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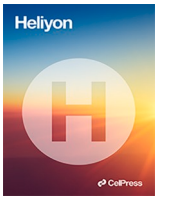

Prevalence and risk factors for falls in community-dwelling older population in Kerala; results from a cross sectional survey

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ABSTRACT

Background: Falls and their incapacitating effects are a significant concern for older people, especially in low- and middle-income countries. Falls are a significant concern among older people which requires immediate public health action. The current study examines multiple fall risk factors among community-dwelling older people in Kerala, India, to devise prevention strategies.

Methods: A cross-sectional survey was conducted between April and May 2020 among the community-dwelling older population aged 60 and above. Data was collected through door-knock surveys using standardized scales. Fall history and associated risks were the primary outcome variables, whereas behavioral and cognitive risk factors of depression, anxiety and stress were the other factors.

Results: The study included 301 older people (aged over 60) from 573 households and found the prevalence of falls in the last year was 37.5%. Older women with moderate levels of physical activity, cognitive symptoms of anxiety and stress, and who are unemployed had higher chances of falls risk. Further, older people with higher functional disability and average and below self-rated health had higher chances of fall risk in the current population. Anxiety was the only significant risk factor which was statistically significant in multiple regression model.

Conclusion: The older population with a combined risk of behavioral and cognitive factors is at higher odds of fall-related risk in Kerala.

1. Introduction

Population ageing is accelerating globally for several reasons; advances in healthcare systems, decreased fertility rates, and socioeconomic progress, to name a few [1]. With 13% of the overall population in 2011 being 60 years or older and further projected to rise to 23% in 2036, India, particularly the state of Kerala, is moving closer to becoming a state with a higher proportion of older people [2]. This demographic transition increases the probability of falls, and a greater share of their burden of morbidity, injury, dependency, and early mortality [3,4] is seen more in low- and middle-income countries (LMICs) [5], which makes it a public health concern. However, ageing and related problems have only recently started to gain attention in these countries. A review of studies on falls in India showed annual fall rates for older adults between 26% and 37% [6]. Another study in rural India found that 38.8% of non-fatal

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injuries were due to falls, with one-third occurring in adults aged 60 years and over [7]. 90% of the older people with falls require medical assistance to reduce the disabling fall impact [8].

Socio-demographically, the intrinsic risk of falls includes age, female gender, physical frailty, and poverty [3]. Additionally, the psychosocial predictors of falls are linked to comorbidities [9], long-term illnesses, social withdrawal [10], chronic health conditions [11], cognitive impairments [3], fear of falls, and medications [12]. In addition to assessing the risk factors, the current study attempts to profile older people based on their prevalence of risk factors. The focus is identifying intrinsic causes of falls in the older community population, such as behavioral risk factors, disability, chronic conditions (e.g., diabetes, hypertension), and comorbidities of depression, anxiety, and stress. Categorizing them into homogeneous subgroups based on the pooled prevalence of risk factors would help to develop targeted fall prevention interventions.

2. Materials and methods

2.1. Research design

A cross-sectional one-phase household survey was conducted in a geographically defined population of Keezhmad Panchayath in Ernakulam district between April and May 2020. The catchment area was selected as it represents a cross-section of the socio-demographic characteristics of people in Kerala. Ernakulam district is one of the 14 districts in Kerala state, India. Two subunits (called wards) within the Keezhmadu panchayath of Ernakulam district were selected through a mapping exercise involving local officials to identify and recruit participants. Following the mapping exercise, household surveys were conducted among 573 households, who agreed to participate in the study from two wards. The study revealed 249 households with at least one older person above the age of 60. A total of 301 people were included in the analysis, with a 95% response rate. All the interviews were conducted in the Malayalam language (the local language of Kerala state).

2.2. Procedural details

A mapping exercise was conducted with community volunteers to identify potential participants, and trained social work graduates approached each household to collect information. Inclusion criteria included community-dwelling adults aged 60 and above who consented to participate in the study. All individuals who fulfilled the inclusion criteria were invited to participate in the study.

3. Measurements

3.1. Socio-demographic questionnaire

Socio-demographic variables assessed include age, gender, educational attainment, and income status. Age was ascertained in years, while gender was identified as male, female, or other. Education was measured categorically as illiterate, those who have not completed primary level education, those who have completed primary education, and lastly, above secondary education. The income level was identified through the annual family income of the participants. Further, the color of the ration card was also used as an indicator of the participants' socioeconomic status. In Kerala, the color of the ration card is coded as "blue" and "white" for the "above poverty line" category and "yellow" and "pink" for the "below the poverty line" category.

