ORIGINAL ARTICLE

Frailty and the Fall: Unveiling the Burden of Falls among the Elderly in the Urban Slums of Siliguri

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Abstract

Background: Falls among the elderly are a significant public health concern, particularly in socioeconomically disadvantaged urban settings. Beyond physical injuries, falls contribute to psychological effects such as fear of falling, which may limit mobility and increase dependency. The concept of fall efficacy, or the confidence in performing daily activities without falling, has emerged as a key psychological indicator in understanding fall risk. However, limited data exist on these aspects among older adults living in urban slums in India.

Objectives: To determine the prevalence of falls among older adults residing in urban slums of Siliguri, West Bengal, and to explore the association between fall efficacy and the occurrence of falls.

Methods: A descriptive cross-sectional study was conducted among 207 adults aged ≥60 years selected *via* two-stage cluster sampling from 30 urban slum clusters in Siliguri. Data were collected *via* a pretested, semi-structured questionnaire capturing sociodemographic information, medical history, fall episodes, and fall efficacy, assessed using the Fall Efficacy Scale (FES). Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 20.0 with multivariable logistic regression to identify predictors of falls.

Results: The prevalence of falls in the past 6 months was 41.1%, and the distribution of falls was nearly equal between indoor and outdoor settings. Significant predictors of falls included advanced age [≥80 years; adjusted odds ratio (AOR) = 4.25], presence of comorbidities (AOR = 8.16), physical disabilities (AOR = 2.50), and residence in pucca houses (AOR = 3.38). Although higher concern about falling (as indicated by higher FES scores) was associated with increased fall risk (AOR = 1.88), the association was not statistically significant.

Conclusion: Falls among the elderly in urban slums are prevalent and influenced by a complex interplay of age, health status, and living conditions. Integrating physical, environmental, and psychological interventions is critical for fall prevention among older adults, especially in underserved urban slums.

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Introduction

A fall is defined by the World Health Organization (WHO) as "an event which results in a person coming to rest inadvertently on the ground, floor, or other lower level."[1] Falls are not only common but also pose a serious threat to the health and well-being of the elderly population. They are multifactorial events influenced by a range of biological, environmental, behavioral, and socioeconomic risk factors.[2] The injuries sustained from falls, along with their psychological impact and potential for long-term disability, can significantly affect an older adult's quality of life and compromise their ability to live independently. These may include physical harm such as fractures and head injuries, a subsequent loss of functional independence, and psychological sequelae like fear of falling. In severe cases, falls may even lead to mortality.[3]

Globally, falls are recognized as a serious public health concern. According to WHO estimates, about 6,84,000 fall-related deaths occur each year, ranking them as the second leading cause of unintentional injury-related mortality.[1] Among these, individuals aged 60 years and above bear the highest mortality burden. A significant number of these deaths—over 80%—occur in low- and middle-income countries, with the Western Pacific and Southeast Asia regions accounting for the majority. Importantly, older adults aged 60 and above experience the highest mortality rates from falls across all global regions.[4]

Despite representing a smaller share of total disability-adjusted life years (DALYs) lost due to falls globally, the consequences for older adults are more severe.[5] Older individuals often live with lasting physical impairments and emotional consequences that diminish their independence and quality of life. They may also require long-term medical care or institutionalization, further straining health systems and families. In addition to human suffering, the economic burden associated with fall-related injuries is substantial, including direct medical costs, rehabilitation, and long-term care.[6]

As aging affects muscle strength, balance, vision, and cognition, the elderly are more susceptible to falls. This vulnerability is compounded by chronic illnesses, medication side effects, and hazardous environments.[7] Beyond the physical consequences, falls can lead to a phenomenon known as "postfall syndrome," characterized by a fear of falling, reduced activity, social withdrawal, depression, and increased dependence on caregivers. This psychological impact may persist even in the absence of physical injury and contribute to a downward spiral of functional decline.[8]

To quantify the psychological component of fall risk, the concept of "fall efficacy"—an individual's confidence in their ability to perform activities without falling—has gained importance. The Fall Efficacy Scale (FES), developed by Tinetti et al., is a widely accepted tool for measuring this fear of falling.[9] Lower fall efficacy correlates with increased risk of falls and functional limitations, and assessing it may help target both physical and psychological interventions more effectively.

The burden can be particularly high in socioeconomically disadvantaged urban populations, where older adults often live in overcrowded, poorly maintained housing with limited access to health and social support services.[10] Despite the known risks, limited data exist on the prevalence, correlates, and psychological dimensions of falls—such as fear of falling—among elderly residents of urban slums.

