

# Risk of Fall among Older Adults and its Association with Cognitive Impairment in a Semi-Urban Community

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## Abstract

**Context:** Fall in older people is a major public health concern. Two-third of the death due to fall are preventable. Risk assessment in older adults therefore is the first step to identify the high-risk group to plan need-based intervention. **Aims:** The aim of the study was to determine the prevalence of risk of fall among older adults and its association with cognitive impairment and sociodemographic characteristics. **Settings and Design:** A cross-sectional study was conducted in the field practice areas of the department of community medicine in a teaching hospital in South Kerala, India. **Subjects and Methods:** A semi-structured questionnaire was used to collect the data. Berg Balance Scale and Mini-Cog Test were used for measuring risk of fall and cognitive impairment. **Statistical Analysis Used:** Descriptive statistics and logistic regression were used for the statistical analysis using SPSS. **Results:** Among the older adults, 45% were at risk of fall, 42.4% in males and 57.6% in females. The risk of fall was found to be significantly associated with cognitive impairment, (odds ratio = 3.89, confidence interval at 95% = 2.06–7.31,  $P < 0.001$ ). Advanced age, female gender, and unemployed status were significantly associated with the risk of fall. **Conclusions:** The risk of fall prevalence was high and significantly related to cognitive impairment, advanced age, female gender, and occupational status, with more than half of those currently not working having a higher risk. The study would recommend regular follow-up of risk groups for prevention a good percentage of fall and thereby the related injuries.

**Keywords:** Cognitive impairment, community dwelling, older adults, risk of fall

## INTRODUCTION

Population aging is associated with various types of risks, causing negative consequences such as deteriorating health, declining ability to live independently, or premature death. This consequently leads to higher utilization of health care and dependence on societal resources for the older person.<sup>[1]</sup> According to the 2011 Indian Population Census, the number of older adults over the age of 60 was 104 million, and by 2030, it is expected to grow up to 198 million.<sup>[2-4]</sup>

Fall is the most common type of accident in people above 65 years and a major cause of injury-related hospitalization in this age group. A review on falls reported that the incidence of falls in India over 60 years of age ranged from 14% to 53% over a period of 6 months to 2 years.<sup>[5]</sup> Injuries caused by falls are associated with disability, loss of independence, increased length of hospital stay, and higher mortality.<sup>[6]</sup> The most common risk factors are reduced balance and gait, previous history of fall, multimorbidity, and polypharmacy.<sup>[7]</sup> Two-third of the death due to fall are preventable, and the World Health

Organization (WHO) has put forward “active aging” that helps to improve the quality of life for the elderly population.<sup>[8,9]</sup> As per the WHO Global Falls Prevention Survey, people aged 65 years and older fell between 28% and 35% per year and this ratio increases as age and frailty levels increase.<sup>[9]</sup>

Recent research reports have shown that cognitive function is related to locomotor function. Mild cognitive impairment, an earlier stage of dementia, is associated with poor gait function. Furthermore, subjects who have a decline in both cognitive and motor abilities have a higher risk of fall.<sup>[10]</sup> Along with this older adult with dementia, the chance of full recovery after a fall is not as good as in older adults without dementia.

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In India, there is a need for fall-related studies and fall prevention programs in view of the ever-increasing aging population.<sup>[5,8]</sup> The risk of fall increases with age due to the many reasons. Risk assessment in older adults therefore is the first step to identify the high-risk group to plan need-based intervention. Therefore, this study aims at examining the risk of fall and its association with cognitive impairment and other sociodemographic factors in older adults to understand its burden in a semi-urban community in Kerala, a state with a high life expectancy.

## SUBJECTS AND METHODS

A cross-sectional community-based study design was used to determine the risk of fall and its association with cognitive impairment and sociodemographic factors in an area adopted under the urban health training center (UHTC) of the department of community medicine in a medical college, South Kerala, India. The study was conducted for a period of 2 months (July to August 2019). The study sample included adults aged more than 60 years living in the area adopted under the UHTC.

The inclusion criteria were (1) older adults (above 60 years), males and females residing in the study area, (2) who understand Malayalam/English, and (3) willing to participate in the study. The exclusion criteria were (1) all patients who were severely ill and with psychological/psychiatric illness and (2) not able to respond. The minimum sample size calculated was 180 considering the proportion of older adults with a risk of fall to be 13%,<sup>[7]</sup> allowable error of 5%, and confidence level of 95%. Data were collected from the families adopted under the UHTC covering a population of 5600. With UHTC as a center, one lane was selected from four lanes by a simple random sampling (lottery method), and data collection was initiated from the first house till the end of the lane and continued with the next lane on the right till the desired sample size was attained. The required sample size was attained after visiting 450 houses.

