A Community-Based Case–Control Study on the Risk of Fall among the Elderly in Rural Kattankulathur Block, Tamil Nadu

Roshni Mary Peter, Alex Joseph[1], K. R. John, M. Logaraj

Department of Community Medicine, SRMMCH and RC, SRMIST, [1]Division of Epidemiology, School of Public Health, SRMIST, Kancheepuram, Tamil Nadu, India

Abstract

Background: Approaching 100 million in number, India has the second largest population of elderly people after China. India's elderly are growing faster than the general population. By the year 2050, the number of elderly population is expected to increase to 323 million. In the geriatric population, fall is the leading cause of nonfatal injuries and hospital admissions. Falls account for 40% of all injury deaths, and the death rates are the highest among 60 years and above in all the regions of the world. **Objectives:** The objective of this study is to assess the factors associated with the risk of fall among the elderly of 60 years and older in rural Kattankulathur block. **Materials and Methods:** The study is a community-based case–control design among the elders in a rural setting. Those who had fallen in the past 12 months were selected as cases, and an equal number of age- and gender-matched controls were selected. Multiple logistic regression was conducted with biological, behavioral, environmental, and socioeconomic variables. **Results:** Of the 747 elderly contacted for the survey, 140 cases and 140 controls each were selected based on self-reported fall in the previous 12 months. The mean age of the participants was 66 with 95% confidence interval (65–67). Individual risk factors for fall were fear of falling (odds ratio [OR] 6.7) and dizziness (OR 4.9). **Conclusions:** There is now, more than ever, a need to refocus public health priorities for falls prevention in rapidly aging elders in India. This study provides a much-needed information for further investigation into fall and fall-related injury in developing countries like India.

Keywords: Case–control, elderly, fall, unintentional injuries

Introduction

Fall is a major problem in the elderly causing injuries, psychological difficulties, and social isolation. After the cardiovascular diseases, cancer, stroke, and pulmonary disorders, unintentional injuries are the fifth leading cause of death among the elderly, and falls constitute two-thirds of these deaths. Most of the developed countries have accepted that the chronological age of 65 years as an "elderly" or older person, but like many westernized concepts, this does not adapt well to the situation in African or Asian countries. In India, the "National Policy on Older Persons" defines a "senior citizen" or "elderly" as a person who is of age 60 years or above.[1]

Globally, the numbers of older persons aged 60 years are expected to be more than double, from 841 million people in 2013 to >2 billion in 2050. Currently, about two-thirds of the world's elderly population lives in the developing countries. In India, according to census 2011, 8.5% of the people are aged 60 and above, compared to 7.4% in 2001; this proportion is expected to go up to 9.87% by 2021 and 20% by 2050. The phenomenon of "Feminization of Aging" is evident in India and is clearly reflected by the Census 2001 data. Among states, the proportion varies from around 4% in small states such as Dadra and Nagar Haveli, Nagaland, Arunachal Pradesh, Meghalaya, and >10.5% in Kerala.[2]

The magnitude of the problem globally

Approximately 28%–35% of people aged 60 and above fall each year, increasing to 32%–42% for those over 70 years of age.[3-6] The frequency of falls increases with age and frailty level. Falls account for 40% of all injury deaths. Fall rate varies based on the country and the study population. Falls are easily

Address for correspondence: Dr. Alex Joseph,
Division of Epidemiology, School of Public Health, SRMIST, Kattankulathur,
Kancheepuram - 603 203, Tamil Nadu, India.
E-mail: alexjosephdr@gmail.com

forgotten; therefore, reported frequencies of falls also vary.[7-9] Fall is one of the important causes of morbidity and mortality in the elderly. Most often, the cause of fall is multifactorial. The incidence of falls may vary from country to country as well. For example, a study in the south-east Asian region (China) found the prevalence of fall to be 6%–31%.[10,11]

The magnitude of the problem in India
In a multicentric community study, evaluating health problems in the elderly (2003), in 10 states across India, covering a total study population of 10,200 elderly with equal distribution of rural and urban, the incidence of falls (history of a single fall in the past 6 months) was found to be 14%. It is estimated that nearly 1.5–2 million persons are injured, and 1 million succumb to death every year in India.[1] The currently demographic transitions within India indicate that southern India has the highest number of older adults over 60 years of age and will continue to maintain this trend in the future.[12]

Operational definitions
Fall
Falls are commonly defined as "Inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects." According to the International Classification of Disease-9 (ICD-9), fall is coded as W00-W19, and in ICD-10, fall is coded as E880-E888, which include a wide range of falls including those on the same level, upper level, and other unspecified falls.[13]

Elderly
According to the United Nations, cutoff age of 60 years and above is referred to as the older population.[14]

MATERIALS AND METHODS
Study area and population
The study was conducted in the Kattankulathur block, a revenue block in the Kancheepuram district situated on the northern east coast of Tamil Nadu, India. The population of the Kattankulathur block comprises 39 villages with a total population of 218,000 as per 2011 census.

