RESEARCH PAPER

Functional Dependence and Fall Risk Among the Geriatric Population in Selected Community Areas of Ludhiana, Punjab: A Cross-Sectional Study

Prof. Neelam Dass[1*], Prof. (Dr.) Prabhjot Singh[2]
[1*]College of Nursing, Mohan Dai Oswal Hospital, Ludhiana.
Email: dass.neelam@yahoo.com
[2]Professor cum Deputy Director (Faculty of Nursing),
Desh Bhagat University.Mandi Gobindgarh.

ABSTRACT

Background: Falls and functional dependence are among the most significant health concerns in the geriatric population. With India's elderly population rising rapidly, community-level assessment of these conditions has become imperative. Despite their interrelated nature, integrated evaluations assessing both conditions simultaneously remain limited in the Indian community setting.

Objective: To assess functional dependence and fall risk among community-dwelling elderly individuals in Ludhiana, Punjab; to determine the correlation between the two; and to identify associated sociodemographic and health-related variables.

Methods: A descriptive, cross-sectional study was conducted among 500 elderly individuals aged 65 years and above, recruited through non-probability convenient sampling from selected community areas of Ludhiana, Punjab. Functional dependence was assessed using the Katz Index of Activities of Daily Living (ADL), and fall risk was evaluated using the Falls Risk Assessment Tool (FRAT). Data were analyzed using descriptive statistics, Pearson's correlation, and chi-square tests (significance level $p \leq 0.05$).

Results: The majority of participants were functionally independent (96%; n=480); 4% (n=20) were partially dependent; and none were fully dependent. Regarding fall risk, 90% (n=450) were at low risk, 8% (n=40) at medium risk, and 2% (n=10) at high risk. A statistically significant moderate negative correlation was observed between functional dependence and fall risk scores ($r = -0.448$, $p<0.001$). Significant associations ($p<0.05$) were identified with age, educational qualification, family income, area of living, marital status, physical activity, musculoskeletal impairment, surgical history, diabetes mellitus, cardiovascular disease, dental problems, and type of financial support.

Conclusions: Most community-dwelling elderly in the study area maintain functional independence and low fall risk; however, a vulnerable subgroup requires urgent attention and targeted intervention. The significant inverse correlation between functional dependence and fall risk underscores the importance of integrated geriatric assessment. An instructional module developed on the basis of these findings may aid in promoting independence and preventing falls among the elderly.

Keywords: Geriatrics; Functional dependence; Fall risk; Katz Index of ADL; Falls Risk Assessment Tool; Community health; Cross-sectional study; India.

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INTRODUCTION

Falls are a major public health concern among older adults globally and represent the second leading cause of unintentional injury-related deaths worldwide.[1] Each year, approximately one in four adults aged 65 years and above experiences at least one fall, resulting in significant morbidity including fractures, functional impairment, fear of falling, prolonged hospitalization, and premature mortality.[1] India is undergoing an accelerated demographic transition, with the elderly population projected to increase from 138 million in 2021 to approximately 319 million by 2050.[2] This expansion places a considerable burden on healthcare systems and amplifies the need for evidence-based community-level geriatric assessment.

Functional dependence is defined as an inability to independently perform activities of daily living (ADLs) and instrumental activities of daily living (IADLs) is one of the most critical health indicators in older adults.[3] It develops progressively through the accumulation of chronic diseases, declining physical reserve, cognitive impairment, and sensory deficits, ultimately reducing quality of life and increasing reliance on caregivers and institutions.[3] Balance impairment, muscle weakness, visual deficits, polypharmacy, and environmental hazards have been identified as primary risk factors for falls in the elderly.[4] The Katz Index of ADL, a validated and widely used tool, provides a standardized measure of functional capacity in older adults.[5]

The relationship between functional dependence and fall risk is recognized as bidirectional and mutually reinforcing. Frailty and functional decline increase vulnerability to falls,[6] while falls—through injury, fear of falling, and restricted mobility—further worsen functional dependence.[7] Geriatric syndromes including falls, cognitive decline, urinary incontinence, and depression frequently co-occur and amplify one another, complicating clinical management.[7] Despite this well-recognized interplay, integrated community-based assessments evaluating both functional dependence and fall risk concurrently remain sparse, particularly in the Indian context.[8]

This study was therefore conducted to fill this gap by systematically assessing the prevalence of functional dependence and fall risk among community-dwelling elderly individuals in Ludhiana, Punjab; to determine the correlation between the two; and to identify sociodemographic and health-related variables significantly associated with both outcomes. The findings are intended to inform community nursing practice, guide preventive policy, and provide a foundation for developing targeted instructional interventions.

