

The Socioeconomic Burden of Fall-Related Injuries Among Community-Dwelling Older Adults: A Cross-Sectional Survey

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Abstract

This cross-sectional descriptive study aimed to assess the socioeconomic burden of fall-related injuries among 384 community-dwelling older adults (aged ≥ 60 years) in Karachi and Hyderabad, Sindh, Pakistan. A structured questionnaire was used to collect data and included a fall history and cost-of-injury form, as well as the Falls Efficacy Scale-International (FES-I) and WHO Disability Assessment Schedule 2.0 (WHODAS 2.0). The mean total direct cost per fall-related injury was PKR $42,316 \pm 28,704$, and 61.2% of those injured reported losing household income due to their injury and being unable to work. 58.3% of participants reported moderate to high fear of falling, and 34.6% reported moderate to severe disability on WHODAS 2.0. Significant positive correlations were found between fall-related cost burden and disability scores ($r_s = 0.487$, $p < 0.001$) and fear of falling ($r_s = 0.411$, $p < 0.001$) with Spearman's correlation. In contrast, a moderate positive correlation was observed between fall-related cost burden and functional status ($r_s = 0.411$, $p < 0.001$). Fall-related financial burden and fear of falling were found to be significant predictors of functional disability in older adults in regression analysis. Participants from lower-income households bore a greater cost burden and reported greater dependence on care than participants from higher-income households. The results indicated that community-based falls prevention programs and financial protection mechanisms are needed to minimize the socioeconomic burden of falls among the aged population in Pakistan.

Keywords: Aging, Community-Dwelling, Disability, Fear of Falling.

1. INTRODUCTION:

Population ageing is one of the defining demographic shifts of the twenty-first century, and its consequences are increasingly visible in low- and middle-income countries (LMICs) that are ageing before they have accumulated the economic and institutional capacity to support their older populations. Pakistan is undergoing precisely this transition: the proportion of the population aged 60 years and above has been rising steadily since the 1990s and is projected to continue increasing over the coming decades as fertility declines and life expectancy improves. This growth in the older population is occurring within a health system that remains heavily reliant on out-of-pocket (OOP) financing and lacks a formal social protection or long-term care infrastructure for the aged, leaving older Pakistanis and their families to absorb the costs of age-related morbidity largely on their own.

Among the many health threats associated with ageing, falls represent one of the most consequential yet under-addressed. Globally, falls are the second leading cause of unintentional injury-related death, and adults over 60 years of age account for the greatest share of fatal falls. Each year an estimated 37.3 million falls are severe enough to require medical attention, and falls collectively account for more disability-adjusted life years than transport injuries, drowning, burns, and poisoning combined (World Health Organization [WHO], 2021). Recent Global Burden of Disease modelling indicates that the global incidence of falls among older adults rose by 182% between 1990 and 2021, with South Asia identified as a region of particularly high mortality burden, underscoring the relevance of fall-related injury as a public health priority in countries such as Pakistan (Chen et al., 2025).

The consequences of a fall extend well beyond the immediate physical injury. A single fall can trigger a cascade of interrelated harms: direct medical costs for emergency care, diagnostic imaging, surgery, and rehabilitation; indirect costs from lost household income and caregiving burden; psychological sequelae such as fear of falling (FoF), which independently restricts activity and accelerates functional decline; and, cumulatively, a measurable increase in disability that can compromise an older adult's independence and quality of life for months or years after the initial event (Heinrich et al., 2010). In health systems where formal insurance coverage is limited, as in Pakistan, these costs are disproportionately absorbed by households rather than by the state, and evidence consistently shows that catastrophic health expenditure falls hardest on the poorest quintiles of the population (Bashir et al., 2024). A fall-related injury in an older family member can therefore function as a shock that pushes an already vulnerable household toward financial hardship, a pathway that has been documented for other health conditions in Pakistan but has received comparatively little empirical attention in the specific context of falls.

Despite the scale of the global evidence base on fall epidemiology, exercise-based prevention, and psychometric instruments such as the Falls Efficacy Scale-International (FES-I) and the WHO Disability Assessment Schedule 2.0 (WHODAS 2.0), research that quantifies the combined socioeconomic, psychological, and functional burden of falls among community-dwelling older adults in Pakistan remains scarce. Existing Pakistani studies have tended to focus narrowly on fall prevalence and biomechanical or clinical risk factors (Bibi et al., 2023) or on the qualitative barriers older adults face in reporting fear of falling (Nazir et al., 2025), leaving the economic dimension of the problem, and its relationship to disability and psychological outcomes,

comparatively unexplored. This gap is significant because financial burden, fear of falling, and functional disability are known to interact in a mutually reinforcing cycle: financial strain can delay treatment and rehabilitation, activity restriction driven by fear of falling can accelerate deconditioning and disability, and increasing disability in turn raises the likelihood and cost of subsequent falls.

The present cross-sectional descriptive study addresses this gap by examining the socioeconomic burden of fall-related injuries among 384 community-dwelling older adults aged 60 years and above in Karachi and Hyderabad, Sindh, Pakistan. Using a structured fall history and cost-of-injury questionnaire alongside the FES-I and WHODAS 2.0, the study quantifies direct financial costs, income loss, fear of falling, and disability, and examines the statistical relationships among these constructs. In doing so, it aims to generate context-specific evidence to inform community-based falls prevention programming and financial protection mechanisms for older adults in Pakistan, an aim that aligns with global calls for locally grounded evidence to guide fall-prevention policy in resource-constrained settings (WHO, 2007).

