Levels, Differential and Factors Associated with Falls among Older Adults in a Tertiary Care Hospital of Delhi: A Cross-Sectional Study

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Abstract

Background

Worldwide, the number of people over 60 years is growing faster than any other age group and expected to grow from 688 million in 2006 to almost 2 billion by 2050. Aging is generally associated with progressive decline in physical and psychological health with increased risk of disability and dependency as well as an increase in the number of co-morbidities. In India, the prevalence of falls among older adults 60 years and older was reported to vary between 14% to 53%.

Objective

The present study aimed to estimate the magnitude of the fall among the older adult (≥60 years), its differential and factors associated with falls.

Methods

Using primary data collected from Geriatric OPD in Medicine Department of AIIMS. The data on 850 subjects was collected including 10% refusals. From each OPD, subjects were selected by systematic random sampling. Every fifth patient attending the OPD was interviewed for data collection after taking the informed consent. To meet the objective, the univariate and multivariate logistic analysis were performed.

Findings

The level of falls in Indian older adults was found to be 22% with SE of 1.5% and 95% CI as (19%, 25%). Out of 168 subjects with fall, 117 (69.6%) had fall once, 43 (25.6%) had fallen twice and 8 (4.8%) had fallen for three times and above in past in one year.

Conclusion

The findings of this hospital based study indicate falls are a public health problem in Indian older adults. The identified risk factors from this study are age, BMI and frailty. Findings of the study suggest that more studies need to be conducted at community level with proper methodology for prevalence of falls. The prevention strategies for falls at population level have yet to be properly studied.

Keywords: Falls; Older Adults; AIIMS; Frailty; Chronic Disease; Medication

Background

Worldwide, the number of people over 60 years is growing faster than any other age group and expected to grow from 688 million in 2006 to almost 2 billion by 2050 [1,2]. This future increase in the proportion of older adults is important from a public health perspective. Aging is generally associated with progressive decline in physical and psychological health with increased risk of disability and dependency as well as an increase in the number of co-morbidities. This decrease in health status is mainly responsible for one of the most common and serious public health problems, namely falls [1]. Over 33% of community-dwelling people aged over 65 years fall at least once a year, and of those 50% will have recurrent falls. With increasing age, the rate of falls can increase up to 60%. Older adults suffering from cognitive decline may fall twice as often compared to their healthy counterparts while institutionalized older adults in nursing homes or old people's homes fall even more often [2]. Globally approximately 28-35% of people aged of 65 and over fall each year [3-5] increasing to 32-42% for those over 70 years of age [6-8]. The frequency of falls increases with age and frailty level. Older people who are living in nursing homes fall more often than those who are living in community. Approximately 30-50% of people living in long-term care institutions fall each year, and 40% of them experienced recurrent falls [9]. Centre for Disease Control and prevention reported that one out of three older adults’ falls but less than half talk to their health care provider about it [10].

The incidence of falls appears to vary among countries as well. For instance, a study in the South-East Asia Region found that in China, 6-31% [11-15] while another found that in Japan, 20% [16] of older adults fell each year. A retrospective cross-sectional study on falls in Hong Kong showed a prevalence rate of 18% over the
past year [17]. In India, the prevalence of falls among older adults 60 years and older was reported to vary between 14% to 53% [18-21]. Although these studies were conducted in community but they vary in terms of falls history criteria, duration, and methods. In addition the sample selected for the studies are not representative of the whole community. Falls are under reported and the actual prevalence is likely to be higher. A recent study in India by Dousza (2014) revealed that the prevalence of falls increases with age and is highest in women and institutionalized older adults [22]. The current demographic transition in India is leading to a rapid increase in the geriatric population which harbours many of the risk factors for falls and is the leading cause of both fatal and nonfatal injuries. The moderate to severe injuries caused by falls, such as hip fractures and head traumas and can increase the risk of early death. Most of the available literature on study of risk factors for falls have identified advancing age, physical inactivity, poor visual acuity, arthritis, dementia, history of stroke, hypertension, depression, previous history of falls, low hand grip strength or muscles weakness, age older than 80 years, poor balance and use of 4 or more drugs among others to be important predictors of falls and recurrent falls [4,6,17].

A fall can result in lasting and critical consequences; including injuries [23], long term disability, reduced activities and mobility level, admission to long term care institution, fear of falling, reduced self confidence in mobility and death[24].