3.2. Past–year fall

A fall is defined here as an event that results in a person coming to rest inadvertently on the ground, floor, or other lower level [13]. The prevalence of falls in the current study was determined by a self-reported question, "Have you had any incidents of falls in the past year?", to which the participants responded dichotomously (Yes = 1, No = 0).

3.3. Falls risk

Falls risk was measured using the FRAT Questionnaire [14]. Major risk factors identified for assessing fall risk include a history of falls, administering four or more medications, a diagnosis of Parkinson's, problems with balance, and being unable to get up from a chair without support, which was recorded in a dichotomous response, yes (value = 1) or no (value = 0). Issues of post-fall were measured through self-reported questions on mechanical or environmental risk factors, the presence of fall-related injury, diagnosis of osteoporosis, the prevalence of subsequent falls, inability to get up after the fall, and altered gait and balance, all of which were scored dichotomously. Falls risk was calculated by summing the scores of these questions, with a higher score indicating a higher risk. The tool is a reliable and valid measurement to identify the older person with a risk of falls [14].

3.4. Depression and anxiety

Depression and anxiety were assessed using the self-reported Depression, Anxiety, and Stress Scale (DASS) [15]. The tool uses a set of 42 questions to measure the level of depression, anxiety, and stress. The participants answered the questions on a 4-point Likert scale. Scores for each subscale are then calculated by summing the scores of relevant questions. DASS has previously been used as a

valid and reliable measure of depression, anxiety, and stress in India [16].

3.5. Disability

Functional disability is assessed using the WHO Disability Assessment Scale [17], a 12-item questionnaire that measures the level of disability in three major subdomains; psychosocial disability, self-care, and mobility-related disability. The items in the scale refer to difficulty in functioning in the past 30 days. Scores for each question range from zero (no difficulty) to four (extreme difficulty/cannot do). A higher score indicated a higher level of disability in each of the mentioned domains. WHODAS is validated and is found to have a good score of reliability [18].

3.6. Other risk factors

The other risk factors assessed were poor nutrition (less than 5 servings of vegetables/fruits daily), self-rated health, physical activity, and the presence of a chronic illness. Self-rated health was measured using a single question - "How do you rate your overall health in the past 30 days?" which is recorded on a five-point Likert scale ranging from zero (very good) to four (very bad). Physical activity was measured using a self-reported question – "Taking into account both work and leisure, would you say that you are (very physically active – 1, fairly physically active – 2, not very physically active - 3

not at all physically active – 4)". Chronic illnesses were ascertained from self-reported diagnoses of hypertension, diabetes, arthritis, angina, and depression. Comorbidity in this study is defined as the presence of two or more of the above chronic illnesses. The questionnaire is attached as a supplementary file.

3.7. Ethical considerations

Before the interview, each participant was briefed about the purpose of the interview, and informed written consent was obtained. The participants were further informed of the voluntary nature of participation and their right to withdraw at any moment. Ethical approval was obtained from the XXXX Hospital Institutional Ethics Committee (Reference Number: RAJH 18003).

3.8. Data analysis

Statistical analysis was performed using STATA (version 13). The demographic characteristics of the respondents were calculated, and the prevalence of past history of falls was explored. The mean and standard deviation were calculated for continuous variables, while frequencies and percentages were presented for categorical variables. Chi-square and T-test statistics were used to explore the between-group associations of demographic variables and other behavioural and cognitive risk factors with falls. Further, simple and multiple linear regression models were used to identify the associated risk factors.

4. Results

The data were examined for normality and multivariate outliers, it was found that they were normally distributed. The study included 301 older people with a mean age of 69.9 years. The study included a fairly distributed population regarding gender (58%

Table 1
Comparison of the older population with and without falls with demographic variables.

Demographic variables	Total (n = 301)	History of fall present – 113 (37.54%)	History of falls absent 188 (62.5%)	Inferential statistics
Age Mean	69.9 (±7.9)	69.9 (±7.5)	69.9 (±7.9)	T = 0.01, P = 0.503
Gender				chi2 = 15.4, P < 0.001
Female	175 (58.1%)	82 (72.6%)	93 (49.5%)	
Male	126 (41.9%)	31 (27.4%)	95 (50.5%)	
Education				chi2 = 1.4, P = 0.482
Illiterate/Less than primary education	128 (42.5%)	52 (46%)	76 (40.4%)	
Completed primary education	104 (34.6%)	39 (34.5%)	65 (34.6%)	
Secondary education and above	69 (22.9%)	22 (19.5%)	47 (25%)	
Type of family				chi2 = 0.2, P = 0.642
Joint/extended family	125 (41.5%)	45 (39.8%)	80 (42.5%)	
Nuclear family	176 (58.5%)	68 (60.2%)	108 (57.4%)	
Income category[a]				chi2 = 0.01 P = 0.918
Low-income group	172 (57.1%)	65 (57.5%)	107 (56.9%)	
High-income group	129 (42.9%)	48 (42.5%)	81 (43.1%)	
Occupation				chi2 = 11.7, P = 0.003
Unemployed	154 (51.2%)	71 (62.8%)	83 (44.2%)	
Employed	52 (17.3%)	11 (9.7%)	41 (21.8%)	
Retired	95 (31.6%)	31 (27.4%)	64 (34.04%)	

[a] income group categorized by the median value of the total annual income of the family.

females vs 42% males), education (42% without education vs 58% with primary or above education), or type of family.