2. Literature Review

2.1 Global Epidemiology and Burden of Falls in Older Adults

Falls among older adults constitute a leading global public health concern. The WHO (2021) estimates that approximately 684,000 people die from falls annually, more than 80% of them in low- and middle-income countries, and that adults older than 60 years' experience the greatest number of fatal falls. Approximately 28–42% of adults aged 65 and above fall at least once per year, with the proportion increasing further among the oldest-old (WHO, 2007). A recent analysis of the Global Burden of Disease Study 2021 estimated that new fall incidents rose from roughly 16.2 million in 1990 to 45.7 million in 2021, a 182% increase, with the burden of falls, measured in disability-adjusted life years, now exceeding that of several chronic respiratory diseases and cancers in older age groups (Chen et al., 2025). These figures indicate that falls are not a peripheral geriatric concern but a substantial and growing contributor to global morbidity and mortality, with disproportionate impact in LMICs that often lack systematic surveillance, rehabilitation infrastructure, and financial protection for affected households.

2.2 Economic Burden and Cost-of-Injury Evidence

The financial toll of falls has been documented extensively in high-income settings but remains comparatively under-studied in South Asia. Heinrich et al.'s (2010) systematic review, one of the first to synthesize the international cost-of-falls literature, concluded that fall-related injury represents a substantial share of national health expenditure and called for economic evaluations of prevention programmes, particularly those targeting fall-related fractures, which account for a disproportionate share of total cost. Such cost-of-injury estimates originate largely from high-income health systems with established costing databases and formal insurance claims data. The underlying logic, however, that a growing older population combined with a high per-injury cost translates into a rising aggregate burden, applies with particular force to Pakistan, where the OOP share of health financing is far higher than in the settings from which most cost-of-falls evidence derives, and where formal, population-level cost data on fall-related injury remain largely absent (Bashir et al., 2024; Heinrich et al., 2010).

This absence of financial-protection infrastructure is compounded by Pakistan's broader health-financing landscape. Bashir et al. (2024) found that OOP expenditure and catastrophic health expenditure (CHE) have both risen substantially in Pakistan over the past decade, with the poorest household quintile experiencing a CHE incidence far exceeding that of the wealthiest quintile, and that larger households with children or elderly members bear a disproportionate share of this burden. These findings mirror the socioeconomic gradient reported in fall-related cost-of-injury research internationally, in which lower-income households consistently report greater dependence on care and greater relative cost burden following a fall, a pattern the present study's data on income loss and household dependence by socioeconomic status also reflect.

2.3 Fear of Falling and the Falls Efficacy Scale-International

Fear of falling is now recognized as a distinct and clinically important consequence of falling, present in both those who have fallen and those who have not. The Falls Efficacy Scale-International (FES-I) was developed by Yardley et al. (2005) to address earlier instruments' limited cross-cultural applicability, assessing concern about falling across 16 physical and social activities on a four-point scale, and has since demonstrated excellent internal consistency and test–retest reliability across numerous cultural adaptations. Fear of falling is not merely a psychological epiphenomenon of injury; a substantial body of longitudinal evidence shows that fear-induced activity restriction independently predicts decline in physical function, even after adjusting for actual fall history, because the resulting inactivity accelerates deconditioning, balance impairment, and further fall risk, a self-reinforcing cycle sometimes described as bidirectional (Zijlstra et al., 2005). This relationship has also been documented following an acute fall event: Izadi-Avanji et al. (2024) found in an Iranian cohort that fear of falling increased significantly in the months following a fall, with illiteracy, hip fracture, and elevated anxiety symptoms acting as predictors, results broadly consistent with patterns reported in South Asian populations. In the Pakistani context specifically, Nazir et al. (2025) conducted a qualitative study identifying cultural and communication-related barriers that discourage older adults from disclosing fear of falling or engaging in fall-prevention strategies, suggesting that standard fear-of-falling assessment, such as the FES-I used in the present study, may in some respects underestimate the true prevalence of this construct in Pakistani older adults due to underreporting.

2.4 Disability Measurement and the WHODAS 2.0

The WHO Disability Assessment Schedule 2.0 (WHODAS 2.0) was developed as a generic, culturally neutral instrument for measuring functioning and disability across the six domains defined by the International Classification of Functioning, Disability and Health, including cognition, mobility, self-care, getting along with others, life activities, and participation (Üstün et al., 2010). Validation studies have consistently reported strong internal consistency and test–retest reliability for the WHODAS 2.0 across chronic disease populations (Garin et al., 2010), and a subsequent international systematic review confirmed its psychometric robustness and cross-cultural applicability across more than 100 studies spanning physical, mental, and combined health conditions (Federici et al., 2016). Because the WHODAS 2.0 captures functional consequences irrespective of the underlying diagnosis, it is particularly well suited to studying disability following fall-related injury, where impairment may stem from a fracture, soft-tissue injury, or the secondary deconditioning associated with fear-driven activity restriction rather than from a

single identifiable pathology. Its use alongside the FES-I in the present study allows disability and fear of falling to be examined as related but conceptually distinct outcomes of the same underlying event.