MATERIALS AND METHODS

Study Design and Setting

A descriptive, quantitative, cross-sectional research design was employed. The study was conducted in selected community areas of Ludhiana, Punjab—specifically Ludhiana East and Ludhiana Central. Ludhiana has a total population of approximately 4.12 million, with an estimated 12.6% of the district population aged 65 years and above. The setting was selected because of the significant concentration of elderly residents and the feasibility of access for the researcher. Official permission was obtained from the concerned community authorities and local leadership prior to data collection.

Participants

Inclusion criteria comprised adults aged 65 years and above who were permanent residents of the selected community areas, cognitively and physically capable of responding to the interview schedule (in Punjabi or Hindi), and willing to provide written informed consent. Individuals who were acutely ill and bedridden, had major cognitive impairment or significant communication deficits, or were unavailable during the data collection period were excluded.

Sample Size and Sampling Technique

The minimum required sample size was calculated using the Cochran formula:[9] $n_0 = Z^2 \times p(1-p) / d^2$, where Z=1.96 (95% confidence level), p=0.5 (estimated proportion), and d=0.05 (margin of error), yielding n_0=384. To enhance generalizability, the final sample size was set at 500 participants. A non-probability convenient sampling technique was employed, selecting elderly individuals who satisfied the inclusion criteria and were accessible during the data collection period.[10]

Data Collection Instruments

A structured interview schedule was used, comprising three sections. **Section I** collected sociodemographic and health-related data: age, gender, educational qualification, occupation, family monthly income, area of living, marital status, type of family, dietary preference, type of sensory impairment, previous surgical history, level of physical activity, musculoskeletal impairment, washroom type, social support system, financial support, and comorbidities (diabetes mellitus, hypertension, cardiovascular disease, liver disease, osteoarthritis, urinary incontinence, and dental problems).

Section II assessed functional dependence using the **Katz Index of Activities of Daily Living (ADL)**, developed by Katz et al. in 1963.[5] This validated instrument evaluates the ability to perform six fundamental daily tasks—bathing, dressing, toileting, transferring, maintaining continence, and feeding—and classifies individuals as: Independent (score 5–6), Partially Dependent (score 3–4), or Dependent (score 0–2).

Section III assessed fall risk using the **Falls Risk Assessment Tool (FRAT)**, developed by Stapleton, Hough, and Oldmeadow in 1999.[11] FRAT evaluates history of falls, medications, mental health status, cognitive function, and mobility, stratifying individuals into: Low Risk (score 5–11), Medium Risk (12–15), or High Risk (16–20).

Validity and Reliability

Content validity of the data collection instruments was established through expert review by ten specialists in mental health nursing, community health nursing, and medical-surgical nursing, who evaluated items for clarity, relevance, and appropriateness. Reliability was determined through a pilot study (n=50) using the Spearman-Brown split-half (odd-even) method. The reliability coefficient of the Katz ADL was 0.763 and of the FRAT was 0.896, both indicating acceptable internal consistency.

Pilot Study

A pilot study was conducted between January 10 and February 1, 2025, in the community areas of Ludhiana East and Ludhiana West, following receipt of formal administrative consent. Fifty participants were recruited using convenient sampling. The pilot confirmed the feasibility of the study design, validated the data collection procedure, and informed the final plan for statistical analysis.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee (IEC) of Desh Bhagat University, Mandi Gobindgarh. Written informed consent was secured from all participants prior to data collection. Participant identities were protected through unique coded identifiers. All participants were informed of their right to withdraw from the study at any time without consequence.

Statistical Analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive

statistics—including frequency, percentage, mean, median, and standard deviation—were used to summarize demographic characteristics and outcome variables. Pearson's correlation coefficient was computed to examine the relationship between functional dependence and fall risk scores. Chi-square tests were applied to determine associations between the dependent variables and sociodemographic/health-related variables. The level of statistical significance was set at $p \leq 0.05$.