### Study tools

A semi-structured questionnaire was used to collect the sociodemographic data. The risk of fall was measured using Berg Balance scale (BBS) and cognitive impairment using the Mini-Cog test. The procedure was detailed and demonstrated to all the participants. The equipment used was a watch with a second hand, a ruler, chairs of appropriate height, and a step or a stool.

The BBS included 14 items such as sitting to standing, standing unsupported, sitting unsupported, standing to sit, transfers, standing with eyes closed, standing with feet together, reaching forward with outstretched arm, retrieving objects from the floor, turning to look behind, turning 360°, placing alternate foot on the stool, standing with one foot in front, standing on one foot, and each item was scored as 0–4. The maximum score was 56 and the score between 56 and 45 indicated “No risk” and < 45 indicated “Risk of fall.”<sup>[11]</sup> In the Mini-Cog test, participants were instructed to listen carefully to and remember three unrelated words listed to them and repeat the words later when asked. They were instructed to draw the face of a clock

on the sheet with a clock circle. The participants were asked to put numbers and draw the hands to make 10 min after 11 on the clock. Finally, the participants were asked to repeat the three previously stated words. The test was scored as 1 point for each recalled word after the clock drawing test distracter. A normal clock drawing gets 2 points and abnormal 0 points. A combined total score of <3 indicates cognitive impairment.<sup>[12]</sup>

Ethics approval was obtained from the Institutional Ethics Committee. Eligible participants were identified following the sampling procedure described above. The participants were approached and the objectives of the research were explained. The required data were collected by interview method using the study tools listed and entered directly into the KoBo Toolbox.

### Data analysis

The population characteristics were summarized using means (standard deviation [SD]) and proportions. Frequency and percentages were computed for qualitative variables. The association between categorical variables was done using univariate logistic regression to find the prevalence odds ratio. Multiple logistic regression was done to find the association between the risk of fall and cognitive impairment when adjusted for other factors. The analysis was done using IBM SPSS 25 (Armonk, NY, USA). A significant level was set at  $P = 0.05$  and confidence interval 95%.

## RESULTS

Among the 180 study participants, more than half were females (55%), and mean and SD of the age of the sample was  $72.2 \pm 9.1$  years; the majority were living with their families (95.6%). Unemployed and retired were 42.2% and 33.9%, respectively. Only 5.6% had poor educational status (primary/illiterate) [Table 1].

Table 2 presents the association between the risk of fall and sociodemographic factors. Among the community-dwelling older adults, 45% (81) were at risk of fall. Age was found to be significantly associated with the risk of fall. As the age advanced, participants were more likely to be at the risk of fall ( $P < 0.001$ ). Females (57.6%) when compared to males (42.4%) were at higher risk of fall (odds ratio [OR] = 3.22,  $P < 0.001$ ). There was a significant association between occupational status and risk of fall. When considering the occupational class, older people who were at the risk of fall had higher odds to be retired and unemployed. The type of living was not associated with the risk of fall ( $P = 0.771$ ).

Table 3 shows that among older adults with cognitive impairment, 64.8% were at risk of fall and the association was found to be significant ( $P < 0.001$ ) with a prevalence odds ratio of 3.89.

In multiple logistic regression, people with the risk of fall had significantly higher odds for cognitive impairment (OR = 3.28) even after adjusting for age and gender. Being retired (OR = 16.35,  $P = 0.01$ ) and unemployed (OR = 11.04,  $P = 0.04$ ) were found to be independent factors associated with the risk of fall.

## DISCUSSION

In the present community-based cross-sectional study among older adults above 60 years, residing in a semi-urban area,

**Table 1: Basic characteristics of the study participants (n=180)**

Characteristics	Frequency (%)
Age (years)	
60-70	86 (48)
70-80	63 (35)
80-90	23 (13)
>90	8 (4)
Gender	
Male	81 (45)
Female	99 (55)
Type of living	
Living alone	8 (4)
With family	172 (96)
Occupation	
Professional/semiprofessional/clerical	23 (13)
Skilled/semiskilled/unskilled	20 (11)
Unemployed	76 (42)
Retired	61 (34)
Education	
Professor/graduate	55 (31)
Intermediate	83 (46)
High/middle school	32 (18)
Primary/illiterate	10 (6)

approximately half (45%) were found to be at the risk of fall. Cognitive impairment, age, gender, and occupational status were significantly associated with the risk of fall. The risk of fall was found to be very high among our participants when compared to studies conducted in Norway (13%)<sup>[7]</sup> and Canada (18%).<sup>[13]</sup> Most of the studies from India were on the prevalence and incidence of fall and could not find any on the risk of fall.<sup>[14,15]</sup> Among the 180 participants, 39.4% had cognitive impairment, which was also higher when compared to other studies<sup>[7]</sup> (28%).