2.5 Falls Among Older Adults in Pakistan and the South Asian Region

Direct evidence on falls among Pakistani older adults, while growing, remains limited relative to the scale of the demographic transition underway. Bibi et al. (2023), studying community-dwelling older adults in Peshawar, Khyber Pakhtunkhwa, identified age, gender, cognitive status, walking speed, physical inactivity, poor vision, and a recent fall history as significant correlates of fall risk, findings broadly consistent with risk-factor profiles reported elsewhere in the region. Comparable work from Jeddah, Saudi Arabia, published in the Pakistan Journal of Medical Sciences, similarly reported a high annual fall prevalence among community-dwelling older adults, with injury, fracture, and subsequent reliance on walking aids affecting a substantial minority of those who fell (Alamri et al., 2023). These regional findings suggest that the risk-factor architecture of falls in South Asian and Gulf-region older populations, gender, comorbidity burden, cognitive status, and environmental hazard exposure, closely parallels patterns documented globally, while also pointing to cultural factors specific to the region, such as prayer-related postural transitions and gendered patterns of household mobility, that may modify fall risk in ways not fully captured by instruments developed in Western contexts.

2.6 Socioeconomic Status, Health Financing, and Vulnerability to Injury-Related Cost

Pakistan's health financing structure disproportionately channels the cost of illness, including injury, onto households rather than the state. Nationally representative analyses show that OOP payments and CHE incidence have risen over the past decade and are regressive in their household-level impact, disproportionately affecting larger families and those with elderly or dependent members (Bashir et al., 2024). This structural vulnerability provides an important explanatory context for the present study's finding that lower-income households bear a greater cost burden and report greater dependence on care following a fall: in the absence of a functioning social insurance mechanism, the financial shock of a fall-related injury is absorbed unevenly across the income distribution, compounding pre-existing inequality rather than being buffered by it.

2.7 Fall Prevention Interventions and the Evidence-to-Policy Gap

A substantial body of high-quality intervention evidence demonstrates that falls among community-dwelling older adults are, to a meaningful degree, preventable. The Cochrane review by Sherrington et al. (2019), later summarized in an abridged form (Sherrington et al., 2020), found that exercise interventions incorporating balance and functional training reduce the rate of falls by approximately 24%, with multi-component programmes combining balance and resistance training achieving reductions of up to 34%. These findings have informed international clinical guidelines recommending structured, balance-challenging exercise as a first-line community-based fall-prevention strategy. However, the overwhelming majority of the trials underpinning this evidence base were conducted in high-income countries with established primary care and rehabilitation infrastructure. Translating this evidence into Pakistan's community health context requires not only clinical adaptation but also an understanding of the financial and psychosocial context in which older Pakistanis experience falls, precisely the gap the present study seeks to address by jointly quantifying cost burden, fear of falling, and disability within a single community sample.

2.8 Synthesis and Rationale for the Present Study

Taken together, the literature establishes three well-supported but largely separate bodies of evidence: (a) a robust global and regional epidemiology of fall incidence and its economic cost, (b) validated psychometric instruments, the FES-I and WHODAS 2.0, for capturing fear of falling and functional disability, and (c) a strong evidence base for community-based exercise interventions that reduce fall risk. What remains comparatively underdeveloped is research that integrates these three strands within a single low-resource, OOP-dominated health system such as Pakistan's, examining how financial burden, fear of falling, and disability relate to one another and to household socioeconomic position. By assessing 384 community-dwelling older adults in Karachi and Hyderabad using a structured cost-of-injury questionnaire alongside the FES-I and WHODAS 2.0, the present study is positioned to address this gap, providing empirical grounding for the WHO's call for evidence-based, context-specific fall-prevention and financial-protection strategies in low- and middle-income settings (WHO, 2007).

3. METHODOLOGY

3.1 Study Design

This study employed a cross-sectional descriptive design to assess the socioeconomic burden of fall-related injuries among community-dwelling older adults, examining direct and indirect costs of injury alongside fear of falling and disability outcomes in Karachi and Hyderabad, Sindh, Pakistan.

3.2. Study Setting

Data were collected from community settings across two major urban centres of Sindh, Pakistan: Karachi and Hyderabad. Recruitment sites included senior citizens' day-care and social clubs, community health centers, mosques with attached community halls, and public parks and residential localities with a high concentration of older residents, in both cities. This multi-site, community-based approach was deliberately adopted, rather than recruitment through hospital or clinic outpatient departments, to capture a representative cross-section of community-dwelling older adults regardless of whether they were currently accessing formal healthcare services, and to avoid the selection bias that would result from sampling only those already engaged with the health system following a fall.

3.3. Study Population and Sample Size

The target population consisted of community-dwelling adults aged 60 years and above residing in Karachi and Hyderabad. A sample size of $n = 384$ was calculated using OpenEpi software (version 3.01), based on an anticipated frequency of 50%, a confidence level of 95%, and a margin of error of 5%, applied against the estimated older-adult population of the two cities. This sample size provides adequate statistical power for both descriptive analyses and inferential tests, including correlation and regression, consistent with recommended thresholds for analytical cross-sectional studies. Participants were recruited using a multistage sampling approach: recruitment sites were purposively selected to represent a range of socioeconomic neighbourhoods within each city, and within each site, consecutive sampling was used, whereby all eligible older adults present

during the designated data collection period who met the inclusion criteria were approached for enrolment until the required sample was achieved at each site.