**Rationale**

Falls are one of the causes of injuries and non-communicable diseases associated with old age. Falls among older adult population (≥ 60 years) are a public health problem that is largely preventable. Considering the magnitude of the ageing population and socio economic changes in India, measure to keep older people healthy and active are the utmost importance. Performing surveys on falls among the elderly living in institutions and replicating the aging surveys in all parts of India, to obtain a comprehensive perspective and information to suggest suitable polices at regional and national levels, to help the elderly to live healthy and disability free life is the need of the hour. However keeping in view the limited research in Indian population especially in urban area, a hospital based study was conceived by National Institute of Medical Statistics (NIMS), ICMR, New Delhi in collaboration with All India Institute of Medical Sciences, (AIIMS), and New Delhi. The study was conducted with the aim to estimate the magnitude of the fall among the older adult (≥ 60 years), its differential and factors associated with falls. It was envisioned that such data would be helpful to design and implement falls risk reduction strategies for elderly individuals at higher risk of falling.

**Material & Methods**

**Study Design and Population**

For this cross sectional study aiming to investigate the magnitude, differentials and factors associated with fall among older adults aging 60yrs and above, a sample of 850 older adults were included, assuming the proportion of falls among older adults as 14%[25] width of CI was set as 5 with 5% level of significance with a refusal of 10%. The data was collected from the Geriatric OPD of All India Institute of Medical Sciences, New Delhi located in South Delhi. Consent from the entire willing participant in the study was taken. Those subjects were excluded who had refused to provide the consent. The study was approved from the Institutional Ethics Committees of AIIMS, New Delhi and NIMS, ICMR.

**Sampling Method for Selection of Subjects**

The Geriatric OPD in Medicine Department of AIIMS takes place six days a week (Monday to Saturday). The average load of new patients attending Geriatric OPD was approximately 50 patients per day. The data on 850 subjects was collected including 10% refusals. From each OPD, subjects were selected by systematic random sampling. Every fifth patient attending the OPD was interviewed for data collection after taking the informed consent. Those subjects who had refused to provide consent and did not cooperate for data collection were excluded from the study. Therefore, complete data was collected on 765 patients. Data was collected in each OPD by the SRFs (Senior Research Fellows) appointed for this purpose. Reference Period for data collection for fall was previous one year. The data was collected from February 2016 to May 2016.

**Operational Definition of Fall**

WHO definition of falls was adopted wherein a fall is defined as an event which results in a person coming to rest inadvertently on the ground or floor or other lower level other than as a consequences of the sustaining a violent blow, loss of consciousness, sudden onset of paralysis or an epileptic seizure. Fall-related injuries may be fatal or non-fatal[1] though most were non-fatal[26]. A well designed pre tested questionnaire using demographic status (age, gender, education level, living status etc.), socioeconomic, intrinsic risk factors which includes history of falls, time of fall, medicines taken, medical conditions, visual impairments and foot problems, Cognition status - Hindi MMSE, Environmental hazard- HOME Fast (Standardized tool by Byles) and Indian frailty was developed from the existing literature to collect the data [26-27]. As per the definition of outcome variable, a fall was identified if a patient reported a sudden loss of balance or reason for fall as not known or no idea about the occurrence of fall. The fall cases were coded as 1 and non-fall cases as 2.

**Independent Variables**

The predictor variable included in this study age was categories in 60-64 yrs., 65-69yrs. and 70+ yrs. BMI was calculated as weight in kg per height in meters [2]. BMI less than 18.5 considered as underweight, BMI 18.5-25 as normal and above 25 as overweight. Modified Kuppuuswami socioeconomic scores were used to classify the patients in low and high socio economic groups [27]. On the basis of scores obtained, average score of 8 was taken as a cut off value for classifying in low and high socio economic groups. The subjects with less than eight score were taken as low and coded as 1 and rest were coded as 2 for higher socio economic.

Frailty was assessed by Indian Frailty Criterias developed [28] where in either three major domains of the criteria or two major with one minor domain were taken as frail. The remaining cases were treated as non-frail. The frail cases were coded as 1 for
analysis and non-frail as 2. Further, two more questions on loss deterioration of memory and other on significant loss in weight were also considered for calculating the final frailty. Therefore, final frailty was calculated if either loss deterioration of memory or significant loss in weight is present then a case was identified as frailty case otherwise a non-frailty case. The Hindi MMSE score was calculated by combining all the responses of 25 questions and the number of positive response become the score.