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Siliguri, a rapidly growing city in West Bengal, is home to a substantial elderly population residing in such underserved areas. Understanding the interplay between physical, environmental, and psychological factors contributing to falls in this setting is essential for designing context-specific interventions. In this context, the present study aims to fill that gap with the following objectives.

Objectives

- To determine the prevalence of falls in older adults living in urban slums of Siliguri.
- To explore the association between fall efficacy scores and the occurrence of falls in the study population.

Methodology

Study Design and Setting

This descriptive cross-sectional study was conducted among older adults residing in urban slum areas of Siliguri, located in the Darjeeling district of West Bengal, India. Many elderly residents live in densely populated, low-income slum settlements.

Study Population

The target population consisted of adults aged 60 years and above residing in the identified urban slums of Siliguri. Inclusion criteria included elderly individuals who had been permanent residents (living for at least the past 6 months) of the slum areas and were capable of understanding and responding to interview questions. Individuals who were critically ill, exhibited signs of cognitive impairment (as judged by the interviewer), or were unable to provide informed consent were excluded from the study.

Sample Size Estimation

The sample size was calculated using Cochran's formula for estimating proportions in descriptive studies:

$$Z\alpha^2 \times P(1-P) / d^2$$

Where:

- n = required sample size.
- Z = Z-score for 95% confidence level (1.96).
- p = estimated prevalence of falls among elderly individuals (36.6%, based on previous study by Joseph et al.[11]).
- d = absolute allowable error (10%).

Applying a design effect of two (to account for cluster sampling) and adjusting for a 15% nonresponse rate, the final calculated sample size was approximately 206. For equal distribution across clusters, the sample size was rounded to 210 (7 participants × 30 clusters).

Sampling Technique

A two-stage cluster sampling method was adopted to ensure representative selection from the diverse slum areas of Siliguri. An updated list of all urban slums within Siliguri Municipal Corporation limits was procured from local authorities, detailing the number of households and individuals in each slum. From this list, 30 clusters (i.e., slum localities) were selected using the probability proportional to size (PPS) sampling method. This ensured that slums with larger populations had a proportionately higher probability of being selected, thereby preserving representativeness.

Within each of the 30 selected clusters, seven elderly individuals (≥60 years) were randomly selected to participate in the study, yielding a total sample size of 210 participants. If the selected individual was unavailable or declined participation, the next eligible person on the list was approached.

Data Collection Tools

Data were collected using a predesigned, semi-structured questionnaire, which was pretested in a similar population outside the study area to ensure clarity, validity, and reliability.

The questionnaire was divided into the following components:

- Sociodemographic details: Age, gender, marital status, education, occupation, income, and living arrangements.
- Medical history and risk factors: Presence of chronic illnesses (e.g., hypertension, diabetes, and arthritis), medication use, visual or hearing impairment, and use of walking aids.
- History of falls: Participants were asked if they had experienced any fall in the past 6 months. For those who had, additional details such as the number of falls, time and place of fall, cause, injuries sustained, and any hospitalization were recorded.
- Fall Efficacy Scale: The FES developed by Tinetti et al.[9] was used to assess self-perceived confidence in performing daily activities without falling. The scale includes 10 items related to common activities of daily living, such as bathing, dressing, and walking in the home. Each item is rated on a scale from 1 (very confident) to 10 (not confident at all), with higher total scores indicating lower fall efficacy (greater fear of falling). The scores are generally interpreted as 10–30: high confidence, low fear of falling; 31–60: moderate concern about falling; 61–100: low confidence, high fear of falling (low fall efficacy).

Data Collection Procedure

The selected participants were visited in their homes after obtaining verbal and written informed consent. The purpose and scope of the study were explained clearly in the local language. Each interview lasted approximately 25–30 minutes. Privacy and confidentiality were strictly maintained throughout the data-collection process.

Data Analysis

Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) version 20.0. Descriptive statistics summarized participant characteristics and fall history. Bivariate analyses were conducted to assess associations between the occurrence of falls (yes/no) and other factors. Multivariable logistic regression identified independent predictors of falls, adjusting for age, gender, comorbidities, and FES scores. Adjusted odds ratios (AORs) with 95% confidence intervals were reported. All statistical tests were two-tailed, and a p-value < 0.05 was considered statistically significant.

Ethical Considerations

Prior to data collection, ethical clearance was obtained from the Institutional Ethics Committee. Informed consent was obtained from all participants before the interview. Participants were assured of the confidentiality and anonymity of their responses. Those identified as being at high risk for falls or with untreated medical issues were referred to the nearest healthcare facilities for further evaluation and management.

