

The Relationship Between Activities of Daily Living and Risk of Falling in Older Individuals

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"Cite this Article" Received: 08 January 2026; Accepted: 05 March 2026; Published: 30 March 2026

Author Contributions: Concept: FA, MHS; Design: FA, TP, YK; Data Collection: FA, S, TP, YK, AMR, KM; Analysis: FA, YK, AMR, MHS; Drafting: FA, S, TP, AMR; Critical Revision: MHS, KM; Supervision: MHS. All authors reviewed and approved the final manuscript. **Ethical Approval:** Royal Institute of Physiotherapy and Rehabilitation Sciences, Sukkur, Pakistan. **Informed Consent:** Written informed consent was obtained from all participants; **Conflict of Interest:** The authors declare no conflict of interest. **Funding:** No external funding; **Data Availability:** Available from the corresponding author on reasonable request; **Acknowledgments:** NA

ABSTRACT

Background: Falls and functional dependency are major threats to independence among older adults, but evidence regarding their relationship remains limited in community settings in Pakistan. **Objective:** To determine the relationship between activities of daily living and fall risk among community-dwelling older adults in Sukkur. **Methods:** This cross-sectional analytical study included 150 adults aged 65 years or older recruited through convenience sampling from Sukkur Township and Sindhi Society. Functional independence was assessed using the Barthel Index, and fall risk was evaluated using the Morse Fall Scale. Descriptive statistics and Pearson's correlation analysis were performed using IBM SPSS Statistics version 26.0. **Results:** Participants had a mean age of 75.12 ± 5.48 years; 92 (61.3%) were men. Moderate dependency was observed in 57 (38.0%) participants, while only 15 (10.0%) were fully independent. High fall risk was identified in 64 (42.6%) participants, and 116 (77.3%) had moderate or high fall risk. The mean Barthel Index and Morse Fall Scale scores were 67.85 ± 15.42 and 48.63 ± 18.21 , respectively. A significant moderate inverse correlation was found between the scores ($r = -0.462$, 95% CI: -0.579 to -0.326 ; $p = 0.001$). **Conclusion:** Greater independence in activities of daily living was associated with lower fall risk. Functional assessment may support comprehensive fall-risk screening among community-dwelling older adults. **Keywords:** Activities of Daily Living; Accidental Falls; Aged; Functional Independence; Barthel Index; Morse Fall Scale.

INTRODUCTION

Population ageing is accelerating worldwide and is accompanied by an increasing burden of functional limitation, disability, and healthcare dependence. Ageing is associated with progressive reductions in muscle mass and strength, postural control, proprioception, visual function, and reaction speed, all of which may impair mobility and increase vulnerability to falls. Falls are therefore a major public-health concern among older adults and are an important cause of injury, loss of independence, hospitalization, institutionalization, and mortality (1).

Falls among older adults are multifactorial events arising from interactions between intrinsic, behavioural, and environmental factors. Community-based evidence indicates that a substantial proportion of adults aged 60 years and above experience at least one fall annually, although prevalence varies according to population characteristics, living conditions, comorbidities, and assessment methods (2,3). In addition to physical injury, falls may produce persistent fear of falling. This fear can lead older

adults to restrict mobility and avoid routine activities, resulting in physical deconditioning, social isolation, further functional decline, and a potentially self-perpetuating cycle of reduced activity and increased fall susceptibility (4).

Activities of daily living comprise essential self-care and mobility tasks required for independent living, including feeding, bathing, grooming, dressing, toileting, continence, transfers, walking, and stair use. The ability to perform these activities provides an important indicator of functional independence and the level of support required by an older person. Limitations in activities of daily living are associated with poorer quality of life, greater healthcare utilization, prolonged hospitalization, and increased need for long-term care (5). The Barthel Index is widely used to assess independence in basic activities of daily living by quantifying an individual's ability to perform essential self-care and mobility tasks.

