Original Research Article

Epidemiology of fall and its risk factors among elders in a rural area of Coimbatore, India

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ABSTRACT

Background: Global reports show that falls are the major cause of disability injuries among the elders. Developing countries lack the required epidemiological data on the burden of falls and factors that contribute to it. The objectives of the study were to find the burden of fall and its distribution in time, place and person among elders and to identify risk factors associated with fall among elders.

Methods: A community–based cross-sectional study of 655 elders ($\geq$ 60 years) was done in a rural area of Coimbatore District by two stage sampling technique. History of fall within the past 6 months was included in the study. Semi-structured pre-tested questionnaire was used to assess factors contributing to falls. The burden of falls was expressed as proportions and percentages. Logistic regression analysis was done to identify risk factors for fall.

Results: 26% (95%CI: 22.59-29.32) elders experienced at least one fall. Of the total falls 50.2% occurred outside home and the remaining inside home. Most of the falls occurred during ambulation and at the morning hours (39.1%). Age $\geq$80 years (OR: 3.28, 95%CI: 1.28-5.98) and dizziness (OR: 3.27, 95%CI: 1.00-10.06) were only found to be significantly associated with fall on multivariate analysis.

Conclusions: The occurrence of fall was found to be almost similar to that identified in western countries where fall preventive measures have been implemented. Similar efforts are yet to be initiated here and so this study provides the evidence for the need. Prospective studies through more frequent home visits are needed to confirm the enormity of the problem to suggest policy recommendation.

Keywords: Elderly, Fall, Prevalence, Risk factors

INTRODUCTION

Ageing population is one of the significant trends in the 21st century. Current statistics shows 12.3% of global population is those above 60 years. Even though ageing is a universal phenomenon, this growth is more drastic among the developing countries.[1] Globally, the percentage of aged (60 years and more) has increased from 9% in 1994 to 12% in 2014 and is expected to reach

21% by 2050.[2] A country is labelled as 'ageing' when 7 percent of the populations are age 60 years and above. India exceeded this mark in 2000 and by 2025 it is expected to reach 12.6 percent.[3] This highlights the fact that India is moving from a young nation to a greying nation.

Among the various factors that contribute to the morbidity of elders, falls are considered to be one of the

major problems i.e. "Geriatric Giants". Studies show that about one-third of elders living in the community have a fall every year.[4] It accounts for 40% of all deaths due to injury in the elderly age group but this rate varies in different countries and study populations.[5] The consequences of fall are a major public health problem that often needs medical attention.[6]

A global study conducted in 2010 showed that fall due to unintentional injuries (other than road traffic accidents) accounted for 77% and 85% of years lived with disability (YLDs) in the age group of 50-69 and those above this age group respectively. This burden of YLDs due to fall was only 34% in developed countries whereas it was 66% in developing countries[7]. It has been documented that developing countries lack the required epidemiological data which are needed to develop falls prevention programme that can be incorporated into their national health policy framework.[5,8-11] Many low-cost interventions on fall prevention have been identified and implemented in the high-income developed countries which can be applied to the developing countries. Hence, epidemiological research is urgently needed especially in the low and middle income countries to identify the determinants and conditions contributing to fall-related injury. The primary objective of our study was to find the burden of fall and its distribution in time, place and person among elders. Secondary objective was to identify certain risk factors associated with fall among elders.

METHODS

A community based cross sectional study was conducted in the field practice area of Rural Heath Training Centre (RHTC) Vedapatti under the Department of Community Medicine of PSG Institute of Medical Sciences and Research, Coimbatore. Prevalence of fall in a previous multi-centric community study involving 10 Indian states among the elders was found to be 14%.[12] With an allowable error of 20% and expecting a non-response rate of 20% the sample size was calculated to be 736. Two-stage sampling method was used to obtain the required sample size. Inclusion criteria were all elders' ≥60 years. Elders not present on more than two consecutive visits or not willing to give consent were excluded. A total of 655 elders were interviewed by the principal investigator from November 2015 to April 2016 and included in the final analysis. Flow diagram of recruitment of samples is shown in Figure 1.