Results

Out of 210 elderly people approached for the study, data could be obtained from 207 participants. The majority were aged between 60 and 69 years (55.1%) and were female (61.8%). Most were married (52.2%) and resided in pucca houses (77.8%). A major proportion reported having at least one chronic illness (89.9%) and some form of disability (83.1%).

Of the 207 participants recruited for the study, 85 reported that they had experienced any fall in the past 6 months (Fig. 1). Among those who had fallen, the location was nearly evenly distributed: 50.6% reported indoor falls, while 49.4% fell outdoors. Bruising was

the most common injury (58.8%), followed by muscular pain (40%). More serious injuries, such as fractures and lacerations, were each reported by 4.7%, and 12.9% of fallers sustained no external injuries. Most falls occurred in the evening (54.1%), followed by daytime (25.9%) and nighttime (20%). A majority (62.4%) of the injured elderly did not use any mobility assistive device, while 37.6% reported using one at the time of the fall (Table 1).

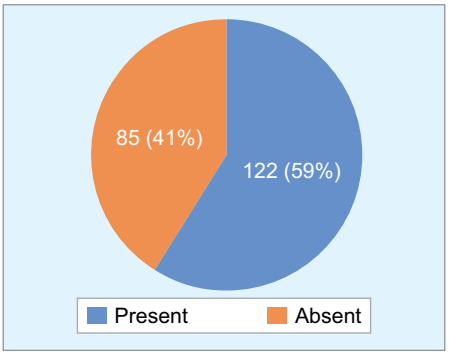

Fig. 1: Prevalence of reported falls in the study population ($n = 207$)

Among various disabilities, only mobility disability showed a statistically significant association with falls ($p = 0.005$). Visual and hearing disabilities were not significantly associated. Regarding comorbidities, respiratory disease ($p = 0.042$) and mental illness ($p = 0.016$) were significantly linked to a higher fall risk. Other conditions, such as diabetes, hypertension, cardiac disease, pain disorders, and others, did not show significant associations. Overall, mobility issues, respiratory problems, and mental illness were important risk factors for falls in this population (Table 2).

Multivariable regression analysis (Table 3) revealed that advanced age was significantly associated with higher fall incidence. Participants aged 80 years or more had over four times the odds of falling compared to those aged 60–69 (AOR = 4.25; 95% CI: 1.06–17.07). Gender and marital status were not statistically significant predictors of falls.

Environmental and clinical factors played a notable role. Elderly individuals residing in pucca houses were more likely to report falls (AOR = 3.38; 95% CI: 1.46–7.83), possibly due to higher indoor mobility or home hazards. The presence of comorbidities substantially increased the risk (AOR = 8.16; 95% CI: 1.72–38.64), as did physical disabilities (AOR = 2.50; 95% CI: 1.02–6.15). Although participants with high concern about falling (as per FES) showed increased odds of falling (AOR = 1.88), this association was not statistically significant.

Table 1: Characteristics of falls in the study population ($n = 85$)

Characteristics of fall	*Frequency*	*Percent*
Place of fall		
Indoors	43	50.6
Outdoors	42	49.4
Type of injury		
Bruise	50	58.8
Laceration	4	4.7
Fracture	4	4.7
Muscular pain	34	40.0
No external injury	11	12.9
Time of injury		
Daytime (6 am–4 pm)	22	25.9
Evening (4 pm–8 pm)	46	54.1
Nighttime (8 pm–6 am)	17	20.0
Use of mobility assistive device		
Yes	32	37.6
No	53	62.4

Discussion

The study sheds light on the multifactorial nature of falls among the elderly living in urban slums—a setting that is often underrepresented in research but highly relevant due to poor infrastructure, crowded living conditions, and limited access to preventive care. A total of 207 elderly participants were included, with a higher proportion of females (61.8%) and individuals in the 60–69 age-group (55.1%). Similar demographic trends have been observed in other studies, where females and the younger subset of elderly (60–69 years) were more commonly represented in community-based research due to higher survival and participation rates among females and the relatively higher mobility and better availability of younger elderly individuals.[12,13]

Notably, 41.1% of participants reported a history of fall in the past year. This is consistent with prevalence estimates from other Indian studies, as reported in a systematic review, which reported fall prevalence rates ranging from 30 to 50% among community-dwelling older adults.[14] This highlights the high burden

Table 2: Association of history of falls with disability and comorbidity profile in the study population ($n = 207$)

