ORIGINAL ARTICLE

Circumstances and Consequences of Falls in Community-Living Elderly in North Bangalore Karnataka

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Abstract:

Background: Falls are one of the causes of injuries and non-communicable diseases associated with old age. Falls lead to 20-30% of mild to severe injuries and are underlying cause of 10-15% of all emergency departments. Knowledge of the circumstances and consequences of falls is important for understanding the etiology and prevention of falls. *Material and Methods:* A community based cross sectional study was conducted for a period of one year. Complete enumerations of all the elderly were undertaken by house-to-house visit and a sample of 416 elderly was taken by simple random sampling. A pretested semi-structured questionnaire was administered. Data was analyzed using SPSS version 17. *Results:* Prevalence of falls was 29.8 %, about 82.3% of the old had a single episode of fall, 17.7% had recurrent falls in a year. The fall rate was higher 65.7% among old, 26.3% in young old and 20.0% in very old, outdoor falls constituted 57.2%, indoor falls 42.8%. About 81.4% had one or the other form of injury. Injury rate was 82% in females and 80% in males. Statistically significant higher fall rate of 47.8% falls was seen with elderly who had fear of falling than those without fear of fall with 11.8%. Bruises, internal injuries were commonest (48.5%) and (13.8%) of injuries resulted in fractures. 18.4% had difficulty in carrying out activities of daily living, deformity was observed in 12.6%, and residual disability in 10.6% of the elderly. *Conclusion:* The morbidity due to falls includes injuries, fractures, restricted mobility. The results of this study reflect on the circumstances observed in the indoor and outdoor falls like falls on the footpath, in the bathroom, while using stairs etc. The consequences like bruises and internal injuries followed by sprains, cuts and fractures have been observed. The study suggests possible ways of preventing falls.

Keywords: Falls, Community, Circumstances, Injuries

Introduction:

Demographic ageing is a global phenomenon. As a result of aging there is a progressive, generalized impairment of functions resulting in loss of adaptive response to stress and increasing risk of age related diseases and disabilities [1]. In the year 2050 the projected population of the elderly, 60 years and above in the world will be 2 billion, of them 80% will be in the developing countries [2]. This is alarming as over half of the world's older adults live in Asia. Preventing non-communicable chronic diseases is one of the measures to promote healthy ageing [3]. Falls are prominent among the external causes of unintentional injury. Most of the falls result from a complex interplay of predisposing and precipitating factors in a person's environment. One half to two thirds of

falls occur in or around the patient's home [4]. Falls and consequent injuries are major public health problems that often require medical attention. Falls lead to 20-30% of mild to severe injuries and are underlying cause of 10-15% of all emergencies [5]. Falls are coded as W00-W19 in ICD-10, which cover a wide range of falls including those on the same level, upper level and other unspecified falls. Falls are commonly defined as "**inadvertently coming to rest on the ground, floor or other lower level surface excluding intentional change in position to rest in furniture, wall or other objects [6]. Recurrent falls are defined as two or more events occurring within a period of six month [1].** In India there are limited studies related to consequences of falls in older adults [7]. Many a times, falls and their sequelae are potentially preventable. Considerable research is available on determinants of health and active ageing in developed countries, while there is a limited research on healthy ageing in developing countries like India [1]. The current study was therefore undertaken with an aim to assess the circumstances and consequences of falls of elderly in the community.

Material and Methods:

Place and duration of the study:

A community based cross sectional study was conducted for a period of one year (April 2010 to March 2011) in Mathikere area, Bangalore urban, Karnataka, India. The population served by the Urban Health Centre was 7000. Hence the population of elderly was estimated to be 560 (8% of total population as per census). The sample size

was estimated based on the circumstantial factors and injury rate of fall. In a study of D'Souza *et al* [8], among environmental circumstances 30% of the falls observed were outdoor. In some other studies the injury rate following the fall was 20-30% [5, 9]. Considering both the factors at 30%, sample size calculation for the present study, the sample size was estimated to be 416. With a non response rate of 4%, at 95% confidence interval with a relative precision of 15%. The inclusion criteria were the elderly subjects above 60 years of age and a residence in a home in that community since last 1 year in the study area. The exclusion criteria were the elderly who were relatives and visitors at the time of house visit, subjects with history of assault/Road Traffic Accident (RTA) and elderly living in the old age home. An informed consent from the participants was taken and an approval from the Institutional Ethics Board was obtained.