Functional dependency may also be closely related to fall risk. Older adults who require assistance with transfers, ambulation, toileting, or other daily activities may have impaired balance, reduced lower-limb strength, limited coordination, or restricted mobility. These impairments may compromise their capacity to respond effectively to environmental obstacles or postural disturbances. Arli et al. reported a significant inverse relationship between Barthel Index scores and fall-risk scores, indicating that greater dependency was associated with higher fall risk among older adults (6). Similarly, Mortazavi et al. found that reduced independence in basic and instrumental activities of daily living was associated with falls and fear of falling (7). Evidence from China further suggests that disability in activities of daily living may partly mediate the relationship between impaired balance and falls, demonstrating that functional ability is an important component of the multifactorial pathway leading to falls (8).

Despite growing international evidence, the relationship between functional independence and fall risk has received limited investigation among community-dwelling older adults in Pakistan. Social circumstances, housing arrangements, environmental hazards, healthcare access, and patterns of family support may influence both the performance of daily activities and exposure to fall-related risks. Evidence generated in other countries may therefore not be fully applicable to older adults living in Sukkur, Sindh. In particular, locally relevant evidence using the Barthel Index to assess activities of daily living and the Morse Fall Scale to assess fall risk remains limited.

The present study was conducted to determine the relationship between activities of daily living and fall risk among community-dwelling older adults in Sukkur, Pakistan. It specifically assessed functional independence using the Barthel Index, evaluated fall risk using the Morse Fall Scale, described the participants' demographic characteristics, and examined the correlation between the two scale scores. It was hypothesized that functional independence would be significantly associated with fall risk, with higher Barthel Index scores corresponding to lower Morse Fall Scale scores.

MATERIALS AND METHODS

A quantitative, cross-sectional analytical study was conducted to examine the relationship between functional independence in activities of daily living and fall risk among community-dwelling older adults. The study was carried out over six months in Sukkur Township and Sindhi Society, two residential areas located in Sukkur, Sindh, Pakistan.

The target population comprised permanent residents of Sukkur aged 65 years or older. Participants were eligible when they could understand verbal instructions, were oriented to time and place, and provided informed consent to participate. Individuals were excluded if they had a diagnosed neurological disorder affecting function or mobility, including stroke or Parkinson's disease; paralysis; terminal malignancy; a critical or unconscious condition; or a recent major surgical procedure. These criteria were applied to reduce the inclusion of participants whose functional performance or fall-risk assessment could be substantially affected by severe neurological or acute medical conditions.

A non-probability convenience sampling technique was used. Potential participants who were available in the selected residential communities during the data-collection period were approached and assessed for eligibility. Those who met the eligibility criteria, received information about the study, and voluntarily agreed to participate were enrolled. The final sample comprised 150 older adults. The sample size was determined according to the feasibility of recruitment, availability of eligible participants, and the time and resources available for data collection.

Ethical clearance was obtained from the relevant institutional authority before commencement of the study. Eligible individuals were informed about the purpose and procedures of the research, the voluntary nature of participation, and their right to withdraw without penalty. Informed consent was obtained before data collection. Participant information was treated confidentially, and the collected data were used solely for research purposes.

Data were collected using a demographic information form, the Barthel Index, and the Morse Fall Scale. Demographic information included age and gender. Functional independence was assessed using the Barthel Index, a standardized measure of basic activities of daily living covering feeding, bathing, grooming, dressing, bowel control, bladder control, toilet use, transfers, mobility on level surfaces, and stair use (5). Item scores were summed to produce a total score ranging from 0 to 100, with higher scores representing greater independence. Scores were categorized as total dependency from 0 to 20, severe dependency from 21 to 60, moderate dependency from 61 to 90, slight dependency from 91 to 99, and full independence at a score of 100.

Fall risk was assessed using the Morse Fall Scale. The scale evaluates six domains: a recent history of falling, the presence of a secondary diagnosis, use of an ambulatory aid, intravenous therapy or a heparin lock, gait or transferring ability, and awareness of personal functional limitations. Domain scores were summed to obtain a total score ranging from 0 to 125, with higher scores indicating greater fall risk. Scores from 0 to 24 were classified as low risk, scores from 25 to 44 as moderate risk, and scores of 45 or above as high risk.