Variables	*Total*	*History of falls*		*Statistical test of significance*
		Absent	*Present*	
Disability				
Sight disability	145	86 (59.3%)	59 (40.7%)	$\chi^2 = 0.028$, $p = 0.493$
Hearing disability	45	26 (57.8%)	19 (42.2%)	$\chi^2 = 0.032$, $p = 0.495$
Mobility disability	96	47 (49%)	49 (51%)	$\chi^2 = 7.366$, $p = 0.005$
Comorbidity				
Diabetes	50	27 (54%)	23 (46%)	$\chi^2 = 0.664$, $p = 0.257$
Hypertension	57	30 (52.6%)	27 (47.4%)	$\chi^2 = 1.292$, $p = 0.164$
Cardiac disease	34	20 (58.8%)	14 (41.2%)	$\chi^2 = 0.988$, $p = 0.567$
Respiratory disease	34	25 (73.5%)	9 (26.5%)	$\chi^2 = 3.579$, $p = 0.042$
Mental illness	12	3 (25%)	9 (75%)	$\chi^2 = 6.062$, $p = 0.016$
Pain disorder	104	60 (57.7%)	44 (42.3%)	$\chi^2 = 0.134$, $p = 0.411$
Others	56	34 (60.7%)	22 (39.3%)	$\chi^2 = 0.100$, $p = 0.439$
Total	207	122 (58.9%)	85 (41.1%)	

Table 3: Correlates of fall in the study population (n = 207)

Correlates of fall	*History of falls*		*Total*	*Crude odds ratio (COR) (95% CI)*	*AOR (95% CI)*
	Absent	*Present*			
Age-group					
60–69 years	74 (64.9%)	40 (35.1%)	114	1 (referent)	1 (referent)
70–79 years	45 (57%)	34 (43%)	79	1.398 (0.776, 2.518)	1.590 (0.800, 3.163)
80 years or more	3 (21.4%)	11 (78.6%)	14	6.783 (1.788, 25.733)	4.250 (1.058, 17.073)
Gender					
Female	74 (57.8%)	54 (42.2%)	128	1 (referent)	1 (referent)
Male	48 (60.8%)	31 (39.2%)	79	0.885 (0.500, 1.568)	0.986 (0.512, 1.899)
Marital status					
Widowed	56 (56.6%)	43 (43.4%)	99	1 (referent)	1 (referent)
Married	66 (61.1%)	42 (38.9%)	108	0.829 (0.476, 1.443)	0.730 (0.386, 1.379)
Pucca house					
Absent	37 (80.4%)	9 (19.6%)	46	1 (referent)	1 (referent)
Present	85 (52.8%)	76 (47.2%)	161	3.676 (1.666, 8.111)	3.383 (1.462, 7.829)
Any comorbidity					
No	19 (90.5%)	2 (9.5%)	21	1 (referent)	1 (referent)
Yes	103 (55.4%)	83 (44.6%)	186	7.655 (1.733, 33.812)	8.161 (1.724, 38.640)
Any disability					
No	26 (74.3%)	9 (25.7%)	35	1 (referent)	1 (referent)
Yes	96 (55.8%)	76 (44.2%)	172	2.287 (1.012, 5.170)	2.500 (1.016, 6.151)
Concern about falling (FES)					
Low concern	12 (70.6%)	5 (29.4%)	17	1	1
Moderate concern	64 (66%)	33 (34%)	97	1.237 (0.402, 3.810)	1.232 (0.373, 4.067)
High concern	46 (49.5%)	47 (50.5%)	93	2.452 (0.800, 7.513)	1.879 (0.555, 6.355)
Total	122 (58.9%)	85 (41.1%)	207		

of falls as a public health concern among older adults, particularly in resource-limited urban settings. Among the elderly participants who reported falls, 12.9% sustained no visible injury, which may still contribute to psychological consequences such as fear of falling or reduced mobility, as previously reported in the literature.[2]

The association of increasing age with increased fall risk was evident in the current study. Participants aged 80 years and above were significantly more likely to have experienced a fall compared to those in the 60–69 age-group (AOR = 4.25; 95% CI: 1.06–17.07). Advanced age is a well-established risk factor for falls due to age-related decline in muscle strength, balance, vision, and reaction time.[1] Similar findings were reported by Tripathy et al.,[13] where individuals aged 80 and above had a two-fold increased risk of falling.