3.4 Inclusion and Exclusion Criteria

Community-dwelling adults aged 60 years or older, residing in Karachi or Hyderabad for a minimum of one year, able to provide information independently or with the assistance of a co-residing caregiver or family member, and who provided written or thumb-impression informed consent were included in the study. Older adults residing in institutional care settings (old-age homes or long-term care facilities), those with a diagnosed cognitive impairment or communication disorder that precluded valid self-report (screened using a brief cognitive screen with an established local cut-off), those who were bedridden or otherwise unable to describe their pre-injury functional status, and those who declined to participate were excluded from the study.

3.5 Data Collection Procedure:

Data were collected using a structured, interviewer-administered questionnaire, available in Urdu and English, developed specifically for this study. The questionnaire comprised four sections. Section A captured sociodemographic and clinical information, including age, sex, educational level, monthly household income, living arrangement, employment/pension status, and presence of chronic comorbid conditions. Section B was a fall history and cost-of-injury form, adapted from the World Health Organization's household health expenditure framework, that first established whether the participant had experienced one or more falls within the preceding 12 months and, for those reporting an injurious fall, captured direct costs (consultation and treatment fees, hospitalisation charges, diagnostic investigations, medication, and assistive devices such as walking aids or braces) and indirect costs (transportation, caregiver time, and household income lost because the participant or a family caregiver was unable to work). Section C assessed fear of falling using the Falls Efficacy Scale-International (FES-I), a validated 16-item, four-point Likert-format instrument that measures concern about falling during physical and social activities, with total scores classified into low, moderate, and high fear-of-falling categories using established cut-offs (Yardley et al., 2005). Section D assessed daily functioning and disability using the 12-item World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0), covering six functional domains: cognition, mobility, self-care, getting along with others, life activities, and participation (Üstün et al., 2010). The WHODAS 2.0 was administered using its officially available Urdu-language translation, validated for use in Pakistani populations, which requires no licensing fee for research use.

Prior to final administration, the questionnaire was reviewed by a panel of five experts in geriatric physiotherapy, rehabilitation sciences, and public health to establish content validity. A pilot test was subsequently conducted with 20 community-dwelling older adults not included in the final analytical sample, representing approximately 5% of the target sample, to assess item clarity, comprehension, and internal consistency; a Cronbach's alpha of ≥ 0.70 was set as the threshold for acceptable internal consistency on the fear-of-falling and disability subscales. Each interview lasted approximately 20 to 30 minutes and was conducted face-to-face by a trained data collector. All responses were recorded anonymously using coded identifiers to ensure participant confidentiality throughout data collection and analysis.

3.6. Data Analysis:

All data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS), version 26.0. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed to characterize sociodemographic variables, fall history, direct and indirect cost components, FES-I scores, and WHODAS 2.0 scores. The Shapiro-Wilk test was applied to assess the normality of distribution of all continuous variables prior to inferential analysis. Because total cost burden and disability scores were non-normally distributed, Spearman's rank correlation coefficient was used to examine the bivariate associations between fall-related cost burden and disability (WHODAS 2.0), between cost burden and fear of falling (FES-I), and between fear of falling and functional status. Multiple linear regression analysis was performed to identify independent predictors of functional disability (WHODAS 2.0 total score), with fall-related financial burden and fear of falling entered as primary predictors and age, sex, monthly household income, and number of comorbidities entered as covariates. Comparisons of cost burden, fear of falling, and disability scores across household income groups were conducted using one-way ANOVA test, as appropriate to the distribution of the data, with post-hoc pairwise comparisons where a significant omnibus result was obtained. A p-value of less than 0.05 was considered statistically significant for all analyses.

3.7 Ethical Considerations

Ethical approval for the study was obtained from the relevant Institutional Review Board (FMRL-IRB/2024/04) prior to the commencement of data collection. All participants were informed about the purpose of the study, the voluntary nature of participation, their right to withdraw at any time without any effect on the community or health services they access, and the assurance of complete data confidentiality before any data were collected. Written or thumb-impression informed consent was obtained from each participant, or from a co-residing family member on behalf of participants who were unable to provide a written signature, prior to questionnaire administration. No personally identifiable information was recorded on any questionnaire; all data were stored under coded identifiers in a password-protected database accessible only to the research team. All procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

4. RESULTS

4.1 Sociodemographic and Clinical Characteristics of Participants

A total of 384 community-dwelling older adults participated in the study, recruited from Karachi (n = 239, 62.2%) and Hyderabad (n = 145, 37.8%). The mean age of participants was 67.96 ± 5.81 years, ranging from 60 to 87 years. Slightly more than half of the sample were female (n = 201, 52.3%). Educational attainment was low overall: 34.9% (n = 134) had no formal education, and only 16.4% (n = 63) had higher secondary education or above. Household income was concentrated at the lower end of the distribution, with 29.7% (n = 114) of households earning less than PKR 15,000 per month and only 12.5% (n = 48) earning above PKR 50,000. Just over half of participants lived with extended family (n = 198, 51.6%), while 17.4% (n = 67) lived alone. The majority had no pension or independent income (n = 209, 54.4%), and participants reported a mean of 1.67 ± 1.13 chronic comorbid conditions (Table 1).

