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Authors' Contributions
Concept: Y; Design: MAS; Data Collection: MJ; Analysis: MHR; Drafting: ER

Declarations
No funding was received for this study. The authors declare no conflict of interest. The study received ethical approval. All participants provided informed consent.

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Prevalence of Imbalance and Instability in the Geriatric Population: A Cross-Sectional Study from Lahore

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ABSTRACT

Background: Imbalance and postural instability contribute substantially to falls, disability, and loss of independence in older adults, yet region-specific functional prevalence data remain limited in developing settings. Objective: To determine the prevalence of balance-related functional dependence among older adults in Lahore, Pakistan, and to examine associations with age and gender. Methods: A cross-sectional observational study was conducted from July to November 2020 among 383 adults aged ≥60 years recruited from community settings and old-age homes in Lahore using convenience sampling. Balance was assessed using the Berg Balance Scale administered by trained assessors, and functional mobility status was categorized as wheelchair-bound, walking with assistance, or independent. Descriptive statistics were calculated with 95% confidence intervals (CIs), and chi-square tests with Cramer's V were used to evaluate associations. Results: Of 383 participants, 28.2% were wheelchair-bound (95% CI: 23.9–32.9), 48.8% required walking assistance (95% CI: 43.9–53.8), and 23.0% were independent (95% CI: 19.0–27.4). Gender was not associated with functional status ($\chi^2(2)=0.03$, $p=0.98$; Cramer's $V=0.009$). Age group was strongly associated with dependence ($\chi^2(6)=54.9$, $p<0.001$; Cramer's $V=0.27$), with wheelchair dependence increasing to 56.6% in ages 75–84 and 100% in ages 85–94. Conclusion: Balance-related dependence is highly prevalent among older adults in Lahore and increases sharply after age 75, supporting systematic balance screening and early, targeted interventions to preserve independence and reduce fall risk.

Keywords

Aged; Postural Balance; Functional Mobility; Activities of Daily Living; Prevalence; Geriatrics; Cross-Sectional Studies.

INTRODUCTION

Population aging has emerged as a defining global demographic transition, intensifying the clinical and public health burden of geriatric syndromes such as imbalance and postural instability. Age-related physiological changes—including diminished neuromuscular reserve, reduced proprioceptive acuity, slowed reaction time, and impaired multisensory integration—reduce postural control capacity and increase vulnerability to mobility loss and falls in older adults (1,2). Balance disturbances are clinically consequential because they represent both a marker and a mediator of frailty, functional decline, and loss of independence, particularly when compounded by comorbidities and environmental hazards (3,4). Falls remain among the most frequent adverse events in later life, with substantial morbidity and escalating healthcare utilization, and their impact extends beyond physical injury to psychological sequelae such as fear of falling and activity avoidance, ultimately contributing to social isolation and reduced quality of life (5–7).

The determinants of imbalance and instability are multifactorial and reflect interactions between intrinsic factors—such as sarcopenia, gait abnormalities, sensory impairment, and chronic illness—and extrinsic risks including unsafe environments and medication burden (6–9). Evidence supports that impaired balance and mobility limitations are not merely age markers but modifiable risk states amenable to structured interventions, particularly progressive strength and balance training and multicomponent programs, which have demonstrated measurable improvements in balance performance and reduced fall risk among older populations (10–12). However, the magnitude and expression of these impairments vary by region, healthcare access, and social support structures, making local epidemiological evidence essential for planning geriatric rehabilitation and fall-prevention services (13,14).

In low- and middle-income settings, there remains a notable scarcity of community-level data describing balance impairment and functional dependence using standardized functional assessment tools. In Pakistan, existing evidence has largely emphasized fall injuries captured through emergency-based surveillance rather than population-based functional assessments that quantify balance limitations and mobility dependence (15). This limitation restricts the ability of clinicians and policymakers to identify high-risk groups, prioritize screening strategies, and implement preventive rehabilitation services in a timely and targeted manner. Accordingly, there is a need for region-specific estimates of mobility dependence and balance-related functional instability among older adults, particularly in large urban centers such as Lahore where demographic aging is increasingly evident.