Contrary to some studies, gender and marital status did not significantly influence the history of falls in this population. Although some research suggests that women may have a higher fall risk due to osteoporosis and longer life expectancy, the findings of the current study align with studies that found no gender-based differences in fall prevalence.[15] Marital status, which is often associated with social support and caregiving, also did not show a significant association, though it could still play an indirect role through psychosocial support.[16]

An interesting finding of this study was the higher odds of falls among those living in pucca (concrete/brick) houses (AOR = 3.38; 95% CI: 1.46–7.83). This may seem counterintuitive, as pucca houses are typically associated with better socioeconomic status. However, it is plausible that increased indoor mobility, lack of environmental modifications, slippery floors, and clutter in small, enclosed spaces may contribute to higher indoor fall risk in such dwellings. Similar observations have been made in studies from other urban settings, where home environment hazards contributed significantly to fall risk.[17]

Health status emerged as a strong predictor of falls. The presence of comorbid conditions significantly increased the odds of falling (AOR = 8.16; 95% CI: 1.72–38.64). Chronic illnesses such as diabetes, arthritis, cardiovascular disease, and visual impairments can impair mobility and stability, thereby elevating fall risk.[18] Similarly, individuals with physical disabilities had over twice the odds of falling compared to those without disabilities (AOR = 2.50; 95% CI: 1.02–6.15), a finding consistent with previous studies that highlight the role of functional impairments in predisposing elderly individuals to falls.[19]

The psychological component of fall risk was assessed using the FES, which measures concern or fear of falling during daily activities.[9] Nearly 45% of participants had high concern about falling, and while those with higher concern had greater odds of experiencing a fall (AOR = 1.88), this was not statistically significant. Nonetheless, this association aligns with literature suggesting that fear of falling can lead to activity restriction, muscle deconditioning, and ultimately, a higher risk of future falls—a phenomenon often described as the "vicious cycle" of falls.[20] Fear of falling is also linked to lower quality of life and increased risk of institutionalization.[21]

Analysis of the circumstances of falls revealed that falls were almost equally distributed between indoor (50.6%) and outdoor (49.4%) environments. This finding is crucial for designing targeted interventions. While indoor falls may be prevented through home modifications such as installing handrails, removing loose rugs, and improving lighting, outdoor falls may require community-level changes like safer walkways, better street lighting, and public awareness programs.[22]

The study highlights a significant association between mobility disability and increased fall risk among the elderly, aligning with findings from a North Indian study where functional disability was a key predictor of falls.[12] Respiratory diseases also emerged as a notable risk factor; a prospective cohort study reported a 26% higher fall risk among middle-aged and older adults with

respiratory conditions.[23] Mental illness, particularly depression and sleep disorders, was significantly linked to falls, corroborated by a Korean study identifying depression as a prominent risk factor.[24]

Regarding the type of injury, most fall-related injuries were minor. Bruises were the most common (58.8%), followed by muscular pain (40%). Only a small proportion suffered fractures or lacerations (4.7% each), and 12.9% reported no visible injury. Though serious injuries were infrequent, the psychological and functional consequences of even minor falls should not be underestimated. Muscular pain and bruises may reduce mobility, lead to fear of falling, and increase dependence.[17] Fractures, even if rare, are associated with long-term disability and increased mortality among the elderly.[25]

The high prevalence of comorbidities (89.9%) and disabilities (83.1%) in the study population underscores the vulnerability of elderly residents in urban slum areas. These findings reinforce the need for integrated health services focusing on chronic disease management, rehabilitation, and fall prevention. Screening for fall risk factors during routine health visits, providing physiotherapy for mobility improvement, and educating caregivers and families are essential components of a comprehensive fall prevention strategy.[26]

Moreover, public health policies should prioritize the development of age-friendly urban environments, particularly in underserved areas like slums. Programs promoting physical activity, community engagement, and awareness of fall hazards can help improve the confidence and safety of older adults.[27]

This study had a few limitations. First, its cross-sectional design limits causal inference between fall efficacy and actual fall risk. Second, the use of self-reported data may introduce recall bias, particularly in elderly populations. Finally, the study was limited to a specific urban slum population and may not be generalizable to other settings or rural populations.

Conclusion

Falls among the elderly residing in urban slums are prevalent and associated with a range of clinical, environmental, and psychological factors. While the majority of falls resulted in minor injuries, their cumulative impact on quality of life, independence, and healthcare utilization is substantial. Age, comorbidities, disabilities, and low fall efficacy scores are important predictors.

This highlights the importance of incorporating fall efficacy assessments into routine geriatric evaluations and underscores the need for interventions that address both physical and psychological components to effectively reduce fall risk and promote functional independence in elderly populations in underserved urban areas.

Author Contributions

Dr Shweta Pandey contributed to acquisition of data and drafting the article.

Dr Abhijit Mukherjee designed the study and supervised data collection.

Dr Sharmistha Bhattacherjee conducted the data analysis and contributed to manuscript drafting.

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