37% of the participants had a previous history of falls. Among the 113 participants with a previous history of falls, 72% were females, 46% were illiterate or had not completed primary education, 90% were unemployed/retired, 60% either stayed alone or belonged to a nuclear family, and 57% belonged to the low-income group (Table 1). Also, among the older people with a fall history, 62.8% were unemployed. The differences between the groups were significant for gender and occupation.

Table 2 describes the sub group analyses of the various risk factors of falls with a previous history of falls. Among the participants with a history of falls, 49.6% had comorbid chronic conditions, 67.1 had below average self-rated health, 49.5% were fairly physically active and 28.3% were not very physically active. Mean scores of depression, anxiety, stress, functional disability, and falls risk were higher among people with a history of falls. The relationships were statistically significant for falls risk and anxiety scores.

Table 3 details the simple and multiple linear regression analysis of fall risk among the participants. In simple linear regression, functional disability, gender, occupation, self-rated health, anxiety and stress symptoms were associated with total fall risk scores. Female gender, respondents with higher scores of functional disability, anxiety and stress, average and below self-rated health, and moderate physical activity had higher risks of falls. Also, compared to unemployed older persons, people who are employed/retired had lower risks of falls. However, in the multiple regression model, only anxiety symptoms were significantly associated with falls risk score.

5. Discussion

The current study attempts to identify various intrinsic risk factors associated with fall risk among the older population in Kerala, India. The study found that 37% of the participants (n = 113) experienced a fall in the past year. The prevalence rate of falls was consistent with a study done in India, where a pooled prevalence of falls was found to be 31% [19]. However, it is slightly higher than studies conducted in several developed nations, like Canada (between 20% and 30%) and Taiwan (22.7%), where the weighted prevalence of falls was 28.4% in India over the same period [20]. The number of years lived with disability (YLDs) due to falls in 2010 was higher in India (631.2 per 100000) compared to other nations [21].

Although Kerala's population enjoys higher life expectancy and longevity due to greater human development indices comparable to developed nations [22], the higher fall rate may well be ascribed to ineffective fall prevention strategies in Kerala in comparison with developed countries. A higher prevalence rate is a challenge to a healthy life expectancy, especially in the context of the socio-demographic transition of the state, where the phenomenon of aging is rapid. Unemployed females with a sedentary lifestyle, poor self-rated health, multimorbid illnesses, and depressive and anxiety symptoms had a higher risk of falls in the current population. The studies were consistent with another study that identified risk factors for falls in the Indian context [3].

Analysis showed that older women with moderate levels of physical activity, cognitive symptoms of anxiety and stress, and who are unemployed had higher chances of falls risk. Further, self-rated health and functional disability were significant factors of higher falls risk scores. Older people with higher functional disability and average and below self-rated health had higher chances of falls risk in the current population. A study conducted among older adults in northern India [23] shows similar results as self-rated health and female gender as risk factors for falls. Though physical activity is protective against falls, fear of falls reduces their physical activities, which increases their vulnerability. Our study found that addressing psychological risks such as stress and anxiety can reduce falls, enhance the management of chronic conditions, improve self-care, and reduce healthcare costs associated with fall-related injury and disability.

Table 2
Comparison of the older population with and without falls with other risk factors.

