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Falls among Elderly in a Rural Community: Incidence and Determinants

Sanjay TV[1], Ramu P[2], Madhusudan M[3], Nandhini RC[4]

[1]Professor, Department of Community Medicine, Kempegowda Institute of Medical Sciences, Bengaluru, Karnataka
[2]Assistant Professor, Department of Community Medicine, Al Ameen Medical College, Athani Road, Vijayapura Karnataka
[3]Scientist 'D' (Medical), ICMR-National Centre for Disease Informatics and Research, Bengaluru, Karnataka
[4]Assistant Professor, Department of Community Medicine, Dr B R Ambedkar Medical College and Hospital, Bengaluru, Karnataka

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Abstract

Background: Falls are one of the emerging public health issues and a barrier for active aging. There is a scarcity of studies on incidence of falls among elderly population which provide information on real burden from rural part of India. Hence, the study was undertaken to find out the incidence of falls and determinants among elderly population.

Materials and Methods: A prospective cohort study was carried out by involving 260 elderlies in a primary health centre area of Bengaluru by using simple random sampling technique over a period of one year. Data was collected regarding, socio-personal characteristics, substance use, co-morbidities and self-perceived health status using interview method and assessment of housing conditions was also undertaken. House visit was conducted to explain the purpose of the study and to distribute falls dairy. Telephonic interview was undertaken to collect history of falls and related information once in three months and at the end of one-year elderly were revisited to confirm the falls. All the data was analysed using Epi info 7.2.2.1.

Results: The incidence of falls among elderly was 48.2%. The socio-personal characteristics such as age group ≥70 years ($p<0.001$), low/medium standard of living index (SLI) ($p=0.03$), poor/average self-perceived health status ($p=0.001$), provision of separate living room ($p=0.0006$) and location of bathroom and toilet outside the house ($p=0.04$) were associated with falls.

Conclusion: The incidence of falls among elderly was more compared to previous studies and associated with advanced age, poor income, poor self-perceived health status, living alone in separate room and location of bathroom and toilet outside the house.

Keywords: Falls, Incidence, Elderly, Rural area, cohort study.

Introduction

Aging is a dynamic process which brings about morphological, functional and biochemical changes leading to an increase in the risk of falls among elderly. Falls are one of the most serious emerging public health issues among elderly all around the world. It is considered as a barrier for active aging and identified as one of the important geriatric giants.[1]

Even though, falls are part of normal aging, majority of the falls are multifaceted in nature and result from complex interplay of intrinsic causes such as disorders of cardio-vascular, nervous and balance systems and extrinsic causes such as environmental hazards which are potentially predictable and preventable.[2]

Falls are responsible for injury-related hospitalization, loss of independence, poor quality of life and premature death. It has enormous socio-economic impact in terms of increased hospital stay and consumption of health care resources.[3]

Corresponding Author:
Dr Ramu P, MD (Comm Med)
Assistant Professor, Department of Community Medicine
Al Ameen Medical College, Athani Road, Vijayapura, Karnataka-58610
Email: ramu.guptha03@gmail.com

It was documented that approximately one-third of elderly living in community and over two-third of institutionalized elderly will fall at least once a year and also reported that about 4,24,000 fall-related deaths occurred globally and around one-fifth of them (95,000 deaths) occurred in India. These evidences confirm that falls among elderly in India is a growing public health concern due to increase in the population of elderly which is projected to reach 19 per cent by the year 2050.[4-7]

Many prospective studies from developed countries have shown that the incidence of falls for elderly living in the community varies between 29% to 40% and this increases with age. Falls are responsible for 19% of all emergency department visits and more than 50% of injury-related hospitalisations among elderly people.[8-9]

Recent reviews on falls among elderly in India has shown that, there are many prevalence studies displaying important information on the epidemiological problem of falls and according to these studies burden of falls (prevalence) varies from 26% - 37%. The major drawback of prevalence study is the underestimation of real burden of falls due to recall bias. This evidence is strengthened by the fact that 13% to 32% of elderly had forgotten their previous falls. This sort of under-reporting is due to embarrassment and fear related to loss of independence.[10-11]

There is limited information on burden of falls and its determinants based on incidence studies carried out on the elderly living in rural part of India where majority of the elderly live. Such studies immensely help policy makers and planners to design effective interventional strategies to improve the quality of life of elderly in near future. Hence, present study was planned and undertaken with a primary objective to find out the incidence of falls and the secondary objective to identify determinants of falls among elderly population.