RESULTS

Sociodemographic Profile of Participants

A total of 500 elderly participants were enrolled. The largest age group was 75–80 years (28%), followed equally by the 65–70 years and >80 years categories (each 26%); only 20% were aged 70–75 years. Females constituted the majority (56%) compared to males (44%). In terms of educational attainment, 34% had no formal education and only 12% had graduated or above. Nearly half were unemployed (46%) and 34% were retired. Joint families were most common (52%), followed by nuclear (32%) and extended (16%). A majority (58%) resided in rural areas, and 68% followed a vegetarian diet. The most prevalent comorbidities were hypertension (56%), dental problems (38%), osteoarthritis (34%), diabetes mellitus (28%), and cardiovascular disease (22%). Visual impairment was the most common sensory deficit (52%). Walking was the predominant form of physical activity (84%), while 6% were confined to bed. Family constituted the primary source of social support (92%), and 54% depended on children for financial support.

Functional Dependence Among the Geriatric Population

The vast majority of participants (96%; n=480) were functionally independent (Katz ADL score 5–6), with only 4% (n=20) classified as partially dependent (score 3–4). No participant was fully dependent (score 0–2). The mean Katz ADL score was 5.80 (median=6, SD=0.63, mean percentage=96.67%), with scores ranging from 3 to 6. This is shown in Figure 1.

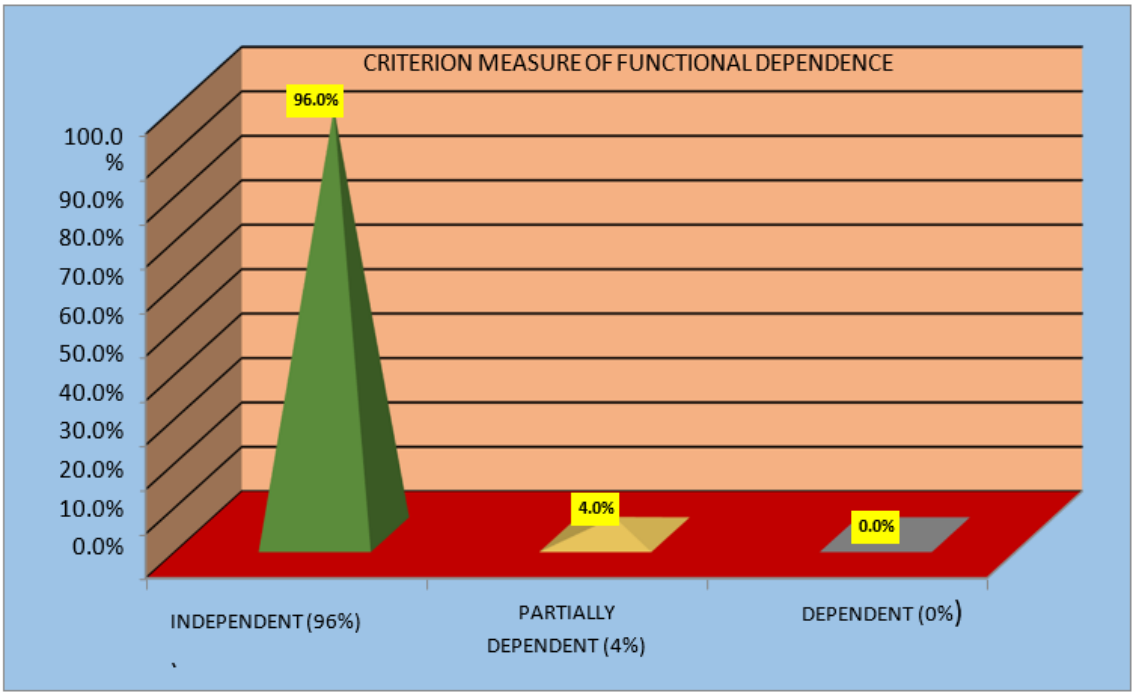

Figure 1: Percentage distribution level of functional dependence among geriatric population

Among the Geriatric Population

he majority of participants (90%; n=450) were at low risk (FRAT score 5–11), 8% (n=40) were at medium risk (score 12–15), and 2% (n=10) were at high risk (score 16–20). The mean FRAT score was 7.90 (median=7, SD=2.54), with scores ranging from 5 to 17. This is shown in Figure 2.