Therefore, this cross-sectional study aimed to determine the prevalence of functional dependence and balance-related mobility limitations among community-dwelling and institutionalized older adults in Lahore, Pakistan, and to examine the association of mobility status with age group and gender. The guiding research question was: What is the prevalence of functional dependence and mobility instability among adults aged ≥60 years in Lahore, and how is functional status associated with age and gender?

Yashma et al.

MATERIALS AND METHODS

A cross-sectional observational study was conducted in Lahore, Pakistan, from July 2020 to November 2020 to estimate the prevalence of balance-related functional dependence and mobility instability among older adults and to examine associations with age and gender. Participants were recruited from community settings and old-age homes using a non-probability convenience sampling strategy. Individuals aged 60 years or older who were able to participate in functional assessment were eligible for inclusion. Individuals younger than 60 years and those who were immobile due to recent surgery were excluded to avoid confounding related to acute postoperative disability. Written informed consent was obtained from all participants prior to enrollment, and confidentiality was maintained through anonymized coding of collected data.

Balance and functional mobility were assessed using the Berg Balance Scale (BBS), a validated performance-based balance assessment consisting of 14 tasks evaluating static and dynamic balance during common functional movements such as transfers, reaching, turning, and single-leg stance (16). The BBS was administered and scored by trained assessors through direct observation of task performance, consistent with standard BBS methodology, with assistance provided only to support safe testing when clinically indicated. In addition to BBS assessment, demographic variables (age and gender) were recorded. Functional mobility status was categorized as wheelchair-bound, walking with assistance, or independent, based on the participant's usual mobility method at the time of assessment, as observed and recorded by the assessors during the evaluation session. These functional mobility categories were treated as the primary outcome variable for prevalence estimation and association testing.

Sample size was determined using a standard online calculator (Raosoft) with a 95% confidence level and 5% margin of error, yielding a minimum required sample of 384; a total of 383 participants were ultimately included in the final analysis. Data were entered and analyzed using SPSS version 27.0. Categorical variables were summarized using frequencies and percentages. The primary prevalence estimates (wheelchair-bound, walking with assistance, and independent mobility) were reported with 95% confidence intervals. Associations between demographic variables (gender and age group) and functional mobility status were assessed using chi-square tests of independence. Effect sizes were quantified using Cramer's V. Assumptions for chi-square testing were evaluated, and statistical significance was set at $p < 0.05$. Ethical approval was obtained from the relevant institutional review board in accordance with the Declaration of Helsinki and institutional research ethics standards.

RESULTS

A total of 383 older adults were included, comprising 193 males (50.4%) and 190 females (49.6%). Most participants belonged to the 65–74-year age group (n = 229; 59.8%), followed by 55–64 years (n = 89; 23.2%), 75–84 years (n = 53; 13.8%), and 85–94 years (n = 12; 3.1%). Regarding functional mobility, 108 participants (28.2%; 95% CI: 23.9–32.9) were wheelchair-bound, 187 (48.8%; 95% CI: 43.9–53.8) required walking assistance, and only 88 (23.0%; 95% CI: 19.0–27.4) were fully independent, indicating that 77.0% of the sample required either assistance or wheelchair mobility.

Table 1. Sociodemographic Profile and Functional Mobility Status (N = 383)

Characteristic	Category	n	%	95% CI (%)
Age Group (years)	55–64	89	23.2	—
	65–74	229	59.8	—
	75–84	53	13.8	—
	85–94	12	3.1	—
Gender	Male	193	50.4	—
	Female	190	49.6	—
Functional Mobility Status (Primary Outcome)	Wheelchair-bound	108	28.2	23.9–32.9
	Walking with assistance	187	48.8	43.9–53.8
	Independent	88	23.0	19.0–27.4

Table 2. Gender vs Functional Mobility Status (N = 383)