Materials and Methods

This population based prospective cohort study was carried out in a primary health centre (PHC) area having 21 villages with 13,901 population which comes under rural field practice area of a medical college in Bengaluru from March 2017 to June 2018 after obtaining approval from the Institutional ethics committee **(KIMSIEC/D-10/2016).**

Sample size: The sample size was estimated to be 233 considering 'prevalence of falls among elderly' as 18.6%, absolute precision of 5%. Assuming 10% non-response it was revised to 260.[12]

Study population: A total of 884 ambulatory elderly subjects (≥60 years) were enumerated in the PHC area by conducting house to house visit. Of which 570 subjects were identified based on inclusion criteria such as resident of the locality for at least six months, ambulatory and willing to participate in the study. Those with severe illness, cognitive impairment, speech and hearing difficulty were excluded. All the subjects were line listed according to alphabetical order and finally, 260 subjects were selected by simple random sampling technique using computerised random number generator.

Study tools: In the study, fall was defined according to WHO 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.[13] Baseline data regarding socio personal characteristics and substance use (currently using chewable and smokable tobacco, alcohol and beverages) were collected. Co-morbidities were diagnosed based on clinical examination and physician's report. Self-rated health (SRH) status was assessed by asking the elderly subjects to rate their present state of health as poor, average or good.

Assessment of housing conditions included following variables: overcrowding (<50 sq feet/ person), adequate ventilation (total area covered by doors and windows >2/5th of the total floor space of the living room), adequate lighting (able to read newspaper comfortably) in atleast 2/3rd area of the living room, presence of unsafe furniture (haphazardly placed, projecting and broken), cooking on the floor, uneven stars, location of the bathroom, toilet and its flooring (uneven and slippery).[14]

Data collection: In the first house visit, purpose of the visit was explained and informed consent was taken from the elderly. By interview method, trained investigator collected data using a pre-tested, semi-structured questionnaire.

Each elderly subject was followed up to one year for the incidence of falls. For better monitoring, every elderly subject was instructed to record fall in a falls' dairy given at the time of first visit. Every subject was asked to record time of falls, cause, location, type of injury, body part involved and treatment received

with the help of care giver. Along with this, follow-up of each subject was undertaken once in three months by telephonic interview and house visit was made in case of any fall.

At the end of year, houses of 247 (11 subjects died and 2 subjects moved out of the study area) elderly subjects were re-visited to confirm the falls and its details by verifying falls dairies. At the end of the study, every subject was given education on causes, consequences and prevention of falls.

Statistical analysis: In this study, both descriptive (percentages, mean and standard deviation) and inferential statistics such as chi-square test (to find out association of falls with socio-personal characteristics and housing conditions) were used. P-value of <0.05 was considered as statistically significant. All the data were entered and analysed using Epi info 7.2.2.1.

Results: Out of 260 subjects, 115(42%) were males and 145(58%) females. The mean age of subjects were 68.7 ± 7.5 years with a range of 60 to 98 years. 136(52.3%) belonged to the age group of 60-69 years and, 124(47.7%) to ≥70 years age group. 132 (50.8%) were literate, 128(49.2%) illiterate, 170(65.4%) were not working, 90(34.6%) working, 214(82.3%) were married, 46(17.7%) unmarried/widowed, 141(54.2%) were from joint family, 51(19.6%) from nuclear and 68(26.2%) from 3 generation family. 28(10.8%), 135(51.9%) and 97(37.3%) were respectively from high, medium and low socioeconomic class as per the Standard of Living Index.

Out of total 260 study subjects, 247 study subjects were included for the final analysis due to attrition. Totally, 119 elderly reported single fall in one year (Incidence of falls was 48.2% (13.5 per 100 person-years). Among them, 54 (45.4%) of the subjects were males and 65 (54.6%) were females. Elderly subjects who had fallen more than once were 24 (9.7%) (recurrent falls). Totally there were 143 subjects (57.9%) who had reported falls. 95 (66.4%) of subjects had falls due to environmental cause, 93(65%) of subjects experienced falls in the indoor settings and 97(67.8%) of them had fall during night time (Table – 1).

Out of 143 falls, 135 (94.4%) of falls led to injury. Most of the injuries were on the head and neck (48.7%) followed by trunk (46.7%). Contusion (72.6%) was the major type of injury following falls (Table – 2).