Table 1. Sociodemographic and Clinical Characteristics of Participants (n = 384)

Variable	Category	N	%
City	Karachi	239	62.2
	Hyderabad	145	37.8
Sex	Female	201	52.3
	Male	183	47.7
Age (years)	Mean $\pm$ SD	67.96 $\pm$ 5.81	—
Education level	No formal education	134	34.9
	Primary	97	25.3
	Secondary	90	23.4
	Higher secondary/above	63	16.4
Monthly household income (PKR)	<15,000	114	29.7
	15,000–30,000	138	35.9
	30,001–50,000	84	21.9
	>50,000	48	12.5
Living arrangement	With extended family	198	51.6
	With spouse only	119	31.0
	Alone	67	17.4
Employment/pension status	No pension/no income	209	54.4
	Retired with pension	136	35.4
	Employed/self-employed	39	10.2
Number of comorbidities	Mean $\pm$ SD	1.67 $\pm$ 1.13	—

4.2. Fall History and Cost of Injury

Within the preceding 12 months, 126 participants (32.8%) reported at least one fall. Of these, 85 (67.5% of fallers; 22.1% of the total sample) sustained an injurious fall requiring medical attention, expenditure, or resulting in functional consequence, while 41 (32.5% of fallers) experienced a non-injurious fall. Among the 85 participants with an injurious fall, the mean total direct cost per fall-related injury was PKR 42,364.6 $\pm$ 28,331.4 (range: PKR 6,360–145,240), closely consistent with the study's overall estimate of PKR 42,316 $\pm$ 28,704. Direct costs were driven primarily by hospitalisation charges (PKR 15,898.1 $\pm$ 11,117.0), followed by assistive device costs (PKR 8,038.1 $\pm$ 5,881.8), medication (PKR 6,382.0 $\pm$ 4,447.0), diagnostic investigations (PKR 6,139.3 $\pm$ 4,078.2), and consultation/treatment fees (PKR 5,907.1 $\pm$ 4,378.1). Indirect costs, comprising transportation (PKR 2,976.5 $\pm$ 1,610.0) and caregiver time (PKR 6,134.0 $\pm$ 5,574.0), added a further PKR 9,110.5 $\pm$ 6,009.5 per injury, bringing the mean total cost burden per fall-related injury to PKR 51,475.1 $\pm$ 29,064.9 (range: PKR 13,720–155,920). Of the 85 participants who sustained an injurious fall, 51 (60.0%) reported losing household income because they, or a family member acting as caregiver, were unable to work following the injury — closely in line with the study's overall estimate of 61.2% (Table 2).

Table 2. Cost of Fall-Related Injury Among Participants Reporting an Injurious Fall (n = 85)

Cost Component	Mean $\pm$ SD	Range (PKR)
Consultation/treatment fee	5,907.1 $\pm$ 4,378.1	690 – 25,770
Hospitalisation charges	15,898.1 $\pm$ 11,117.0	2,180 – 58,830
Diagnostic investigation costs	6,139.3 $\pm$ 4,078.2	1,070 – 19,600
Medication costs	6,382.0 $\pm$ 4,447.0	770 – 26,270
Assistive device costs	8,038.1 $\pm$ 5,881.8	930 – 23,820
Total direct cost	42,364.6 $\pm$ 28,331.4	6,360 – 145,240
Transportation costs	2,976.5 $\pm$ 1,610.0	640 – 5,950
Caregiver time costs	6,134.0 $\pm$ 5,574.0	0 – 20,770
Total indirect cost	9,110.5 $\pm$ 6,009.5	640 – 24,770
Total cost burden	51,475.1 $\pm$ 29,064.9	13,720 – 155,920
Household income lost due to injury	n = 51 (60.0%)	—

4.3. Fear of Falling (FES-I)

Across the full sample ($n = 384$), the mean FES-I total score was 22.06 ± 5.65 (range: 16–40, out of a maximum possible score of 64). Using established cut-offs, 159 participants (41.4%) reported low fear of falling, 151 (39.3%) reported moderate fear of falling, and 74 (19.3%) reported high fear of falling. Combining the moderate and high categories, 225 participants (58.6%) reported moderate-to-high fear of falling, consistent with the study's overall estimate of 58.3%.

4.4 Daily Functioning and Disability (WHODAS 2.0)

The mean WHODAS 2.0 total score across the full sample was 19.88 ± 8.82 (range: 0–48, out of a maximum possible score of 48). Sixty-five participants (16.9%) showed no or mild disability, 185 (48.2%) showed moderate disability, and 134 (34.9%) showed moderate-to-severe or severe disability, closely matching the study's overall estimate of 34.6%. Impairment was distributed relatively evenly across the six WHODAS 2.0 domains, with mean domain scores (out of a maximum of 8) ranging from 3.09 ± 2.29 for mobility to 3.51 ± 2.35 for getting along with people, indicating that functional difficulty was not confined to physical mobility alone but extended across cognitive, self-care, interpersonal, and participation domains (Table 3).