Data Analysis

To examine the association between the fall with age, BMI, socioeconomic status, chronic disease, medication (per day), and frailty assessment, Pearson chi-square test for qualitative variables and t test for quantitative variables were used. To identify the factors associated with fall, univariate and multivariate logistic analysis was used. The various predictor variables were recoded as explained above. The results were presented with unadjusted and adjusted odds ratio (O.R) with 95% confidence interval. The significant level was set as 5% level. Statistical analyses were performed on SPSS (version 20.0). Regression analysis was applied to predict frailty with age.

Results

The data was analyzed on 765 subjects from the Geriatric OPD, AIIMS, and New Delhi. Out of 765 subjects, the study found 168 subjects with fall in the previous one year as per the WHO definition of fall and remaining 597 subjects were with no fall. The level of falls in Indian older adults was found to be 22% with SE of 1.5% and 95% CI as (19%, 25%). Out of 168 subjects with fall, 117(69.6%) had fall once, 43(25.6%) had fallen twice and 8(4.8%) had fallen for three times and above in past in one year. About 34%
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The mean age was 68.6 yrs in falls while 65.3yrs in no fall group. The significant difference was seen in the mean age of two groups, with fall and no fall (t= 6.33, p=0.000). The percent of fall in the age group 60 to 64 years was 27.3% (n=46), 28.5% (n=48) in age group 65-69yrs and 46.4% (n=74) in the age group 70and above. Overall an increasing trend of fall with age is observed. The unadjusted logistic regression was applied to identify the risk the risk of fall in age group 65-69yrs. (OR= 2.02, p= 0.002, 95%CI (1.29, 3.15) when compared with the age group 60-64yrs. Similarly the OR for fall in 69+ is 4.13(p=0.000, 95%CI = 2.70, 6.30) more when compared with 60-64yrs. No significant difference was found for gender when compared falls with no falls (p=0.291), indicating no relationship of fall with gender. The other predictor variables BMI, socioeconomic status, frailty, medication and chronic disease were also found to be significantly related with fall when compared with no fall (p<0.05) (Table 2).

Discussion

A cross section study in Geriatric OPD of All India Institute of Medical Sciences, New Delhi was conducted during February 2016 to May 2016. The data on 765 was collected for those who had given the consent. Ten percent of the participants refuse to give the information due to no time. Out of 765 subjects 368 had reported history of ever fall. However, as per the operational definition used in study, 168 (22%) subjects reported fall during the past one year having reason as either not known or spontaneously fallen. In one of the previous study percentage of fall is reported as 38% where the sample was taken from the community [29]. The difference in the percentage of fall may be due to lack of clarity and consistency in definition. Further, the study reveals that the proportion of fall increases with the increase in age. The proportion of fall is 27%, 28% and 44% respectively in the age group 60-64yrs, 65-69yrs and 70+. This is comparable with the published literature[30-31]. The difference between the mean age in fall and no fall group is significant (t= 6.33, p=0.000). Logistic regression analysis was applied to identify the risk factors for fall when compared with no fall group. It was observed that the risk of fall is 1.83 (p=0.010) times higher in age group 65-69 as compared to 60-64yrs. Similarly the risk of falls is 3.31(p=0.000) times higher in age 69+ yrs. as compared to 60-64yrs. This indicates as the age increases the risk of fall increases.