Incidence of falls were significantly more among subjects aged ≥70 years (61.2%) compare to subjects in 60-69 years group (36.6%), *P*<0.001. Similarly, falls were significantly more among subjects from low/middle SLI (50.2%) compared to subjects from high SLI category (30.8%), *P*=0.03. Falls were significantly more among subjects having poor/average self-perceived health status (57%) compared to subjects with good self-perceived health status (36.2%), *P*=0.001. There was no statistically significant association of falls with sex (*P*=0.8), education (*P*=0.9), employment status (*P*=0.1), marital status (*P*=0.2), type of family (p=0.6), substance use (p=-0.4) and co-morbidity (p=0.09). (Table – 3)

This study revealed incidence of falls significantly more among subject living alone in separate room (66.7%) compared to those sharing room with other family members (41.9%), *P*=0.0006. Similarly, falls were significantly more among subjects living in house with bathroom and toilet placed outside (52.8%) compared to bathroom and toilet placed inside the house (39.3%) *P*=0.04. There was no statistically significant association of falls with overcrowding (*P*=0.9), adequate ventilation and lighting (*P*=0.2, 0.3)), unsafe furniture (*P*=0.6), cooking on the floor (*P*=0.3), uneven steps in the entrance and stairs (*P*=0.7, 0.6), slippery floor in the bathroom and toilet (*P*=0.2) (Table – 4).

Table 1: Distribution of study subjects according to characteristics of falls (n=143).

Variable	Category	Total
No. of falls	1	119(83.2)
	≥1	24(16.8)
Causes for Falls	Intrinsic	48 (33.6)
	Environmental	95(66.4)
Location of falls	Indoor	93(65)
	Outdoor	50(35)
Time of Fall	Day	46(32.2)
	Night	97(67.8)

Table 2: Distribution of study subjects according to characteristics of injury due to falls

Variable	Category	Total
Injury after fall (n=143)	Yes	135(94.4)
	No	8(5.6)
Body parts injured (n=199) *	Head and neck	97(48.7)
	Trunk	93(46.7)
	Upper limb	7(3.5)
	Lower limb	2 (1)
Type of Injury (n=135) #	Contusion	98(72.6)
	Abrasion	28(20.7)
	Laceration	3(2.2)
	Puncture wounds	2(1.5)
	Fractures	4(3)

** Multiple parts; #subjects with injury*

Table 3: Association between Socio-personal characteristics and falls (n=247)

Variable	Category	Falls	No Falls	CI		χ 2	P-value
				Lower	Upper		
Age (years)	60-69	48(36.6)	83 (63.4)	1.6	4.6	14.9	<0.001
	≥70	71(61.2)	45(38.8)				
Sex	Male	54(48.6)	57(51.4)	0.5	1.6	0.02	0.8
	Female	65(47.8)	71(52.2)				
Education	Illiterate	58 (48.3)	62(51.7)	0.6	1.7	0.002	0.9
	Literate	61(48)	66(52)				
Employment Status	Working	35(41.7)	49(58.3)	0.8	2.2	2.1	0.1
	Not Working	84(51.5)	79(48.5)				
Marital status	Married	95(46.3)	110(53.7)	0.8	3.0	1.6	0.2
	Others	24(57.1)	18(42.9)				
Type of family	Nuclear	22(44.9)	27(55.1)	0.4	1.6	0.2	0.6
	Non-Nuclear	97(49)	101 (51)				
SLI	High	8(30.8)	18 (69.2)	1.0	5.4	3.5	0.03
	Low/Middle	111(50.2)	110(49.8)				
Substance use	Yes	72(50.7)	70(49.3)	0.7	2.1	0.8	0.4
	No	47(44.8)	58(55.2)				
Co-morbidity	Yes	58(54.2)	49 (45.8)	0.9	2.5	2.7	0.09
	No	61(43.6)	79(56.4)				
Self-perceived Health status	Good	38(36.2)	67(63.8)	1.4	3.9	11	0.001
	Poor/average	81(57)	61(43)				

Table 4: Association between housing conditions and falls (n=247)