Data collection tool- A semi-structured questionnaire was designed to collect information on fall history and WHO conceptual framework/ model was used to identify risk factors contributing to fall.[5,13] Operational definition for a fall was coming to rest inadvertently on the ground or floor or other lower level occurring inside or outside home within the past 6months. Independent variables included for analysis of risk factors were- biological factors (age, sex and chronic illness), socioeconomic factors (education and socioeconomic status) and

behavioural factors (alcohol intake, medication use and activity level). Information regarding medical history and illness was documented as reported by the elders and their family members.
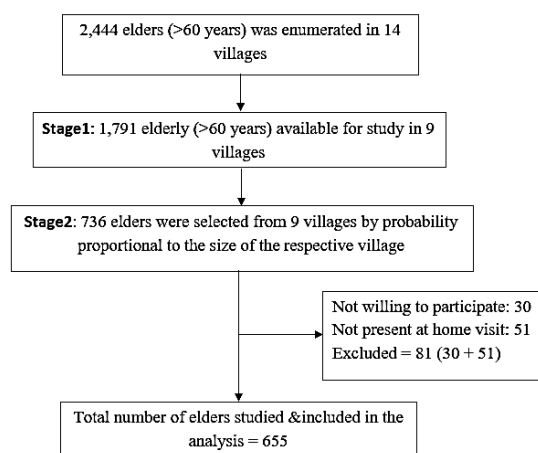

Figure 1: Flow diagram describing method followed to reach the target sample size.

Statistical analysis

Data entry was made in the Microsoft Excel software in codes and analysis was done with SPSS-19 computer package. Occurrence of fall is expressed in percentage with confidence interval and other details relating to fall is expressed in percentage. The association between demographic and biological variables with fall was tested for significance using chi square test and odds ratio was estimated. Variables with p values showing <0.2 were considered for multivariate analysis including age and sex. Variables with p<0.05 was considered as statistically significant. Hosmer and Lemeshow test was done to find the goodness of fit of this model.

Ethical approval was obtained before conducting the study from the Institutional Human Ethics Committee of PSG Institute of Medical Science and Research, Peelamedu, Coimbatore. Both written and verbal consent was taken from the participants.

RESULTS

Most of the elders in our study population belong to the age group 60-69 (57.4%) and 70-79 (33%). The female elderly population was more (57.9%) than the male elders (42.1%). Majority of the elders were engaged in some form of work either household or outside. The participants in the study were financially relatively better off with most of the elders belonging to class 4 (31.6%) followed by class 3 (24.6%) and 2 (24.4%) based on modified BG Prasad's classification (Table 1).

In our study 170 elders had contributed to a total of 199 falls in the past 6 months (Table 2). Proportion of elders among 655 reporting one or more falls in the study

population was 26% (95% CI - 22.59 - 29.32). Among those aged more than 80 years 52.4% had experienced a fall whereas among those less than 80 years it was only 23.1%. It was found that 50.2% fell outside their home and the remaining inside or home surrounding. Among falls occurring outside the most common location was along the roadside (60%) followed by fall at work place (16%). Within the home premises 31.3% of falls occurred during ambulation around home like bathroom/toilet etc. and 22.2% occurred inside the various room like living room, bedroom etc. Falls mostly (39.1%) occurred in the morning hours as compared to rest of the days (Figure 2).

Of the total 199 falls reported by the elders, 147 (73.8%) suffered injury following the fall. Most common type of injury was bruise and contusion (60.5%) needing no treatment or only first aid measure. About 10.5% elders had to be hospitalized after a fall needing treatment for fracture. Overall we found 4 elders being bedridden after a fall.

Table 1: Socio- demographic profile of study participants (n=655).