Following enrolment, demographic information was recorded and both assessment instruments were administered using their standard item descriptions and scoring criteria. Barthel Index item scores were summed to determine each participant's level of functional independence, while Morse Fall Scale item scores were summed to determine the corresponding fall-risk category. The principal exposure variable was the total Barthel Index score, and the principal outcome variable was the total Morse Fall Scale score. Age, gender, dependency category, and fall-risk category were included as descriptive variables.

Data were analysed using IBM SPSS Statistics version 26.0. Continuous variables, including age and total Barthel Index and Morse Fall Scale scores, were summarized using means, standard deviations, minimum values, and maximum values. Categorical variables, including gender, functional-dependency level, and fall-risk category, were summarized using frequencies and percentages. Pearson's product-moment correlation coefficient was used to determine the direction and strength of the relationship between total Barthel Index and Morse Fall Scale scores. Statistical significance was defined as a two-sided p value of 0.05 or less, with analysis conducted at the 95% confidence level. Because the study used a cross-sectional design and a bivariate correlation analysis, the findings were interpreted as associations rather than causal or independently adjusted effects.

RESULTS

A total of 150 community-dwelling older adults were included in the study. Their mean age was 75.12 ± 5.48 years, with ages ranging from 65 to 85 years. Men constituted 61.3% of the sample, while women accounted for 38.7%. The demographic characteristics and descriptive summaries of the principal study measures are presented in Table 1.

Table 1. Demographic Characteristics and Descriptive Statistics of the Study Participants (N = 150)

Variable	Category or measure	n (%)	Mean $\pm$ SD	95% CI for mean or proportion	Minimum–maximum
Age, years	Continuous measure	—	75.12 $\pm$ 5.48	74.24–76.00	65–85
Gender	Male	92 (61.3)	—	53.3%–68.8%	—
	Female	58 (38.7)	—	31.2%–46.7%	—
Barthel Index score	Functional-independence measure	—	67.85 $\pm$ 15.42	65.36–70.34	30–100
Morse Fall Scale score	Fall-risk measure	—	48.63 $\pm$ 18.21	45.69–51.57	10–90

Values are presented as n (%) or mean $\pm$ standard deviation. Confidence intervals for means were derived from the reported means, standard deviations, and sample size. Confidence intervals for proportions were calculated using the Wilson method. CI: confidence interval; SD: standard deviation.

The distribution of Barthel Index categories showed that moderate dependency was the most common functional classification, affecting 57 participants (38.0%). Severe dependency was identified in 38 participants (25.3%), while 40 participants (26.7%) had slight dependency. Only 15 participants (10.0%) were classified as fully independent. No participant was represented in the total-dependency category because the minimum observed Barthel Index score was 30.

Fall-risk classification demonstrated that 64 participants (42.6%) were at high risk of falling, 52 (34.7%) were at moderate risk, and 34 (22.7%) were at low risk. Overall, 116 participants (77.3%) were classified as having moderate or high fall risk. The complete distributions of functional independence and fall-risk categories are shown in Table 2.

Table 2. Distribution of Functional Independence and Fall-Risk Categories (N = 150)

Assessment	Category	Score classification	n	Percentage (%)	95% CI for proportion
Barthel Index	Total dependency	0–20	0	0.0	—
	Severe dependency	21–60	38	25.3	19.0–32.8
	Moderate dependency	61–90	57	38.0	30.6–46.0
	Slight dependency	91–99	40	26.7	20.2–34.3
	Independent	100	15	10.0	6.2–15.8
	Total	—	150	100.0	—
Morse Fall Scale	Low risk	0–24	34	22.7	16.7–30.0
	Moderate risk	25–44	52	34.7	27.5–42.6
	High risk	≥ 45	64	42.6	35.0–50.7
	Moderate or high risk combined	≥ 25	116	77.3	70.0–83.3
	Total	—	150	100.0	—

Barthel Index classifications were based on the scoring thresholds reported in the study. Morse Fall Scale classifications were defined as low risk, 0–24; moderate risk, 25–44; and high risk, ≥ 45 . Confidence intervals for proportions were calculated using the Wilson method. CI: confidence interval.