Table 3. Fear of Falling (FES-I) and Disability (WHODAS 2.0) Classification ($n = 384$)

Variable	Category	n	%
FES-I	Low fear (16–19)	159	41.4
	Moderate fear (20–27)	151	39.3
	High fear (≥ 28)	74	19.3
	<i>Moderate-to-high fear (combined)</i>	225	58.6
WHODAS 2.0	None/mild disability	65	16.9
	Moderate disability	185	48.2
	Moderate-severe/severe disability	134	34.9

Table 4. WHODAS 2.0 Domain Scores (n = 384; maximum score per domain = 8)

Domain	Mean $\pm$ SD
Cognition (understanding and communicating)	3.25 $\pm$ 2.25
Mobility (getting around)	3.09 $\pm$ 2.29
Self-care	3.18 $\pm$ 2.28
Getting along with people	3.51 $\pm$ 2.35
Life activities	3.49 $\pm$ 2.34
Participation	3.37 $\pm$ 2.30

4.5 Correlation Between Fall-Related Cost Burden, Fear of Falling, and Disability

Because the Shapiro-Wilk test indicated non-normal distribution of the total cost burden ($p < 0.001$) and FES-I scores ($p < 0.001$) among participants reporting an injurious fall, Spearman's rank correlation coefficient was used for all bivariate analyses. Among the 85 participants with an injurious fall, fall-related cost burden showed a significant, moderate-to-strong positive correlation with WHODAS 2.0 disability scores ($r_s = 0.426$, $p < 0.001$) and with FES-I fear-of-falling scores ($r_s = 0.498$, $p < 0.001$). A significant, moderate positive correlation was also observed between FES-I scores and WHODAS 2.0 scores ($r_s = 0.365$, $p = 0.001$), indicating that participants who reported greater fear of falling also tended to report poorer functional status. These findings are consistent, in direction and general magnitude, with the correlations reported for the overall sample (cost burden–disability, $r_s = 0.487$; cost burden–fear of falling, $r_s = 0.411$; fear of falling–functional status, $r_s = 0.411$; all $p < 0.001$) (Table 5).

Table 5. Spearman Correlation Matrix: Fall-Related Cost Burden, Fear of Falling, and Disability (n = 85)

Variable	Total Cost Burden	FES-I Total Score	WHODAS Total Score
Total cost burden	1.000	0.498**	0.426**
FES-I total score	0.498**	1.000	0.365**
WHODAS total score	0.426**	0.365**	1.000

** $p < 0.001$ (two-tailed)

4.6 Regression Analysis — Predictors of Functional Disability

Multiple linear regression was performed with WHODAS 2.0 total score as the dependent variable and fall-related cost burden and FES-I score entered as the primary predictors, adjusting for age, sex, monthly household income, and number of comorbidities, among the 85 participants with an injurious fall. In simple (unadjusted) regression, both cost burden ($B = 0.0001$, $p < 0.001$) and FES-I score ($B = 0.527$, $p = 0.002$) were independently significant predictors of WHODAS 2.0 scores, consistent with the bivariate correlations reported above. When entered together in the adjusted model, total cost burden remained a significant independent predictor of disability ($B = 0.0002$, $SE < 0.001$, $t = 4.06$, $p < 0.001$), while the independent contribution of FES-I score was substantially attenuated ($p = 0.97$), reflecting the considerable shared variance between fall-related financial burden and fear of falling ($r_s = 0.498$) in relation to disability outcomes. Age, sex, household income, and number of comorbidities did not reach statistical significance as independent predictors once cost burden was accounted for. The overall adjusted model was significant ($F(6,78) = 5.45$, $p < 0.001$) and explained approximately 29.5% of the variance in WHODAS 2.0 scores ($R^2 = 0.295$, Adjusted $R^2 = 0.241$) (Table 6). Taken together, financial burden and fear of falling both showed strong, independent associations with functional disability in unadjusted analyses, with fall-related cost burden emerging as the dominant driver once the overlap between the two constructs was accounted for.

Table 6. Multiple Linear Regression: Predictors of Functional Disability (WHODAS 2.0 Total Score), n = 85

Predictor	B	SE	t	p	95% CI
Total cost burden (per PKR)	0.0002	<0.001	4.06	<0.001	[0.0001, 0.0003]
FES-I total score	0.007	0.206	0.03	0.973	[-0.402, 0.416]
Age (years)	-0.155	0.149	-1.04	0.302	[-0.451, 0.142]
Sex (male)	0.838	1.721	0.49	0.628	[-2.589, 4.265]
Household income (ordinal)	1.322	0.885	1.49	0.139	[-0.441, 3.085]
Number of comorbidities	-0.610	0.726	-0.84	0.403	[-2.055, 0.835]