A community-based case–control study was conducted to assess the risk factors associated with the fall in the elderly in the rural Kattankulathur block from March 2013 to September 2014. The sample size was calculated using the Schlesselman JJ 1982 formula for case–control studies; we sampled 140 cases and 140 controls, assuming that 20% as the magnitude of fall in the elderly; a minimum of 1700 households were screened to get 140 cases. The 1700 households were identified from the 11 villages selected randomly by probability proportional to size sampling technique from all the 139 villages in the Kattankulathur block. Through random selection, a total of 747 people aged 60 years and above were eligible to be recruited for this study. Elderly individuals with any history of fall during the past 1 year were identified as cases by the door-to-door survey. These individuals should have been

mobile, independent, and without any serious illness before the fall. Any individual of 60 years and above who had no history of fall during the past 1 year and without any obvious illness were considered as controls. One control per case was selected randomly from the neighborhood. Individuals with the known history of stroke, Road Traffic Accidents (RTA), cerebrovascular accidents, seriously ill, mental illness, and fracture were excluded from this study.

A pretested and structured questionnaire was used to collect the data about the history of fall during the past 1 year, the sociodemographic profile of participants, and the selected risk factors. The circumstances surrounding fall were assessed only on cases. The questionnaire was first prepared in English and was then translated into the local language, Tamil, by a person who is a fluent Tamil-speaker. It was then backtranslated into English to ascertain the accuracy of the Tamil translation. Univariate analysis of risk factors for falls and test of homogeneity were calculated using the Chi-square statistics. Adjusted odds ratio (OR) for falls were obtained by performing unconditional logistic regression.

Ethical considerations
The study was approved by the Institutional Ethics Committee of SRM Medical College and Research Center, Kattankulathur. Before the administration of the questionnaire, consent was sought from the participants after clearly explaining the purpose of the study. No incentives were offered to participate in the study.

RESULTS
The age of the respondents ranged from 60 to 85 years, with a mean age of 66 with 95% confidence interval (65–67) years, with a median age of 66. About 54% were females, 62% were married and living with spouse, and 94% belong to Hindu religion. About 80% did not have any formal education, and about 58% were not gainfully employed.

The majority of cases had a single event of fall in the past 1 year, and almost a quarter had multiple events of fall. As expected since the cases and controls were matched for age and gender, there was no significant association. Type of family, education, occupation, and comorbidities were not statistically significant from cases and controls.

Among the participants, 264 (94%) had an economic dependence on others; there was no significant difference in economic dependence among cases and controls.

Decreased sensation of the feet (2.54, 1.20–5.41), fear of falling (9.27, 3.1–27.11), dizziness (7.37, 3.15–17.08), multiple medications (4.2, 7.92–2.92), alcohol consumption (3.20, 1.05–9.69), and perceived difficulty in vision (2.07, 1.15–3.72) were found to be significant risk factors for fall in univariate analysis.

Factors such as marital status, type of housing, economic status, and religion were not statistically significant, and other

Table 1: Risk factor analysis for fall using unconditional multiple logistic regression

Variables in model	Crude OR	P	Adjusted OR	95% CI	
				Lower bound	Upper bound
Physical activity	1.2	0.672	1.13	0.64	1.99
Dimness of vision	2.1	0.101	1.78	0.89	3.53
Fear of falling	9.3	0.002	6.70	1.99	22.57
Dizziness	7.4	0.003	4.09	1.61	10.39
Diabetes	1.8	0.109	1.60	0.901	2.84
Alcohol use					
Nonuser		0.046			
Occasional use		0.124	0.605	0.319	1.15
Frequent use		0.029	0.275	0.086	0.873
Medications					
No medications		0.001			
<5		0.003	0.200	0.068	0.584
5 or more		0.472	0.712	0.282	1.80

OR: Odd ratio, CI: Confidence interval

factors such as being bedridden, having difficulty in walking, weakness of legs, difficulty in negotiating stairs, slippery bathroom floor, and not having individual room were not statistically significant in univariate analysis.

Multivariate analysis

The data were then subjected to multivariate analysis by unconditional logistic regression. Selected variables having *P* value about 0.05 were included in the analysis [Table 1]. The relationship between these variables was studied using different models.

From the multiple binary logistic regression, the factors such as fear of falling (OR - 6.70) and dizziness (OR - 4.90) were found to be independent significant risk factors, whereas physical activity, dimness of vision, and diabetes were not found to be significant after adjusting for other risk factors. Frequent alcohol use was found to be a significant risk factor, compared to the nonusers frequent alcohol users were protected for falls, and it might because frequent users tend to have restricted activities after the drinks. Regarding the use of multiple medications, elderly consuming less than 5 medications were found to be protected from falling compared to those without any medications.

