	10 (29,4)	24 (70,6)	0.011
Good muscle strength	25 (56,8)	19 (43,2)	
Balance impairment	8 (21,6)	29 (78,4)	<0,001
No balance impairment	27 (65,9)	14 (34,1)	
Visual impairment	9 (31,0)	20 (69,0)	0.019
Good vision	26 (53,1)	23 (46,9)	
Fall-risk-increasing medication	8 (29,6)	19 (70,4)	0.028
Not using	27 (52,9)	24 (47,1)	
Two or more comorbidities	11 (31,4)	24 (68,6)	0.037
Fewer than two comorbidities	24 (55,8)	19 (44,2)	
Hazardous environment	9 (28,1)	23 (71,9)	0.014
Safe environment	26 (56,5)	20 (43,5)	

The analysis showed that history of falls, muscle strength, balance, visual impairment, use of fall-risk-increasing medications, number of comorbidities, and environmental conditions were significantly associated with fall risk. Age was not statistically significantly associated with fall risk.

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Table 5. Logistic Regression Results for Determinants of Fall Risk

Variable	OR	95% CI	p
History of falls	3.41	1,28–9,07	0.014
Poor muscle strength	2.76	1,09–6,98	0.033
Balance impairment	4.72	1,78–12,53	0.002
Visual impairment	2.31	0,89–5,99	0.084
Fall-risk-increasing medication	2.14	0,82–5,57	0.119
Comorbidities	1.98	0,77–5,08	0.156
Hazardous environment	2.43	0,96–6,17	0.061

Multivariate analysis showed that balance impairment was the most dominant factor. After controlling for other variables, older adults with balance impairment had approximately 4.72 times higher odds of being at high risk of falling than those without balance impairment.

b. Discussion

The findings showed that age was not statistically significantly associated with fall risk, although the proportion of older adults at high risk was greater among those aged ≥70 years. This suggests that age may increase vulnerability but should not be considered the sole determinant of fall risk, as functional capacity and physical condition vary among individuals (Lord et al., 2007; Montero-Odasso et al., 2022). A history of falls was significantly associated with fall risk, consistent with previous meta-analytic findings identifying previous falls as an important predictor of falls among community-dwelling older adults (Deandrea et al., 2010). Therefore, fall history should be included in routine screening because it may reflect underlying balance impairment, muscle weakness, gait problems, visual impairment, medication effects, or environmental hazards (Montero-Odasso et al., 2022).

Reduced muscle strength was associated with an increased risk of falling, as muscle weakness can impair standing, walking, turning, and postural stability. Combining strength and balance exercises is therefore an important fall-prevention strategy (Sherrington et al., 2019). Balance impairment was the strongest determinant in this study, highlighting the importance of assessing mobility and balance through functional tests such as the Timed Up and Go (TUG), alongside other relevant assessments. The World Guidelines for Falls Prevention and Management also emphasize comprehensive fall-risk evaluation rather than relying on a single assessment tool (Montero-Odasso et al., 2022).

Visual impairment was significantly associated with fall risk because it can hinder the identification of obstacles, stairs, and uneven surfaces. Accordingly, vision assessments, adequate lighting, and home modifications are important preventive measures (Centers for Disease Control and Prevention [CDC], 2025a; Montero-Odasso et al., 2022). Medication use was also associated with fall risk in the bivariate analysis, as certain medications may cause dizziness, sedation, impaired coordination, or orthostatic hypotension. Regular medication reviews by qualified healthcare

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professionals are therefore recommended to identify potentially inappropriate medications and reduce medication-related fall risks (American Geriatrics Society Beers Criteria Update Expert Panel, 2023; CDC, 2025b). Medications should not be discontinued without professional guidance.

Older adults with two or more comorbidities had a greater proportion of high fall risk, indicating that multiple health conditions may affect mobility, balance, muscle strength, sensory function, and cognition. Home environmental conditions were also significantly associated with fall risk, particularly hazards such as slippery floors, loose rugs, inadequate lighting, and unsafe stairs or bathrooms. These findings support a comprehensive approach to fall prevention that integrates balance and strength training, vision assessment, medication review, management of comorbidities, and home safety modifications. Such multifactorial interventions are recommended to reduce fall risk and promote independence among community-dwelling older adults (Montero-Odasso et al., 2022; Sherrington et al., 2019).

4. Conclusion

The study found that 55.1% of older adults were at high risk of falling. Fall risk was significantly associated with a history of falls, muscle strength, balance impairment, visual impairment, use of fall-risk-increasing medications, comorbidities, and home environmental conditions, whereas age was not statistically significantly associated with fall risk. Balance impairment was the most dominant determinant (OR = 4.72). Therefore, public health centers and nurses should conduct regular fall-risk screening, provide preventive education, promote strength and balance exercises, review medications, and assess home safety. Families should help create a safe living environment, while older adults should remain physically active according to their abilities and undergo regular health and vision assessments. Future research should consider longitudinal or cohort designs and include additional factors such as fear of falling, nutritional status, physical activity, cognitive function, and sleep quality.

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