The risk of fall was higher in females (57.6%) when compared to males, and it was statistically significant ( $P < 0.001$ ). This finding is consistent with the results of studies conducted in England (29.1%)<sup>[6]</sup> and in a rural community of South India (17%).<sup>[16]</sup> Although there is no conclusive explanation for females having a higher risk of fall, lower strength of muscle mass or multimorbidity may increase frailty in women, ultimately leading to fall.<sup>[17]</sup>

The present study showed a significant association between the age and risk of fall. It is in line with a report from the study in England where the prevalence of risk of fall was found to increase with the increasing age of older adults.<sup>[6]</sup> In contrast to these findings, age and gender did not show any association with the risk of fall in a report from Thailand among residents in senior housings.<sup>[18]</sup> Education was not influencing the risk of fall in our participants, but lower risk of fall was found with more years of education in other studies.<sup>[17]</sup>

Cognitive impairment was an independent factor associated with the risk of fall even after adjusting for age and gender which

**Table 2: Factors associated with risk of fall: Univariate analysis (n=180)**

Sociodemographic variables	Normal, n (%)**	With risk of fall, n (%)**	Crude OR	P	CI* (95%)
Age					
60-70 (reference)	66 (70.7)	20 (23.3)			
70-80	30 (47.6)	33 (52.4)	3.63	<0.001	1.79-7.33
>80	3 (9.6)	28 (90.3)	30.8	<0.001	8.46-112.05
Gender					
Male (reference)	57 (70.4)	24 (29.6)			
Female	42 (42.4)	57 (57.6)	3.22	<0.001	1.73-6.00
Occupation					
Professional/semiprofessional/clerical (reference)	22 (95.7)	1 (4.3)			
Skilled/semiskilled/unskilled	15 (75)	5 (25)	7.33	0.08	0.77-69.23
Unemployed	33 (43.4)	43 (56.6)	28.66	0.001	3.67-223.7
Retired	29 (47.5)	32 (52.5)	24.27	0.002	3.07-191.62
Education					
Professor/graduate (reference)	30 (54.5)	25 (45.5)			
Intermediate	52 (62.7)	31 (37.3)	0.72	0.34	0.35-1.43
High/middle school	14 (43.8)	18 (56.3)	1.54	0.33	0.64-3.71
Primary school/illiterate	3 (30)	7 (70)	2.8	0.16	0.65-11.97
Type of living					
Living with family (reference)	95 (55.2)	77 (44.8)			
Living alone	4 (50)	4 (50)	1.23	0.77	0.29-5.09
Cognitive impairment					
Present	25 (35.2)	46 (64.8)	3.89	<0.001	2.07-7.31
Absent (reference)	25 (35.2)	46 (64.8)			

\*CI, \*\*%: row percentage. CI: Confidence interval, OR: Odds ratio

**Table 3: Association between risk of fall and cognitive impairment: Logistic regression model (n=180)**

Variable	aOR	P	CI - 95%
Cognitive impairment			
Reference: No			
Yes	3.280	0.005	1.43-7.51
Age	1.17	0.000	1.11-1.25
Gender			
Reference: Male			
Female	4.59	0.003	1.67-12.56
Occupation			
Reference: Professional/ semiprofessional/clerical			
Skilled/semiskilled/unskilled	4.06	0.26	0.35-46.95
Unemployed	11.04	0.04	1.08-112.8
Retired	16.35	0.01	1.68-158.7

aOR: Adjusted odds ratio, CI: Confidence interval

was consistent with studies conducted in community-dwelling older adults,<sup>[7,19]</sup> older nursing home residents,<sup>[20]</sup> and also older patients in the outpatient units.<sup>[21]</sup> Slight changes in the cognition may lead to postural instability and processing time and result in fall. Cognitive assessment using valid tools is an important step in translating research findings to clinical practice.<sup>[7]</sup> Multimorbidity and polypharmacy are biologically plausible factors which can lead to fall; certain drugs such as benzodiazepines and muscle relaxants can cause dizziness and loss of balance and fall as a consequence.<sup>[19]</sup> It is a limitation that these factors were not considered in the study. The cross-sectional design limits the interpretation of causality, and further research is needed to identify the intrinsic and extrinsic risk factors of fall among older adults. Further research is needed on the environmental and medical risk factors for fall to initiate comprehensive fall prevention programs.

## CONCLUSIONS

The study found a 45% prevalence of risk of fall among older adults (aged more than 60 years) in a semi-urban area in South Kerala which was significantly associated with cognitive impairment. The risk of fall is also associated with increasing age, female gender, and unemployment. While providing clinical care for older adults, there is a need to focus on the assessment of the risk of fall and early identification of cognitive impairment. It is imperative to raise awareness of the public regarding these facts in this aging society.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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