The mean Barthel Index score of 67.85 $\pm$ 15.42 was consistent with an overall moderate level of functional dependency in the study population. In contrast, the mean Morse Fall Scale score of 48.63 $\pm$ 18.21 exceeded the reported threshold for high fall risk, indicating that the sample had a substantial overall burden of fall susceptibility. The broad ranges of both measures indicated considerable variation in functional independence and fall risk across participants.

Pearson's product-moment correlation analysis identified a statistically significant moderate inverse association between functional independence and fall risk. The correlation between the Barthel Index and Morse Fall Scale scores was -0.462 , with a 95% confidence interval ranging from -0.579 to -0.326 and a p value of 0.001. Thus, higher Barthel Index scores, representing greater functional independence, were associated with lower Morse Fall Scale scores.

The coefficient of determination was 0.213, indicating that the linear association between the two measures accounted for approximately 21.3% of their shared variation. The remaining variation was not explained by this unadjusted bivariate association and may reflect other individual, clinical, or environmental factors. Inferential findings are presented in Table 3.

Table 3. Inferential Analysis of the Relationship Between Functional Independence and Fall Risk (N = 150)

Predictor variable	Outcome variable	Statistical test	Correlation coefficient, r	95% CI for r	Coefficient of determination, r ²	Explained variation (%)	p value	Interpretation
Barthel Index total score	Morse Fall Scale total score	Pearson's product-moment correlation	−0.462	−0.579 to −0.326	0.213	21.3	0.001	Moderate inverse association

The 95% confidence interval for the correlation coefficient was derived using Fisher's z transformation. A negative coefficient indicates that greater functional independence was associated with lower fall risk. Statistical significance was defined as a two-sided p value ≤ 0.05 . CI: confidence interval.

Overall, the findings demonstrated that functional dependency and fall risk were common in this population. Nearly two-thirds of participants had severe or moderate dependency, while more than three-quarters had at least moderate fall risk. The significant inverse correlation supported the study hypothesis that greater independence in activities of daily living was associated with lower fall risk among older adults living in Sukkur.