| Demographic variables		Frequency	Percentage (%)
Age (in years)	60-69	376	57.4
	70-79	216	33
	≥80	63	9.6
Sex	Female	379	57.9
	Male	276	42.1
Education	Illiterate	206	31.5
	Primary	192	29.3
	Middle	128	19.5
	High school	78	11.9
	Higher secondary	29	4.4
	Graduate	22	3.4
Socioeconomic class (Modified Prasad's classification)	Class 1	72	11.0
	Class 2	160	24.4
	Class 3	161	24.6
	Class 4	207	31.6
	Class 5	55	8.4
Occupation	Not Working	193	29.5
	Working	462	70.5
Marital status	Married	393	60
	Unmarried	14	2.1
	Widowed	248	37.9
Family type	Nuclear	372	56.8
	Extended	283	43.2
Living alone	Yes	71	10.8
	No	584	89.2
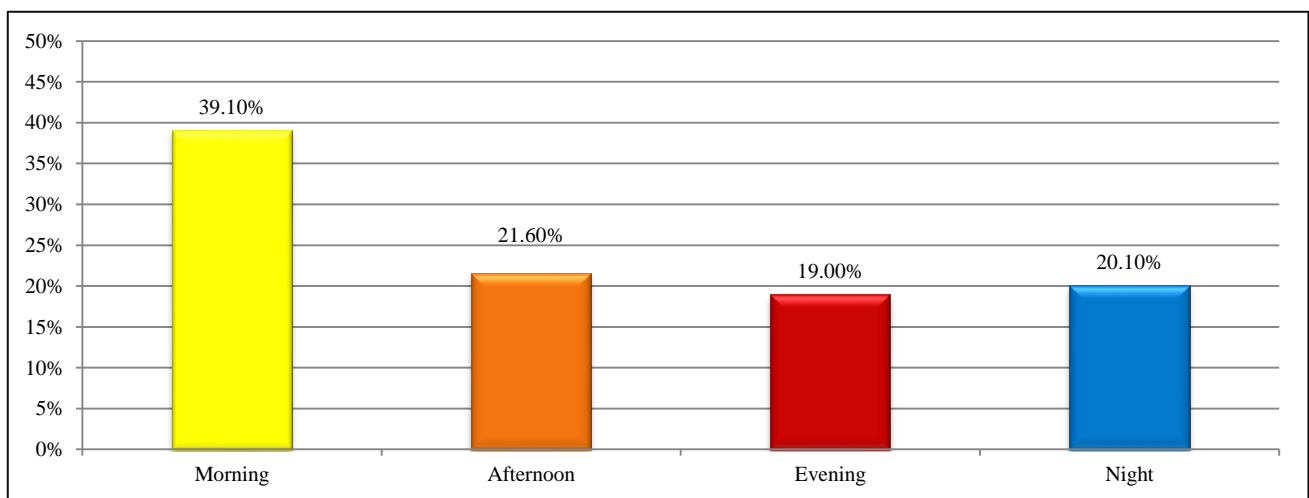
Figure 2: Time of fall among elders (n=199).

Table 2: Burden of frequent falls among the elders (n=170).

History of fall in past 6 months	No. of Elders	No. of Falls
1 fall	150	150
2 falls	12	24
3 falls	7	21
4 falls	1	4
Total	170	199

Table 3: Association of fall with biological, socioeconomic and behavioural variables.

Risk factor	N=655	Non fallers (n=485) (%)	Fallers (n = 170) (%)	Unadjusted OR (95%CI)	Adjusted OR (95%CI)
Sex	Male (n=276)	209 (75.7)	67 (24.3)	1	1
	Female (n=379)	276 (72.8)	103 (27.2)	1.16 (0.81-1.66) p≤0.228	0.97 (0.65-1.43) p=0.887
Age	<80 yrs (n=592)	455 (76.9)	137 (23.1)	1	1
	≥80 yrs (n=63)	30 (47.6)	33 (52.4)	3.65 (2.15-6.20) p=0.000*	3.28 (1.82-5.90) p=0.000*
Activity level	Working (n=462)	352 (76.1)	110 (33.9)	1	1
	Not working (n=193)	133 (69.9)	60 (31.1)	1.44 (0.99-2.09) p=0.053	1.01 (0.65-1.56) p=0.955
Education	≥HS[a] (n=129)	106 (82.1)	23 (11.9)	1	1
	<HS[a] (n=526)	379 (71.2)	147 (27.9)	1.78 (1.09-2.91) p=0.020*	1.56 (0.93-2.62) p=0.086
Socio-economic status	Class 1, 2 & 3	299 (76.1)	94 (23.9)	1	
	Class 4 and 5	186 (71.0)	76 (29.0)	1.30 (0.60-1.95) p=0.346	
Arthritis	Absent	357 (76.4)	110 (23.6)	1	1
	Present	128 (68.1)	60 (31.9)	1.52 (1.04-2.21) p=0.028*	1.39 (0.09-2.08) p=0.101
Diabetes	Absent	400 (74.5)	137 (25.5)	1	
	Present	85 (72.0)	33 (28.0)	1.13 (0.72-1.77) p=0.582	
Hypertension	Absent	345 (76.2)	108 (23.8)	1	1
	Present	140 (69.3)	62 (30.7)	1.41 (0.97-2.04) p=0.065	1.18 (0.72-1.94) P=0.507
Vision	Normal	428 (75.9)	136 (24.1)	1	1
	Defective	57 (62.6)	34 (37.4)	1.87 (1.17-2.99) p=0.008*	1.64 (0.98-2.74) p=0.055
Dizziness	Absent	478 (74.4)	164 (25.6)	1	1
	Present	6 (50)	6 (50)	2.91 (0.92-9.16) p=0.067	3.27 (1.00-10.6) p=0.049*
Medicine intake	Absent	254 (77.2)	75 (22.8)	1	1
	Present	231 (70.8)	95 (29.2)	1.39 (0.98-1.97) p=0.065	1.49 (0.92-2.41) p=0.103
Alcohol intake	No	421 (74.5)	144 (25.5)	1	
	Yes	63 (70.7)	26 (29.3)	1.20 (0.73-1.97) p=0.457	

a- High school; * statistically significant.