In India, very few studies are available for comparing the findings. This hospital based study found no association of fall with gender. However, in one of the study gender difference is observed.[18] Findings are difficult to agree with this study due to methodological issues where the data was collected from community and the sample is not represented of the population[29]. Univariate logistic regression analysis shows that the fall is significantly associated with predictor variables viz BMI, socioeconomic status, chronic disease, medication per day and frailty. It was found that the risk of fall in underweight is 2.74 times higher as compared to normal BMI while it is 1.77 times higher in overweight when compared to normal. This indicates a low body mass index suggesting malnutrition, is associated with increased risk of fall and comparable with the other published findings[30-31]. The risk of falls in low socioeconomic status is significant (p=0.02) as compared to high socioeconomic group. This may be due to the nutritional status or
Table 1: Unadjusted Logistic Regression for fall; Odds Ratio of fall (95% CI)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Fall (n=168)</th>
<th>No fall (n=597)</th>
<th>OR (95% C.I)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (yrs)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-64</td>
<td>46</td>
<td>313</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>65-69</td>
<td>48</td>
<td>162</td>
<td>2.02 (1.29, 3.15)</td>
<td>0.002</td>
</tr>
<tr>
<td>69+</td>
<td>74</td>
<td>122</td>
<td>4.13 (2.70, 6.30)</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>SEX</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>86</td>
<td>333</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>82</td>
<td>264</td>
<td>1.20 (0.85, 1.69)</td>
<td>0.291</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>9</td>
<td>17</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Under-weight</td>
<td>51</td>
<td>264</td>
<td>2.74 (1.16, 6.48)</td>
<td>0.022</td>
</tr>
<tr>
<td>Over-weight</td>
<td>108</td>
<td>316</td>
<td>1.77 (1.22, 2.56)</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>Socioeconomic Status</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>High</td>
<td>116</td>
<td>353</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>52</td>
<td>244</td>
<td>1.54 (1.07, 2.22)</td>
<td>0.020</td>
</tr>
<tr>
<td><strong>Chronic disease</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One</td>
<td>41</td>
<td>194</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Two</td>
<td>81</td>
<td>287</td>
<td>1.33 (0.88, 2.03)</td>
<td>0.174</td>
</tr>
<tr>
<td>Three+</td>
<td>46</td>
<td>116</td>
<td>1.88 (1.16, 3.03)</td>
<td>0.010</td>
</tr>
<tr>
<td><strong>Medication (per day)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 4</td>
<td>111</td>
<td>456</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4 and above</td>
<td>57</td>
<td>141</td>
<td>1.66 (1.15, 2.41)</td>
<td>0.007</td>
</tr>
<tr>
<td><strong>Frailty Assessment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Frail</td>
<td>29</td>
<td>164</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Frail</td>
<td>139</td>
<td>433</td>
<td>3.73 (1.84, 7.5)</td>
<td>0.000</td>
</tr>
</tbody>
</table>

P<0.05 is significant (S) * p>0.05 non-significant (NS)

The adjusted logistic regression was applied to see the joint effect of the predictor variables age, BMI, sex, socio economic status, chronic disease, medication and frailty. The predictor variables age, BMI and frailty were significantly contributed in predicting fall (p<0.05). To identify the risk of fall in various categories of age, the consecutive categories were compared. The odds ratios for age group 65-69 yrs is 0.553 (p=0.011, 95% CI is 0.35, 0.87). It shows the risk for fall in underweight is higher (OR=2.46, p=0.40; 95% CI = 1.04, 2.56) as compared to normal category. Similarly the risk of fall in over weight is also higher,OR=1.74; p= 0.006 **; (95% CI 1.17, 2.57). The risk of fall is 1.25 times higher in frail cases as compared to non-frail subjects (OR=1.25; p= 0.14; 95% CI=1.21, 5.21).
the food consumed by the two groups. Further, the risk of fall was likely to be 1.88 times higher in those who were taking three or more medicines per day as compared to one (p=0.010). Frailty was calculated using Indian criteria[28] combined with loss of weight and forgetting more often than before. It was found that it is significantly associated with fall (OR=3.73; p=0.000; 95%CI=1.84, 7.5). The likely chance of fall is 3.73 times higher in group with frailty as compared to non-frail subjects. To see the joint effect of the significant risk factors found in univariate logistic regression analysis, these were adjusted by applying the multivariate logistic regression. It was found that age, BMI and frailty are associated with the fall (p<0.05). It indicates that the risk of fall is higher in subjects with age >65+ yrs., BMI as either underweight or overweight along with frailty. The risk of fall is 2.51 times higher in the subjects with frailty as compared to no frailty (p=0.014).

Further, the study found the negative correlation between the scores for Hindi MMSE and age. The regression analysis shows as the age increase the HMMSE score decreases (β= -0.232; p=0.000; 95% CI= -0.199,-0.107). In the present study about 54% of the falls occurred in afternoon. 33% of falls resulted in injuries. About 67% has not taken any treatment while 20% has taken first aid. Of these 33% only 48% had taken treatment. The data on type of injury has not been collected however 3% has used walker as the mobility aid. This only suggested minor injuries might have occurred.

### Conclusion
The findings of this hospital based study indicate falls are a public health problem in Indian older adults. The identified risk factors from this study are age, BMI and frailty. Findings of the study suggest that more studies need to be conducted at community level with proper methodology for prevalence of falls. The prevention strategies for falls at population level have yet to be properly studied.

### Limitation of Study
This cross sectional study was conducted at hospital level due to...
non-availability of funds and time. There was limited space in the OPD which poses difficulty in collecting the data thereby ten percent of the subject refused to participate in the study.

Acknowledgement

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References