Housing Conditions		Falls	No Falls	CI		χ^2	P-Value
				Lower	Upper		
Living alone in separate room	Yes	42(66.7)	21 (33.3)	1.5	5.1	11.6	0.0006
	No	77(41.9)	107(58.1)				
Overcrowding	Yes	53(48.6)	56(51.4)	0.6	1.7	0.01	0.9
	No	66(47.8)	72(52.3)				
Adequate ventilation	Yes	66(44.9)	81(55.1)	0.4	1.2	1.5	0.2
	No	53 (53)	47(47)				
Adequate Lighting	Yes	66(45.5)	79(54.5)	0.4	1.2	0.9	0.3
	No	53(52)	49(48)				
Unsafe furniture (broken/ sharp edges)	Yes	6(40)	9(60)	0.2	3.1	0.2	0.6
	No	113(48.7)	119(51.3)				
Cooking on the floor	Yes	9(60)	6(40)	0.5	4.8	1.0	0.3
	No	110(47.4)	122(52.6)				
Uneven stairs in the entrance	Yes	10(52.6)	9(47.4)	0.5	3.1	0.2	0.7
	No	109(47.8)	119(52.2)				
Uneven stairs in the stairs	Yes	4(57.1)	3(42.9)	0.3	6.6	0.2	0.6
	No	115(47.9)	125(52.1)				
Location of Bathroom and toilet	Inside	33(39.3)	51(60.7)	0.3	0.9	4.0	0.04
	Out side	86(52.8)	77(47.2)				
Slippery floor in bathroom and toilet	Yes	39(47.3)	39(52.7)	0.8	2.4	1.8	0.2
	No	80(45.1)	89(54.9)				

Discussion

Falls is an important public health concern in developing countries like India where a large proportion of elderly live in rural areas. There has been limited research focusing on incidence of falls among elderly from India. This research studied incidence, cause, location and time of falls, injury following falls and its determinants among elderly aged ≥ 60 years in a rural community.

The present study revealed that the incidence of falls among elderly in the community was 48.2%. Similar incidence studies on falls by Sasidharan DK, Merom D et al and Palagyi A et al observed the incidence of 20.1%, 27% and 30.7% respectively.[8,15,16] These findings strengthen the evidence that the incidence of falls in the present study is higher. This difference probably could be due to variation in the socio-demographic background and divergent lifestyle of the study population.

Most of the falls in this study occurred indoor due to environmental cause and during night times. Vikman I et al., have also reported similar findings.[17] This probably could be due to spending more time in home environment because of functional decline and reduced mobility. In such elderly, environmental factors such as uneven or slippery floors, stairs, obstructed walkways due to poorly arranged furniture and poor lighting increases the incidence of falls. Even though, majority of the causes for falls are environmental in nature, it is difficult to rule out influence of intrinsic factors due to ageing.[18]

Majority (94.4%) of the elderly had injuries following fall and most of them were minor in nature. Similarly, Chu LW observed that 75.2% of the fallers had injuries.[11] These facts show that falls in elderly invariably results in injury. Such injuries also cause fear of falling, loss of independence, functional decline and social isolation as age advances. This study also documents that head and neck was the most common site of injury. Such incidents increase risk of hospitalization and demand high health care cost.

Advanced age (≥70 years) was significantly associated with falls. The result is consistent with studies carried out elsewhere.[17,19,20] Possible explanations for increase in falls with age could be due to setting of frailty leading to gradual motor decline, decreased muscle strength affecting motor activity and also decreased adaptability to the changing environment.[21] Poor socio-economic status (poor/medium standard of living index) was associated with falls. The result is in agreement with studies by Kuh D and Zhang L.[22,4] The reason could be due to the association of lower socio-economic status with poor health status and inadequate health seeking behaviour which increases the risk of falls. Falls were associated with poor self-perceived health status. This is in line with studies by Singh DKA et al and Zhang L.[23,4] This could be due to presence of physical, psychological and functional decline with poor self-perceived health status. Hence, advanced age, socio-economic status and self-perceived health staus can be used as risk factors for predicting falls among elderly population.

Assessment of housing environment showed that falls were associated observations elderly living alone in separate room. Similar observations were made by Bu F.[24] This could be due to the fact that elderly living in the separate room need to take care of themselves (self-care) which increases risk of falls. In such cases, frequent monitoring of elderly is required. Falls were also associated with location of bath room more distance to be travelled and toilet outside the house. This could be due to poor maintaince in terms of inadequate lighting, poor flooring and lack of assistive devices like grab bar in bathroom and toilet located outside. This association needs to be probed in future studies.

As a cohort study, it is limited by loss to follow-up due to death and shifting of residence by elderly and has many strengths such as use of falls diary and close monitoring of elderly subjects with falls which prevented loss of data.

Conclusions: Incidence of falls in this study was more compared to previous studies. Advanced age, low-income, poor self-perceived health status, living in a separate room and location of bathroom and toilet outside the house were associated with increased incidence of falls. This study results reinforce the need for similar prospective large representative sampled studies in near future to confirm the findings and to generate needed information for the development of long term, sustainable interventions in reducing falls among elderly in rural parts of India.

Ethical clearance: Obtained from the from the Institutional Ethics Committee of Kempegowda Institute of Medical Sciences, Bengaluru (KIMSIEC/D-10/2016).

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