Table 3 shows the association of fall with the risk factors. On univariate analysis age (>80 years), females, low education (less than high school), having arthritis and defective vision were found to be statistically significant. The variables showing p<0.2 including age and sex were subjected to multivariate analysis which showed only age more than 80 years and dizziness to be statistically significant. Hosmer and Lemeshow test was 7.849 which showed that the model is fairly good (p<0.448).

DISCUSSION

Falls are generally considered as unexpected accidents but statistics have shown that fall incidence differs

significantly from the poisson distribution. This could indicate that there might be a causal process that cause fall and that they do not occur just by chance.[13] Therefore research needs to be done to identify any association if it exists with factors contributing to the fall so that they could be prevented or reduced. It becomes more essential to study this aspect among the elders since, they are more affected by the consequences of fall as compared to the younger population.

Due to increase in population of elders in India, falls are emerging public health problem.[12] Although lot of literature about this problem and its prevention is available from developed countries, only limited data on occurrence, risk factors and measures for prevention of falls is available from the developing countries, hence this study was carried out to identify the burden of falls among elders and factors contributing to the same with the hope to recommend preventive measures.

A review article on falls among Indian older adults states the prevalence of fall to range from 14% to 53%.[14] The burden of falls in our study population was 26% (95% CI: 22.6-29.3) which is similar to a study done by Savitha et al in Karnataka (29.8%) but more than that reported in a multi-centric study done by Krishnaswamy in 10 Indian states (14%).[12,15] Joshi et al reported a high prevalence of 51.5% of fall among elders in northern India but the time period during which falls happened in the study was not mentioned.[16] Another study done in Gujarat by Dinesh et al showed a very low prevalence of fall (3.4%) among elders above 60 years of age but again the definition of fall used to capture it as a fall was not made known.[17] It has been difficult to compare the magnitude of burden of fall between the various studies due to lack of uniformity in the operational definition of fall. Hence, it is difficult to conclude whether the varying burden of falls widely among different countries is due to lack of uniformity in the operational definition or a real one. Moreover most of the studies have been done retrospective which can have recall bias. Hence a need to conduct prospective studies with defined fall criteria as done in some western countries.[18,19]

The location of fall helps to identify where falls commonly occur and decide on how to reduce it. In our study almost equal number of falls occurred inside and outside home. But a study by Berg et al showed more falls occurred outside home whereas Graafmans et al showed in their study most of the falls occurred inside home.[18,20] Among the falls that took place outside home, the commonest location was along the roadside which was similar to the study done by D'souza et al.[21] Other studies have shown that 50% of falls among elders in the community occurs within their homes and immediate home surroundings.[22,23] A study done in urban area of Karnataka showed that most of the indoor falls occurred in bathroom or toilet but in our study we found the entrance of home to be the most common location.[15] This difference can be attributed to the decrease in number of typical bathing room and toilets that are present in rural

houses as compared to that seen in urban area or in western countries.

Even though most of the falls occurred in the morning hours (39%) similar to others studies, we found a significant proportion of falls occurring at night time (20%) which was only 0.8 to 1.1% in those studies.[15,21] This difference may be attributed to poor lighting in the houses and streets in rural areas.

In our study, elders more than 80 years were 3.65 times at higher risk of falling which was found to be statistically significant (p<0.000). This was the only factor that was also significant upon multivariate analysis also. A Canadian survey found the risk of fall to increase from 35 to 76 per 1000 elders in those aged 60s and 80s respectively.[24] Keeping this in view and the high cost incurred due to injuries following a fall, most of the developed countries use quick and reliable screening tool to identify those elders at greater risk in order and implement preventive measures.[25] There are also tools available that can be used at the community level on larger number of elders, like the Falls Risk for Older People in the Community Screen (FROP-Com Screen) used in Australia.[26] Similar measures need to be implemented in our setting also. We suggest further studies in our population is needed to identify others risk factors like cognition, grip strength, environmental hazard etc. contributing to fall. This may lead to development of various fall preventive measures that can be socially, culturally and economically be accepted by elders in our country.

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