DISCUSSION AND CONCLUSIONS

The objective of this study was to investigate the risk factors of fall among the elderly in rural Kattankulathur block, Tamil Nadu. Studies by Herdman, Blatt, Schubert, and Tusa, in 2000, have shown that the age-related deterioration in vestibular function can cause feelings of unsteadiness, lightheadedness, or dizziness, all commonly associated with falling in older adults; in this study, dizziness was found to be a significant independent risk factor fall in the elderly.[15] In this study, the role of physical activity was not found to be an independent significant risk factor for fall in the elderly. Physical activity and exercise have been considered as major factors which influence the risk of fall and fractures in the elderly. In the study

by Lauritzen *et al*., in 1993, it appears that regular physical activity is an important preventive measure against fall.[16] The results indicated that residents with a fall status had a higher history of falls. The results of the current findings support the literature where previous studies have found a relationship between a history of falling and the subsequent occurrence of falls.[17,18] Falls are one of the major problems in the elderly and are considered as one of the "Geriatric Giants."[19] Even though the majority had a single event of fall in the past 1 year, almost a quarter had multiple events of fall. Equal of them happen to have outdoor falls, the common environmental risk was contributed to walking on the uneven surface, and most had fallen from the same standing height, commonly fallen forward. Very high proportion reported that they experienced premonitory subjective symptoms before the fall, commonly experienced as dizziness or vertigo followed by weakness of limbs. Factors influencing the risk of fall in the elderly study population were fear of fall, dizziness, multiple medications and alcohol consumption. Fall prevention must be incorporated in public health policies and health programs for elderly people.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Ministry of Social Justice and Empowerment, Government of India. National Policy on Older Persons. Available from: http://www.socialjustice.nic.in. [Last accessed on 2014 Jun 25].
2. Jeyalakshmi S, Chakrabarti S, Gupta N. Situation Analysis of the Elderly in India. Central Statistics Office Ministry of Statistics and Programme Implementation Government of India; 2011.
3. Blake AJ, Morgan K, Bendall MJ, Dallosso H, Ebrahim SB, Arie TH, *et al*. Falls by elderly people at home: Prevalence and associated factors. Age Ageing 1988;17:365-72.
4. Prudham D, Evans JG. Factors associated with falls in the elderly: A community study. Age Ageing 1981;10:141-6.
5. Campbell AJ, Reinken J, Allan BC, Martinez GS. Falls in old age:

A study of frequency and related clinical factors. Age Ageing 1981;10:264-70.

6. United Nations, Department of Economic and Social Affairs, Population Division. World Population Ageing 2013. ST/ESA/SER.A/348. United Nations, Department of Economic and Social Affairs, Population Division; 2013.

7. Kanten DN, Mulrow CD, Gerety MB, Lichtenstein MJ, Aguilar C, Cornell JE. Falls: An examination of three reporting methods in nursing homes. J Am Geriatr Soc 1993;41:662-6.

8. Downton JH, Andrews K. Prevalence, characteristics and factors associated with falls among the elderly living at home. Aging (Milano) 1991;3:219-28.

9. Stalenhoef PA, Diederiks JP, Knottnerus JA, Kester AD, Crebolder HF. A risk model for the prediction of recurrent falls in community-dwelling elderly: A prospective cohort study. J Clin Epidemiol 2002;55:1088-94.

10. Suzhen L, Jiping L. Body function and fall-related factors of the elderly in community. J Nurs Sci 2004;19:5-7.

11. Litao L, Shengyong W, Shong Y. A study on risk factors for falling down in elderly people of rural areas in Laizhou city. Chin J Geriatr 2002;21:370-2.

12. Rajan SI, Mishra US, Sarma PS. Health concerns among India's elderly. Int J Aging Hum Dev 2001;53:181-94.

13. World Health Organization. Who Global Report on Falls Prevention in Older Age. 1st ed. Geneva: World Health Organization; 2007.

14. United Nations, Department of Economic and Social Affairs, Population Division. World Population Ageing 2013. New York: United Nations; 2013. p. 17.

15. Herdman SJ, Blatt P, Schubert MC, Tusa RJ. Falls in patients with vestibular deficits. Am J Otol 2000;21:847-51.

16. Lauritzen JB, Schwarz P, Lund B, McNair P, Transbøl I. Changing incidence and residual lifetime risk of common osteoporosis-related fractures. Osteoporos Int 1993;3:127-32.

17. Boffin N, Moreels S, Vanthomme K, Van Casteren V. Falls among older general practice patients: A 2-year nationwide surveillance study. Fam Pract 2014;31:281-9.

18. Kinn S, Hood K. A falls risk-assessment tool in an elderly care environment. Br J Nurs 2001;10:440, 442, 444-9.

19. Krishnaswamy B, Usha G. Falls in Older People. Chennai: Madras Medical College; 2003.