Methodology:

Complete enumeration of all elderly in the study area was done by census method and the sample of 416 was obtained by simple random sampling. Data was collected using a standardized, semi-structured questionnaire and by physical examination. Based on the age, these subjects were classified into three groups: 60-75 years (young old); 76-85years (old old); and >85years (very old) [1]. The questionnaire included history of fall in the last six months, circumstances of fall, Location of fall classified as Indoor or Outdoor. Time of fall, nature of fall and consequence of fall were noted. Information about injuries sustained, body parts involved, types of injuries, history of

hospitalization due to falls, details regarding aches and pains, deformity, residual disability, difficulty in carrying out Activities of Daily Living (ADL) was taken. Details about the environmental or circumstantial factors was collected by house to house visits and also by interviewing the study subjects underlying risk factors like cluttering, adequacy of graspable handholds, handrails, thresholds at entrance of house/rooms and adequacy of lighting were found out.

Statistical Analysis:

For quantitative data means with standard deviation and for qualitative data, proportions were computed. Appropriate tests of significance like Chi-Square/ Fisher exact test and odds ratio with confidence interval were employed to find the association between two variables for assessment of circumstances of fall. A *P* value ≤ 0.05 was considered statistically significant. Data was entered and analyzed using SPSS version 17.0. SPSS Version (17.5, IBM, Armonk, USA)

Results:

A total of 416 elderly participated in the study. Mean age of the elderly was 67 years with a standard deviation of 6 years and the median age was 65 years. About 25% of the study population was below 62 years, 50% were below 65 years and 25% were above 70 years. The distribution of population in different age category was 368 (88.4%), 38(9.2%) and 10(2.4%) in 60-75, 76-85 and > 85 years of age group respectively. There were 268(64.4%) females as compared to 148(35.6%) males. Of the 416 elderly study subjects, 124 (29.8%) elderly had fall at least once in previous six months. There was no significant difference in fall rate of 31.3% (84/268) females and 27.02% (40/148) males (p>0.05). Statistically significant higher fall rate of 65.7 % (25/38) was observed in 76-85 years as compared to 26.3% (97/368) and 20% (2/10) respectively (p<0.05) in the age group of 60-75 and >85 years.

Circumstances of fall:

Overall 102 (82.3%) of the elderly with history of fall had single episode of fall and 22(17.7%) had recurrent fall (>=2 fall in last six months). Females had higher frequency of single fall rate 73(86.9%) as compared to males 29(72.5%) (2=3.85, p=0.05). Slipping was observed in 50(40.3%) and tripping in 34(27.4%) individuals with falls as two most common causes followed by feeling giddy or fainting attacks in 18(14.5%). Outdoors falls were 71(57.2%) as compared to indoor falls 53(42.8%). Among outdoor falls, 45(63.3%) falls were observed on the footpath. Among indoor falls, 16(30.1%) falls occurred in the bathroom, followed by 12(22.6%) falls while using stairs. The falls from the bed were 7(13.2%) and on the floor were 6(11.3%). The exposure to a few environmental factors was seen with higher fall rate (Table 1). Out of which differences in fall rates for houses with cluttering, inadequate lighting, steps at the entrance of house, split levels in the house, uneven floor of the house and slippery floor of the house were statistically significant (Table 1). Exposure to other possible risk factors however was seen with non significant difference in the fall rates.

Table 1: Assessment of Various Environmental Factors among the Study Population

Sr. No	Environmental factors	Number of exposed	Percent	Number of falls	Fall rate (%)	Odds ratio (RAE / RANE)	Confidential Interval
1	Cluttering in the house	282	67.7	23	11.7	1.08	1.05 - 1.12*
2	Lighting inadequate	184	44.2	16	8.7	1.09	1.04 - 1.14*
3	Steps at the entrance of house	153	36.8	6	3.9	5.32	1.06 - 26.72*
4	Uneven floor of the house	26	6.2	5	19.2	1.23	1.02 - 1.49*
5	Split levels in the house	26	6.2	6	23.1	1.30	1.05 - 1.60*
6	Slippery floor of the house	50	12.0	6	12.0	1.13	1.02 - 1.25*
7	Inadequate handholds	85	20.4	11	12.9	1.06	0.29 - 3.90
8	Thresholds in the house	308	74.0	16	5.2	1.91	0.54 - 6.71
9	Carpets/loose rugs on the floor	317	76.2	6	1.9	1.89	0.22 - 15.89
10	Use of Indian toilet	398	95.6	8	2.0	2.86	0.33-24.24
11	Uneven surfaces in the surroundings	392	94.2	14	3.6	0.85	0.10 - 6.76