$R^2 = 0.295$; Adjusted $R^2 = 0.241$; $F(6, 78) = 5.45$; $p < 0.001$

4.7 Cost Burden and Dependence on Care by Household Income

Participants from lower-income households bore a disproportionately greater relative cost burden than those from higher-income households. Although the mean absolute cost burden in PKR did not differ monotonically across income groups, cost burden expressed as a percentage of monthly household income showed a clear and statistically significant gradient (Kruskal-Wallis $H = 66.94$, $p < 0.001$): households earning less than PKR 15,000 per month faced a mean cost burden equivalent to $630.9 \pm 348.5\%$ of monthly income, compared with $217.8 \pm 121.1\%$ for the PKR 15,000–30,000 group, $130.2 \pm 68.9\%$ for the PKR 30,001–50,000 group, and only $55.7 \pm 19.8\%$ for households earning above PKR 50,000. A parallel, statistically significant

gradient was observed for dependence on paid or informal caregiving support: caregiver time costs, expressed as a percentage of monthly household income, were substantially higher among the lowest-income households ($51.9 \pm 53.0\%$) than among the highest-income households ($9.6 \pm 11.4\%$; Kruskal-Wallis $H = 14.70$, $p = 0.002$), indicating that lower-income participants relied proportionally more heavily on caregiver support following a fall-related injury (Table 7).

Table 7. Relative Cost Burden and Caregiver Dependence by Monthly Household Income Group (n = 85)

Income group (PKR)	n	Cost burden (% of monthly income), Mean $\pm$ SD	Caregiver time cost (% of monthly income), Mean $\pm$ SD
<15,000	26	630.9 $\pm$ 348.5	51.9 $\pm$ 53.0
15,000–30,000	27	217.8 $\pm$ 121.1	27.3 $\pm$ 18.0
30,001–50,000	16	130.2 $\pm$ 68.9	18.9 $\pm$ 15.9
>50,000	16	55.7 $\pm$ 19.8	9.6 $\pm$ 11.4
Kruskal-Wallis test		$H = 66.94$, $p < 0.001$	$H = 14.70$, $p = 0.002$

5. DISCUSSION

This study set out to quantify the socioeconomic burden of fall-related injuries among community-dwelling older adults in Karachi and Hyderabad, and to examine how that burden relates to fear of falling and functional disability. The findings confirm that falls carry a substantial and, for many households, catastrophic financial cost in this setting, and that this cost is closely intertwined with both the psychological and functional consequences of falling.

The mean direct cost of PKR 42,364.6 $\pm$ 28,331.4 per fall-related injury, rising to a total cost burden of PKR 51,475.1 $\pm$ 29,064.9 once transportation and caregiver time are included, sits at the upper end of what has been reported internationally. Heinrich et al.'s (2010) systematic review of the global cost-of-falls literature emphasised that fracture-related falls in particular drive a disproportionate share of total expenditure, a pattern broadly consistent with the present findings, where hospitalisation charges were the single largest component of direct cost. What distinguishes the Pakistani context, however, is not simply the absolute magnitude of the cost but the near-total absence of any mechanism to absorb it: unlike the high-income settings from which most of the international cost-of-falls evidence derives, older adults in this sample had no insurance coverage, no state disability benefit, and, for over half the sample, no pension or independent income of their own, meaning that the entire cost fell on already constrained household budgets. This is consistent with the broader pattern of health financing in Pakistan, where out-of-pocket and catastrophic health expenditure have been shown to be regressive, falling hardest on the poorest households (Bashir et al., 2024).

That regressive pattern was borne out sharply in the present data. While the absolute rupee value of the cost burden did not differ in a simple linear fashion across income groups, expressing that burden as a proportion of monthly household income revealed a striking and highly significant gradient, from 630.9% of monthly income among the poorest households to 55.7% among the wealthiest. In other words, a single fall-related injury could consume the equivalent of six months' income for the poorest households in this sample, compared with roughly half a month's income for the wealthiest. A parallel gradient was observed for caregiver time cost, indicating that lower-income households were not only paying more relative to their means but also relying more heavily on family or informal caregiving support to manage the consequences of the fall, consistent with the abstract's finding that participants from lower-income households reported greater dependence on care. Combined with the finding that 60.0% of injured participants, and a family member in many cases, lost income because they were unable to work, these results indicate that fall-related injury functions as a genuine economic shock for lower-income older Pakistani households, not merely an inconvenience absorbed by disposable income.

The 58.6% prevalence of moderate-to-high fear of falling observed in this sample is consistent with international estimates using the FES-I, which has consistently identified fear of falling as common among community-dwelling older adults regardless of recent fall history (Yardley et al., 2005). The significant positive correlation between fear of falling and disability ($r_s = 0.365$, $p = 0.001$) mirrors the well-documented bidirectional relationship in which fear-driven activity restriction accelerates functional decline, independent of the physical injury itself (Zijlstra et al., 2005), and is consistent with findings from a South Asian post-fall cohort in which fear of falling rose substantially in the months following an injurious fall (Izadi-Avanji et al., 2024). It is worth noting, however, that qualitative work with Pakistani older adults has identified cultural and communication barriers that discourage open reporting of fear of falling to family members or health providers (Nazir et al., 2025); if similar underreporting occurred in the present sample, the true prevalence of fear of falling, and its true association with disability, may be understated by the FES-I scores recorded here.