Other variables	Total (n = 301)	History of fall present – 113 (37.54%)	History of falls absent - 188 (62.5%)	Inferential statistics
Self-rated health				chi2 = 8.4, P = 0.076
Very Good	14 (4.6%)	5 (4.4%)	9 (4.7%)	
Good	101 (33.5%)	32 (28.3%)	69 (36.7%)	
Average	120 (39.8%)	46 (40.7%)	74 (39.3%)	
Bad	54 (17.9%)	28 (24.7%)	26 (13.8%)	
Very Bad	12 (3.9%)	2 (1.7%)	10 (5.3%)	
Chronic illness				chi2 = 3.0, P = 0.219
No chronic illness	68 (22.6%)	22 (19.5%)	46 (24.4%)	
One chronic illness	103 (34.2%)	35 (30.9%)	68 (36.2%)	
Two or more chronic illness	130 (43.2%)	56 (49.6%)	74 (39.4%)	
Physical activity				chi2 = 4.4 P = 0.216
Very physically active	57 (18.9%)	19 (16.8%)	38 (20.2%)	
Fairly physically active	159 (52.8%)	56 (49.5%)	103 (54.7%)	
Not very physically active	66 (21.9%)	32 (28.3%)	34 (18.1%)	
Not at all physically active	19 (6.3%)	6 (5.3%)	13 (6.9%)	
Depression symptoms	7.9 (±7.4)	8.2 (±8.1)	7.6 (±6.9)	t = −0.7, P = 0.476
Anxiety symptoms	7.3 (±6.7)	8.6 (±7.2)	6.5 (±6.3)	t = −2.7, P = 0.007
Stress symptoms	9.5 (±7.6)	10.1 (±7.5)	9.2 (±7.6)	t = −1.02, P = 0.307
Disability in functioning	8.6 (±8.9)	9.8 (±9.2)	7.9 (±8.8)	t = −1.8, P = 0.071
Falls risk score	3.3 (±2.7)	6.2 (±2.3)	1.5 (±0.8)	t = −24.8, P < 0.001

Table 3
Linear Regression of falls risk score with other risk factors.

	Simple linear regression coefficients		Multiple linear regression coefficients	
Factors associated with Falls risks	Coefficients (95% CI)	P value	Coefficients (95% CI)	P value
Disability in functioning (1-unit increase)	0.04 (0.0–0.1)	0.029	0.02 (−0.03–0.06)	0.506
Gender (reference – males)				
Females	1.1 (0.5–1.7)	0.001	0.6 (−0.2–1.5)	0.140
Occupation (reference – Unemployed)				
Employed	−1.3 (−2.1–−0.5)	0.003	−0.4 (−1.5–0.6)	0.404
Retired	−0.7 (−1.4 to −0.01	0.047	−0.02 (−0.9–0.9)	0.960
Self-rated health (reference – good health)				
Average and below self-rated health	0.8 (0.2–1.4)	0.014	0.3 (−0.4–0.9)	0.474
Physical activity (reference - Very physically active)				
Fairly physically active	0.6 (−0.2–1.4)	0.155	0.2 (−0.7–1)	0.730
Not very physically active	1.7 (0.7–2.7)	0.001	0.8 (−0.3–1.9)	0.152
Not at all physically active	−0.3 (−1.7–1.1)	0.694	−1.5 (−3.3–0.2)	0.089
Depression (1-unit increase)	0.04 (−0.00–0.07)	0.086	−0.02 (−0.08–0.1)	0.431
Anxiety (1-unit increase)	0.1 (0.04–0.13)	<0.001	0.1 (0.02–0.2)	0.014
Stress (1-unit increase)	0.04 (0.00–0.08)	0.039	−0.02 (−0.09–0.04)	0.402

The general healthcare facilities that older people frequently visit because of their various conditions can introduce the systems and processes to triage them based on their risk profiles as a falls prevention strategy. Bundling the community-dwelling older persons into various risk groups would enable health professionals to design evidence-based targeted interventions. The well-designed tailor-made intervention packages addressing the behavioral and psychological risks can be unpacked for the targeted groups using task-sharing approaches [24]. Therefore, the previous successful experiences of community-based task-sharing interventions for various healthcare needs encourage health professionals to replicate the model to prevent falls [25–28].

This proactive engagement is crucial, particularly in light of the rising number of falls in low and middle-income countries like India, which imposes a heavy burden on the significantly subsidized healthcare system. Considering the huge impact of falls on the individual, family, society, and economy, planning prevention programs integrating behavioral and psychological needs would be a bold step towards healthy aging.

The study has some limitations as well. The study, being a cross-sectional one, fails to establish a true cause-effect relationship between the studied variables. Also, generalizability is also limited owing to the smaller sample size. Another possible limitation is that this study did not collect the number of events of falls which could have enriched the analysis of risk factors. Further longitudinal studies will bring more insight into different predictors of the risk of falls among the older population. The study also warrants the need for experimental trials to evidence the effectiveness of intervention strategies to reduce fall risk among the intended population.

6. Conclusion

The older population with a combined risk of behavioral and cognitive factors are at higher odds of fall-related risk in Kerala.

Ethics statement

Before the interview, each participant was briefed about the purpose of the interview and informed written consent was obtained. The participants were further informed of the voluntary nature of participation and their right to withdraw at any moment. Ethical approval was obtained from the Rajagiri Hospital Institutional Ethics Committee (Reference Number: RAJH 18003).

Author contribution statement

Saju Madavanakadu Devassy: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Lorane Scaria: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Data availability statement

Data will be made available on request.

Additional information

Supplementary content related to this article has been publish online at [URL].

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e18737.

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