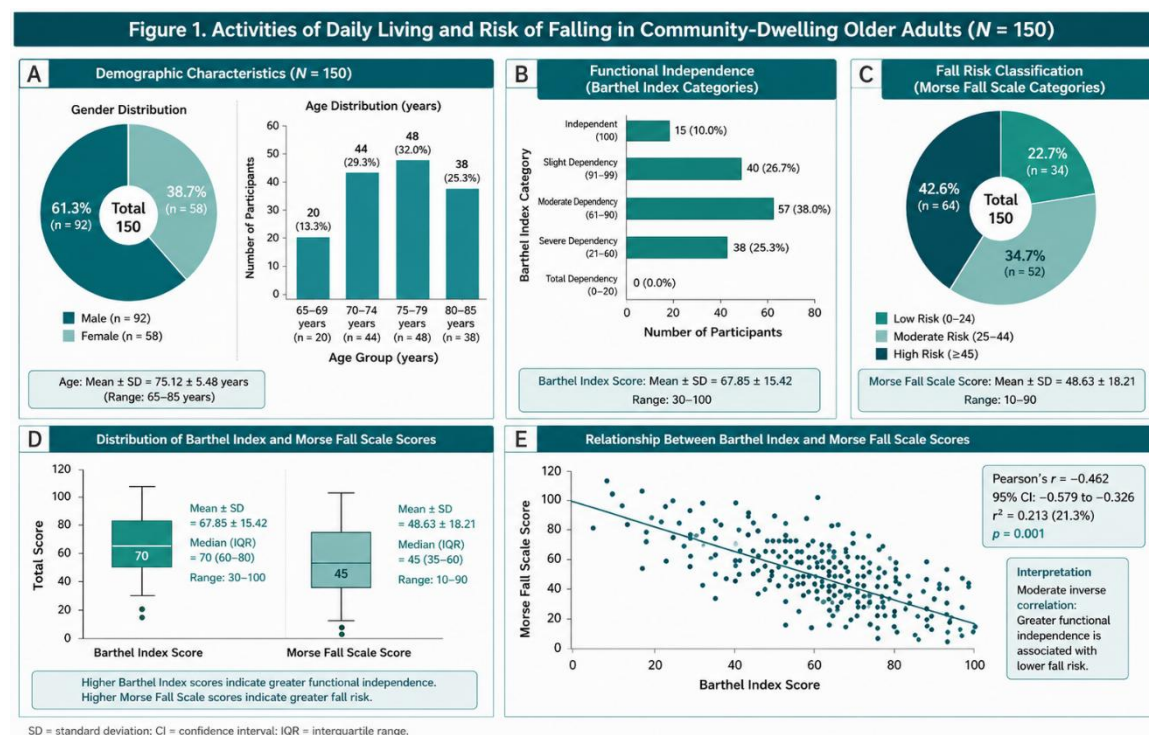


Figure 1 Multi-panel graphical summary of the study findings among 150 community-dwelling older adults. Panel A presents the demographic profile, including gender distribution and age-group frequencies; Panel B illustrates functional independence according to Barthel Index categories, showing moderate dependency as the most prevalent level; Panel C summarizes fall-risk classification using the Morse Fall Scale, with the largest proportion of participants categorized as high risk; Panel D compares the distribution of Barthel Index and Morse Fall Scale scores using box plots; and Panel E demonstrates a statistically significant moderate inverse correlation between functional independence and fall risk ($r = -0.462$, $p = 0.001$), indicating that greater independence in activities of daily living was associated with lower fall risk.

DISCUSSION

The present study identified a statistically significant moderate inverse relationship between functional independence in activities of daily living and fall risk among community-dwelling older adults in Sukkur. Participants with higher Barthel Index scores generally had lower Morse Fall Scale scores, indicating that greater independence in essential self-care and mobility activities was associated with lower assessed fall risk. Functional limitation and fall susceptibility were common in the sample: only 10.0% of participants were fully independent, while 77.3% were classified as having moderate or high fall risk. These findings support the study hypothesis and demonstrate the clinical relevance of

incorporating functional assessment into fall-risk screening among older adults living in the community.

The observed inverse association is consistent with the findings of Arli et al., who reported that fall risk increased as independence in activities of daily living declined among older individuals (6). Mortazavi et al. similarly found significant relationships between limitations in basic and instrumental activities of daily living, falls, and fear of falling (7). These similarities suggest that functional dependency may be an important marker of vulnerability to falls across different community and healthcare settings. A previous study examining future fall risk also found that older adults with difficulty performing activities of daily living were more likely to be vulnerable to subsequent falls (9). Evidence from the Longitudinal Ageing Study in India further supports an association between limitations in daily activities and falls among older adults living in a South Asian context (10).

Several mechanisms may explain this relationship. Activities such as transferring, toileting, dressing, stair climbing, and walking require coordinated contributions from muscle strength, balance, joint mobility, proprioception, vision, reaction time, and executive function. Age-related deterioration in these systems may simultaneously reduce independence and increase fall susceptibility. Older adults who require assistance with transfers or ambulation may be less able to recover from postural disturbances or respond rapidly to environmental hazards. Physical inactivity associated with functional dependency may further accelerate loss of muscle strength, balance, endurance, and mobility, creating a cycle in which reduced activity contributes to additional functional decline and fall vulnerability (16).

The finding is also compatible with evidence that activities-of-daily-living disability may contribute to the pathway linking impaired balance with falls. Jiang et al. reported that limitations in activities of daily living partially mediated the relationship between balance ability and falls among middle-aged and older adults (8). This suggests that functional independence may reflect the combined effects of multiple physiological and behavioural systems rather than representing an isolated characteristic. However, the present study assessed association rather than mediation and did not evaluate balance, lower-limb strength, cognition, or physical activity directly.

The correlation coefficient of -0.462 represents a moderate rather than strong association. The coefficient of determination indicated that approximately 21.3% of the shared variation between Barthel Index and Morse Fall Scale scores was represented by their linear relationship. This finding reinforces the multifactorial nature of falls. Although functional independence was significantly associated with fall risk, a substantial proportion of variation was not captured by the bivariate analysis. Factors such as age, chronic disease, medication use, visual impairment, cognitive status, fear of falling, use of assistive devices, and environmental hazards may also influence fall susceptibility. Community-based research has shown that falls are related to combinations of demographic, health, mobility, and environmental characteristics rather than to a single risk factor (2,3).