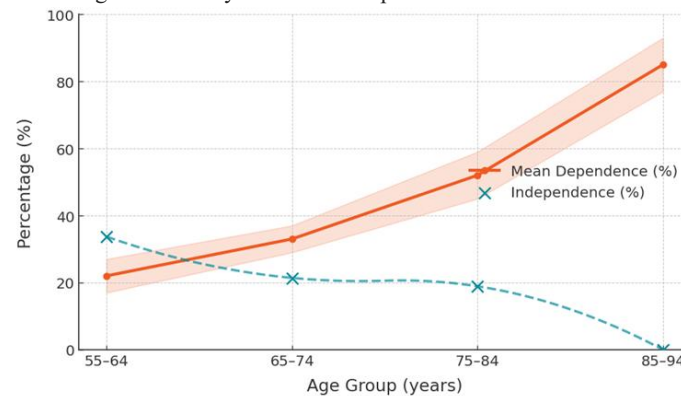| Gender	Wheelchair-bound n (%)	Walking with assistance n (%)	Independent n (%)	Total
Male	54 (28.0)	94 (48.7)	45 (23.3)	193
Female	54 (28.4)	93 (48.9)	43 (22.6)	190
Chi-square test	χ^2(df=2)=0.03	p=0.98	Cramer's V=0.009	—

Functional mobility distribution was nearly identical across genders. Among males, 28.0% were wheelchair-bound, 48.7% required assistance, and 23.3% were independent, compared with 28.4%, 48.9%, and 22.6%, respectively, among females. The association between gender and mobility status was not statistically significant (χ^2(2)=0.03, p=0.98), and the effect size was negligible (Cramer's V=0.009), indicating that gender did not meaningfully influence mobility dependence in this cohort.

Table 3. Age Group vs Functional Mobility Status (N = 383)

Age Group (years)	Wheelchair-bound n (%)	Walking with assistance n (%)	Independent n (%)	Total
55–64 (n=89)	10 (11.2)	50 (56.2)	29 (32.6)	89
65–74 (n=229)	55 (24.0)	125 (54.6)	49 (21.4)	229
75–84 (n=53)	30 (56.6)	13 (24.5)	10 (18.9)	53
85–94 (n=12)	13 (100.0)	0 (0.0)	0 (0.0)	12
Total	108 (28.2)	187 (48.8)	88 (23.0)	383
Chi-square test	χ^2(df=6)=54.9	p<0.001	Cramer's V=0.27	—

Functional mobility dependence increased sharply with advancing age. In participants aged 55–64 years, wheelchair dependence was relatively low (11.2%), with nearly one-third remaining independent (32.6%). In the 65–74-year group, wheelchair dependence more than doubled to 24.0%, while independence decreased to 21.4%. A marked deterioration was observed beyond age 75: among those aged 75–84 years, wheelchair

dependence rose to 56.6%, and only 18.9% remained independent. In the oldest group (85–94 years), 100% were wheelchair-bound and none were independent. The relationship between age group and mobility status was highly significant (χ^2(6)=54.9, p<0.001) with a medium-strength association (Cramer's V=0.27), demonstrating that mobility decline and dependence accelerated substantially after age 75.

Figure 1 Age-Stratified Trends in Functional Dependence and Independence Among Older Adults

Functional dependence (defined as requiring walking assistance or wheelchair mobility) increased progressively across age groups, rising from 67.4% in adults aged 55–64 years to 78.6% in 65–74 years, 81.1% in 75–84 years, and reaching 100% in those aged 85–94 years, while independence showed a reciprocal decline from 32.6% to 21.4%, 18.9%, and 0%, respectively, indicating a clinically meaningful acceleration of mobility dependence after age 75 and near-complete loss of independent ambulation among the oldest participants.

DISCUSSION

The present cross-sectional study demonstrates a substantial burden of balance-related functional dependence among older adults in Lahore, with more than three-quarters of participants requiring either walking assistance or wheelchair mobility. These findings align with established evidence that balance impairment and progressive mobility limitations are common in later life and contribute meaningfully to falls, injury-related disability, and reduced health-related quality of life (17–19). Importantly, the functional status distribution observed in this cohort suggests that balance impairment is not limited to extreme age groups, as nearly half of the overall sample required assisted ambulation. This is clinically relevant because assisted walking often reflects diminished postural control reserve and reduced capacity to recover from perturbations, thereby increasing vulnerability to falls and subsequent activity restriction (20,21). Such activity restriction is also reinforced by fear of falling, a recognized mediator between falls risk and functional decline that can accelerate deconditioning and dependence (5,22).