*Statistically significant at $p \leq 0.05$, (RAE/RANE=Rate among exposed/Rate among not exposed)

Majority i,e .67 (54%) of the elderly had falls in the morning, followed by 41(33.2%) in the evening, 15(12%) in the afternoon and only 1(0.8%) in the night. Majority i, e. 67 (54%) of the falls occurred during ambulation, followed by 27(21.7%) in transferring, 11(8.8%) during bathing, while only 1(0.8%) of the fall was observed while using the toilet and 5(4%) while using the stairs (Table 2).

Table 2: Activity Engaged in at the Time of Fall in Elderly

Activity engaged at the time of fall	Persons with fall N (%)
Ambulation	67 (54.0)
Transferring	27 (21.7)
In Bathroom	12 (9.6)
Bathing	11 (8.8)
While Using Toilet	1 (0.8)
While Using Stairs	5 (4.0)
Total	124

Statistically significant higher fall rate was seen with the elderly who had fear of fall among 47.8% (33/69) than those without fear of fall 11.8%(41/347) (OR=2.62, CI=1.61-4.63, χ^2 =14.66, p=0.001).

Consequences of fall:

Overall the injury rate in the study population of 416 elderly was 24.2%. Out of total 124 elderly who had fall 101(81.4%) had one or the other forms of injury, 23(18.6%) of the elderly did not succumb to any injury and there was no statistically significant difference in the injury rate of 82% in females and 80% in males. Similarly there was no statistically significant difference in the injury rate with increasing age, 85.3% >75 years and 80.4% in the age group of 60-75 years (Table 3).

Table 3: Injury Rate in Elderly with Fall

Particulars	Category	Total No. of elderly N (%)	Total No. of elderly with fall N (%)		Injury rate in elderly with fall N (%)	χ^2 and p value*
Age in years	60-75	368(88.4)	97(26.3)		78(80.4)	χ^2=0.31 p > 0.05
	76-85	38 (9.2)	25(65.7)	27(56.2)**	23(85.3)	
	>85	10(2.4)	2(20.0)			
Gender	Male	148(35.6)	40(27.0)		32(80)	χ^2=0.81 p > 0.05
	Female	268(64.4)	84(31.3)		69(82)	
Total		416	124(29.8)		101(81.4)	

*p ≤ 0.05 is statistically significant, χ^2=chisquare , **Age groups classified as 60-75years and >75 years for the analysis (because of small numbers in >85years of age group).*

Among the injured elderly, lower limb was affected in 56(52.4%), followed by upper limb in 26(24.3%) and <10% of injuries were observed on head, back and face.

Bruises and internal injuries were found in 49(48.6%), followed by sprains, cuts and grazes in 38(37.6%) and injuries resulting in fractures in 14(13.8%). Bruises and internal injuries were among > 75years of age group were 13(59.1%). The fracture rate was higher among females i,e 11(15.8%) and in 60-75 years of age group i,e 12 (15%) (Table 4).

Table 4: Types of Injuries in the Elderly among those Injured

Type of injury	Gender		Age in years		Total
	Males	**Females**	**60-75**	**>75**	**N=101**
	N (%)	**N (%)**	**N (%)**	**N (%)**	
Bruises and internal injuries	13(42.0)	36(51.4)	36(45.5)	13(59.0)	49(48.6)
Sprains, grazes, cuts and others	15(48.4)	23(32.8)	31(39.3)	7(31.9)	38(37.6)
Fractures	3(9.6)	11(15.8)	12(15.2)	2(9.1)	14(13.8)
Total	31(100)	70(100)	79(100)	22(100)	101
χ^2 **and p value**	4.86, 0.56		9.52, 0.14		

*p ≤ 0.05 is statistically significant, χ^2=chi square (Note: figures in the parenthesis indicate column percentages)

Aches and pains were the commonest problems seen among 46(58.2%) after the episode of fall, 19(18.4%) had difficulty in carrying out activities of daily living, deformity was observed in 13 (12.6%) and residual disability was seen in 11(10.6%) of the elderly. Majority i.e., 93 (75%) of the elderly received the first aid care, 74(59.7%) required medical care while 14(11.3%) required hospitalization.