Fear of falling may further complicate the relationship between functional ability and fall risk. Older adults who fear falling may restrict walking, transfers, community participation, and other daily activities, even when they remain physically capable of performing them. Prolonged activity restriction can result in deconditioning, reduced confidence, social withdrawal, and greater dependency. De Roza et al. found that fear of falling among community-dwelling older adults was influenced by several physical and functional factors (4). Wang et al. also reported a relationship between falls efficacy and activities of daily living among older adults receiving different forms of care (12). Consequently, functional dependency may act both as a marker of fall vulnerability and as a potential consequence of fear-related activity restriction.

Environmental conditions are particularly relevant when interpreting the findings in a community setting. Uneven flooring, poor lighting, unsuitable footwear, inaccessible bathrooms, stairs without support rails, and crowded household arrangements may increase fall risk during routine daily activities.

Lyra et al. reported associations between home fall-risk factors and fear of falling among older adults (13). The present study did not assess household hazards, and the observed association between functional dependency and fall risk may therefore have been influenced by unmeasured environmental exposures.

The findings have practical implications for geriatric assessment and physiotherapy practice. Routine assessment of activities of daily living may help clinicians identify older adults who require more comprehensive fall-risk evaluation. Individuals with reduced Barthel Index scores may benefit from targeted assessment of gait, balance, lower-limb strength, transfer ability, assistive-device use, vision, medication burden, and home safety. Interventions should remain multifactorial because improving a single domain may not adequately address the diverse causes of falls. The LiFE trial demonstrated that integrating balance and strength activities into everyday routines can reduce falls among older adults at increased risk (14). Fall-prevention programmes may also improve confidence and quality of life when they combine physical training, education, and environmental modification (15).

The study has several strengths. It addressed a clinically important geriatric rehabilitation problem in an understudied Pakistani population, recruited community-dwelling older adults, and used standardized instruments to assess both functional independence and fall risk. The inclusion of participants from residential communities rather than exclusively from hospitals may also improve the relevance of the findings to community-based screening and preventive physiotherapy services in Sukkur.

Several limitations should be considered. The cross-sectional design prevents determination of temporal sequence or causality; therefore, it cannot establish whether functional dependency preceded increased fall risk or developed alongside other factors associated with falls. Convenience sampling may have introduced selection bias and limits generalizability to the wider older population of Sukkur and other regions. Recruitment was restricted to Sukkur Township and Sindhi Society, and the findings may not represent rural communities, institutionalized older adults, or people with substantially different socioeconomic and environmental circumstances.

The sample-size decision was based on feasibility rather than a formal statistical calculation, which may have affected the precision and representativeness of the estimates. The study also relied on a scale-based assessment of fall risk rather than prospective documentation of actual falls. Moreover, potentially important confounding factors, including comorbidities, medication use, visual impairment, cognitive function, frailty, physical activity, assistive-device use, and home hazards, were not included in an adjusted analysis. The gender distribution was uneven, with a higher proportion of men, and gender-stratified associations could not be examined from the available aggregate results. Finally, the Morse Fall Scale was developed primarily for clinical and institutional settings, and its performance among community-dwelling older adults in this setting requires careful interpretation.

Future research should use probability-based sampling and include larger, more geographically diverse populations. Prospective cohort studies are needed to determine whether reduced activities-of-daily-living independence predicts subsequent falls. Multivariable analyses should assess the independent contribution of functional ability after accounting for demographic, clinical, cognitive, behavioural, and environmental factors. Research should also evaluate whether physiotherapy-led programmes that combine functional training, strength and balance exercises, caregiver education, and home-hazard modification can reduce actual fall incidence among older adults in Pakistan.

CONCLUSION

Greater functional independence in activities of daily living was significantly associated with lower fall risk among community-dwelling older adults in Sukkur. The moderate inverse correlation between Barthel Index and Morse Fall Scale scores indicates that functional assessment may contribute to

identifying older adults who require comprehensive fall-risk evaluation, although functional independence alone does not account for the multifactorial nature of falls.

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