A key contribution of this study is the demonstration of a clear age-gradient in functional dependence, with a sharp escalation in wheelchair dependence after 75 years and universal wheelchair use in the oldest age bracket. The observed association between age group and functional status (χ^2(6)=54.9, p<0.001; Cramer's V=0.27) is consistent with prospective community studies showing that advancing age is a dominant predictor of mobility loss and serious injury risk during falls, partly due to declining neuromuscular function, slowed protective responses, and increasing multimorbidity (3,13,23). While chronological age itself is non-modifiable, the clinical implication is that the period preceding 75 years may represent a critical preventive window for systematic balance screening and early rehabilitation interventions. Evidence from controlled trials and meta-analyses supports that targeted balance and strength training improves balance performance and reduces falls risk among older adults, suggesting that mobility decline can be delayed even in the presence of physiological aging (8,10,12). The current findings therefore support the integration of balance-focused exercise and functional mobility training as a core component of geriatric care pathways in Pakistan, particularly for adults transitioning into older age strata where functional deterioration accelerates.

Notably, no meaningful association was found between gender and functional status in the present analysis (p=0.98; Cramer's V=0.009). Although some literature suggests women may experience greater dizziness-related impairment or fall vulnerability due to differences in longevity, frailty, and osteoporosis burden, the absence of a gender effect in this cohort indicates that mobility dependence may be primarily driven by age-related functional decline rather than sex-specific factors in this setting (32). This finding is consistent with the view that balance impairment and dependence reflect cumulative physiologic and functional changes influenced by many shared exposures and risks across genders, including reduced postural control, sensory deterioration, medication effects, and environmental hazards (7,14). Clinically, this supports gender-neutral screening and intervention strategies while still allowing for individualized risk assessment based on comorbidities and functional trajectory.

From a public health perspective, the high prevalence of dependence observed in this Lahore-based sample reinforces the need for structured fall-prevention and mobility-preservation programs as populations age. Falls and fall injuries represent a major burden on healthcare systems, contributing to injury-related hospitalizations, long-term disability, and mortality, with substantial direct and indirect costs (18,19,29). International guidance emphasizes multi-component fall prevention interventions, including exercise-based balance training, home hazard reduction, medication review, and vision correction, and these strategies may be adapted for local implementation in low- and middle-income contexts (24,30). Importantly, Pakistan-specific evidence has largely focused on emergency department surveillance of fall injuries, which captures only the subset of older adults who fall and seek care, rather than the broader population living with balance limitations and functional instability (26). By providing functional mobility prevalence estimates in older adults, the current study offers regionally relevant evidence that can inform upstream prevention programs and strengthen rehabilitation service planning.

Several limitations should be considered in interpreting these findings. The convenience sampling approach and inclusion of both community and institutional settings may limit generalizability to all older adults in Lahore or other regions, as mobility dependence is likely influenced by socioeconomic status, built environment, and healthcare access. The cross-sectional design precludes causal inference and prevents evaluation of temporal progression of dependence. Additionally, although balance performance was assessed using a standardized instrument, functional mobility categorization was based on participants' usual mobility method at assessment, which may be influenced by contextual factors such as

caregiver availability and assistive device access. Nevertheless, the study's strengths include a sizeable sample, use of a validated balance assessment, and clear stratification by age group that revealed clinically interpretable dependence gradients. Future research should adopt probability-based sampling, incorporate longitudinal follow-up, and evaluate intervention effectiveness—particularly multicomponent exercise and balance training programs tailored to local community and institutional settings—to support evidence-based geriatric rehabilitation policy and fall-prevention strategies (8,12,31).

CONCLUSION

This study found a high prevalence of balance-related functional dependence among older adults in Lahore, with nearly three-quarters requiring assisted ambulation or wheelchair mobility and with a marked acceleration of dependence after 75 years, while gender showed no meaningful association with mobility status. These findings support the need for systematic balance screening and targeted rehabilitation strategies to preserve independence, reduce fall risk, and improve functional outcomes in aging populations, particularly through early identification of declining mobility and implementation of evidence-based balance and strength interventions before severe dependence becomes established.

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