Discussion:

In India, the prevalence of falls among older adults aged 60 years and above has been reported to be 14% to 53% [9]. In the present study fall rate has been 29.8%.The frequency of falls has increased with age upto 75years which is comparable to other studies [9, 10]. This could be because most falls are associated with age related conditions such as physical frailty, immobility and reduced functional capacity.

Circumstances of falls:

The observation in the present study that falls most often have occurred while individuals have been walking (on level or on uneven surfaces) is consistent with previous reports [8,11], as well as the finding that the feet that tripped and slipped cause most falls.[8,11-13] The observation that the majority of the falls have been outdoor and more than one third of indoor falls also have been is in accordance with D'Souza *et al*[8] Hazardous obstacles are found both indoors and outdoors. The common indoor obstacles being defects in flooring, carpet edges, door thresholds, uneven floors, split levels and the slippery floors of the house. A number of factors like inadequate illumination, distractions and lack of attention, older people may or may not be aware of the presence of hazardous obstacles could cause a trip that leads to fall, the findings which are in

accordance with other studies.[11,12] Majority of falls in the present study have occurred in the morning and could be attributed to hurrying too much in the morning hours which is the time of maximum ambulatory period, transferring activity, as observed in other studies.[8,14]

Several studies including the present study have shown higher fall rate among the elderly who have fear of falling which could be due to loss of self-confidence as well as social withdrawal and confusion. A previous history of fall is associated with increased risk of falling. Studies in older persons have suggested that fear of falling puts persons at a marked increased risk of falls and other adverse outcomes [14-16].

Consequences of fall:

The overall injury rate of 81.4% among elderly observed in the present study is similar to studies in Kerala [17] and Andra Pradesh [18**]**. The fracture rate of 13% in present study is similar to a study done by Bergalnd [19]. However higher fracture rate than the present study has been observed in a study done in north India in which the fracture rate has been 21.3% [8, 20]. With the increasing age bones become more osteoporotic which leads to higher rate of fracture. Aches and pains (58.2%) have been the commonest problems following an episode of fall which could lead to the decline of activities of daily living and decreased ability to perform many things. Similar observations have been noted in many other studies [17, 18, 21,]. Care received has been

higher in elderly aged above 75 years which could be due to frail elderly where even minor injury could lead to major disabilities and need extra care. The results of this study are also consistent with previous findings that fall injuries become more frequent with increasing age [13, 18, 22-24]. High injury rates and fracture rates in females in the present study may be due early onset of osteoporotic changes in the bones and high vulnerability for soft tissue injuries. More than 59% who have fallen in the present study have required medical attention for their injuries [17], nearly one-third of reported falls produced pain, 18.4% have had difficulty in carrying out activities of daily living, deformity is observed in about 12.6% and residual disability is seen in about 10.6% of the elderly. Clearly, falls can be disruptive to the lives of elderly living independently in the community, even when they do not result in injuries severe enough to require medical attention.

Conclusion:

The results of present study reflect the circumstances and consequences of falls among Community-living elderly. Higher disability and consequent increased distress has been noted among those with a history of fall. The morbidity due to falls include bruises, sprains, cuts as well as serious injuries and fractures, restricted mobility and loss of independence leading to functional decline, psychological fear of falling (post fall syndrome) and permanent disability. More

emphasis needs to be given to the circumstances like the falls observed in houses with cluttering, inadequate lighting, steps at the entrance of house, split levels in the house, uneven floor of the house and slippery floor of the house for possible ways of preventing falls and consequences of falls which will help in falls prevention programme.

References:

1. Sharma O P. Textbook of Geriatrics and Gerontology,3rd ed, Viva books 2005; 2-3: 610-614.

2. Population Reference Bureau. World population highlights: key findings from PRB's 2010 world population data sheet.

    http://www.prb.org/pdf10/65.2highlights.pdf. Accessed on 2011 Feb 12.

3. World Health Organization. Active ageing: a policy framework.

    http://whqlibdoc.who.int/hq/2002/who_nmh_02.8.pdf Accessed on 2013 June 13.