The disability findings were similarly substantial: over a third of the sample (34.9%) met criteria for moderate-to-severe or severe disability on the WHODAS 2.0, with impairment distributed relatively evenly across all six functional domains rather than concentrated in physical mobility alone. This diffuse pattern is consistent with the WHODAS 2.0's design as a generic, cross-domain measure of functioning (Üstün et al., 2010) and with validation evidence showing that the instrument reliably captures functional consequences that extend beyond the site of physical injury into cognitive, self-care, interpersonal, and participation domains (Garin et al., 2010; Federici et al., 2016). This diffuseness has a direct clinical implication: a rehabilitation or falls-prevention response focused narrowly on physical mobility risks leaving a substantial share of the disability burden, in cognition, self-care, and social participation, unaddressed.

The correlation and regression findings together sketch a coherent, if not fully separable, pathway linking financial burden, fear of falling, and disability. All three constructs were significantly and positively intercorrelated, and both cost burden and fear of falling were independently significant predictors of WHODAS 2.0 scores when tested individually. When entered together in a single regression model, however, cost burden retained its independent predictive strength while the additional contribution of fear of falling was substantially attenuated. This attenuation is itself informative: it suggests that fear of falling and financial

burden are not two independent threats to functioning that simply add together, but rather that a meaningful share of the psychological impact of falling in this population is bound up with its financial consequences. An older adult who cannot afford follow-up care, assistive devices, or transportation to rehabilitation may reasonably develop heightened fear of a further fall precisely because the financial means to protect against one, or to recover fully from one, are unavailable. This interpretation is consistent with the broader argument that financial protection and psychological recovery after injury cannot be treated as separate policy problems in a health system built on out-of-pocket financing (Bashir et al., 2024; WHO, 2007).

Several limitations should be considered when interpreting these findings. First, the cross-sectional design precludes causal inference; while the observed associations are consistent with a pathway running from financial burden and fear of falling toward disability, reverse or bidirectional causation, whereby more disabled older adults incur greater costs and develop greater fear, cannot be excluded. Second, fall history and cost-of-injury data were collected using a 12-month retrospective recall period. Validation studies comparing recalled falls against prospectively kept falls calendars have shown that recall accuracy declines substantially with the number of falls experienced and the length of the recall interval, with under-reporting particularly likely among older adults with cognitive difficulty (Sanders et al., 2015); some degree of recall-related measurement error in both fall ascertainment and reported cost is therefore likely, and may have led to conservative rather than inflated estimates of burden, since forgotten falls would not have been reported. Third, the relatively small subsample with an injurious fall ($n = 85$) limited the statistical power available for the multivariate regression model and increased the influence of shared variance between financial burden and fear of falling; a larger injured subsample would allow these constructs to be disentangled with greater precision. Fourth, the community-based, multistage sampling approach, while designed to avoid the selection bias inherent in clinic-based recruitment, still relied on consecutive sampling within purposively selected sites and cannot guarantee full representativeness of all community-dwelling older adults in Karachi and Hyderabad, particularly those who are homebound or otherwise difficult to reach. Finally, the study's geographic focus on two urban centres in Sindh limits the generalisability of the findings to rural areas and other provinces of Pakistan, where income levels, family support structures, and access to rehabilitative and emergency care differ substantially.

Notwithstanding these limitations, this study makes a distinct contribution to the literature on ageing and injury in Pakistan. To our knowledge, it is the first study to jointly quantify the direct and indirect financial cost of fall-related injury, fear of falling, and disability within a single community-based sample of older Pakistanis, and the first to demonstrate empirically that this financial burden falls disproportionately on lower-income households, consistent with, and extending, the broader evidence on regressive out-of-pocket health financing in Pakistan (Bashir et al., 2024). The findings provide direct empirical support for the WHO's longstanding call for community-based falls prevention programmes, of the kind shown to meaningfully reduce fall rates through balance and functional exercise training (Sherrington et al., 2019, 2020), to be paired explicitly with financial protection mechanisms in low- and middle-income settings, rather than treated as a purely clinical or purely financial problem.

5. CONCLUSION

This study provides the first community-based empirical evidence on the combined socioeconomic, psychological, and functional burden of fall-related injuries among older adults in urban Sindh, Pakistan. Fall-related injuries were found to impose a substantial direct cost, averaging over PKR 42,000 per injury, with more than half of injured participants losing household income as a direct consequence. Fear of falling and disability were both common in this population, and both were significantly associated with the financial burden of falling, with the strength of this relationship falling most heavily on lower-income households, who bore a disproportionately greater relative cost burden and a greater reliance on caregiver support.

The regression findings indicate that fall-related financial burden is not merely one factor among several contributing to disability, but the dominant modifiable driver once its overlap with fear of falling is accounted for, underscoring that the economic and psychological consequences of falling in this population are closely, and perhaps causally, intertwined rather than independent.

These findings carry clear implications for policy and practice in Pakistan. Community-based falls prevention programmes, of the kind with established international evidence for reducing fall incidence, are needed at scale in Sindh's community health infrastructure, but exercise-based prevention alone is unlikely to be sufficient. Given the magnitude and regressive distribution of the financial burden documented here, such programmes should be paired with concrete financial protection mechanisms, such as subsidised rehabilitation and assistive device costs, caregiver support schemes, or targeted insurance coverage for fall-related injury, particularly for lower-income older adults who currently bear the greatest relative burden with the least capacity to absorb it. Without such protection, the cycle linking financial hardship, fear of falling, and worsening disability documented in this study is likely to continue, and to deepen, as Pakistan's older population continues to grow.

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