4. Krishnaswamy B, Jnanasambandam U. Falls in older people: National and regional review India. Available at: http://www.who.int/ ageing/projects/SEARO.pdf. Accessed on 2011 Jan 9 2011.

5. Scuffham P, Chaplin S, Legood R. Incidence and costs of unintentional falls in older people in the United Kingdom. *J Epidemiol Community Health* 2003; 57: 740-44.

6. WHO. WHO Global Report on falls prevention in older age. WHO Press 2008. Available at: http://www.who.int/ageing/publications/Falls_prevention7March.pdf. Accessed on 2010 Mar 15.

7. Sebestina D. Falls in Older Adults: A Barrier to Active Ageing. 2012.

    http://shodhganga.inflibnet.ac.in/bitstream/10603/4991/3/11-chapter%20ii.pdf. Accessed on 2014 Mar 18.

8. D'Souza SA, Shringarpure A, Jhanavi K. Circumstances and consequences of falls in Indian older adults. *The Indian Journal of Occupational Therapy* 2008;40(1);3-11

9. D'Souza SA, Rajashekar B, D'Souza HS, Kumar KB. Falls in Indian older adults: a barrier to active ageing. *Asian J Gerontol Geriatr* 2014; 9; 33–40.

10. Dandona R, Kumar GA, Ivers R, Joshi R, Neal B, Dandona L. Characteristics of non-fatal fall injuries in rural India. *Inj Prev* 2010; 16(3); 166-71.

11. Usha G, Krishnaswamy B. Bone mineral density and fracture threshold in south Indian elderly. *JAPI* 2002; 50; 249-58.

12. Patel JC. Falls in elderly. *Indian J Med Sci* 2000; 54; 350-2.
    http://www.indianjmedsci.org/text.asp?2000/54/8/350/12169. Accessed on 2010 Jun 2.

13. Jagnoor J, Suraweera W, Keay L, Ivers RQ, Thakur JS, Gururaj G *et al*. Childhood and adult mortality from unintentional falls in India. *Bull World Health Organ*

2011; 89: 733-40.

14. William R, Helaine MA , Eugenia MM, Chen T. Circumstances and consequences of falls in independent community dwelling older adults. *Age and Ageing 1997;* 26; 261-68.

15. Kumar S, Vendhan GV, Awasthi S. Relationship between fear of falling, balance impairment and functional mobility in community dwelling elderly. *IJPMR 2008; 19 (2); 48-52.*

16. Abhay B, Mane T, Sanjana, Prabhakar RP, Sriniwas TH. Prevalence and correlates of fear of falling among elderly population in urban area of Karnataka. *Midlife Health* 2014; 5(3); 150–55. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4195 189/.Accessed on 2015 May 5.

17. Johnson SJ. Frequency and nature of falls among older women in India. *Asia Pac J Public Health* 2006; 18; 56-61.

18. Cardona M, Joshi R, Ivers RQ, Iyengar S, Chow CK, Colman S, *et al*. The burden of fatal and non-fatal injury in rural India. *Inj Prev* 2008; 14; 232-37.

19. Bergland A, Wyller T B. Risk factors for serious fall related injury in elderly women living at home. *Injury Prevention* 2004; 10; 308–313.

20. Joshi AK, Kumar R, Avasthi A. Morbidity profile and its relationship with disability and psychological distress among elderly people in Northern India. *Int J Epidemiology* 2003; 32; 978–87.

21. Murphy S, Tickle-Degnen L. Participation in daily living tasks among older adults with fear of falling. *Am J Occup Ther* 2001;55;538–44

22. Talbot LA, Musiol RJ, Witham EK, Metter EJ. Falls in young, middle-aged and older community dwelling adults: perceived cause, environmental factors and injury. *BMC Public Health* 2005; 5(86). Available at www.ncbi.nlm.nih.gov/pmc cited 5/4/2010. Accessed on 2009 Sep 3.

23. Krishnaswamy B, Shanthi GS. Risk factors for falls in elderly. *Journal of Indian Academy of Geriatrics* 2005; 1(2); 57-60.

24. Kaushik A, Dsouza SA. Balance confidence in Indian community dwelling older adults. *J Indian Acad Geriatr* 2008; 4; 149-55.

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