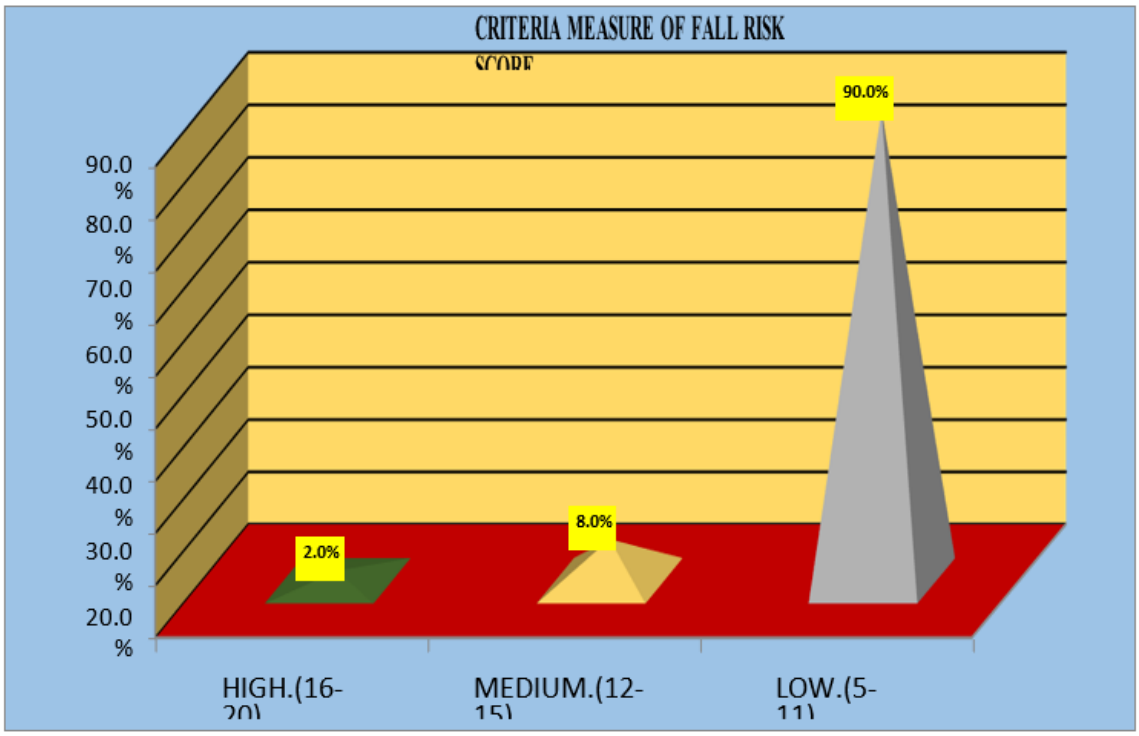

Figure 2: Percentage distribution level of Fall Risk among geriatric population

Correlation Between Functional Dependence and Fall Risk

A statistically significant moderate negative correlation was found ($r = -0.448$, $p<0.001$). This inverse relationship demonstrates that as functional independence decreases (reflected by lower Katz ADL scores), fall risk scores increase correspondingly. The finding confirms that reduced ability to perform activities of daily living is directly associated with elevated fall risk in the elderly population—making joint assessment of these two domains clinically essential. The Pearson correlation between Katz ADL scores and FRAT scores is shown in Table 1.

Table 1: Pearson Correlation Between Functional Dependence and Fall Risk (N=500)

Statistic	Value
Mean – Katz ADL Score	5.80
Mean – FRAT Score	7.90
SD – Katz ADL	0.633
SD – FRAT	2.542
Pearson Correlation Coefficient (r)	-0.448
P-value	<0.001
Result	Statistically Significant (p<0.05)

Associations With Selected Variables

Notably, age >80 years was the most significant predictor of partial functional dependence, while bed-confined participants demonstrated the lowest Katz ADL mean scores (mean=4.0) compared to walkers (mean=5.9). Gender, occupation, type of family, dietary preference, sensory impairment, washroom type, social support system, hypertension, osteoarthritis, urinary incontinence, and liver disease were not significantly associated with either outcome ($p>0.05$). Chi-square analyses identified significant associations ($p<0.05$) of both functional dependence and fall risk with the following variables: age, educational qualification, family monthly income, area of living, marital status, physical activity level, musculoskeletal impairment, previous surgical history, financial support type, diabetes mellitus, cardiovascular disease, and dental problems. This is shown in Table 2.

Table 2: Association of Functional Dependence and Fall Risk with Selected Sociodemographic and Health

Variables
Legend: (Chi-Square Test; p<0.05 = Significant)

Variable	Functional Dependence	Fall Risk	Remark
Age	Significant (p=0.000)	Significant (p<0.001)	Elderly >80 years most dependent
Gender	Not Significant (p=0.581)	Not Significant (p=0.581)	No sex-based difference
Educational Qualification	Significant (p=0.000)	Significant (p<0.001)	Lower education → higher dependence
Occupation	Not Significant (p=0.121)	Not Significant (p=0.121)	—
Family Monthly Income	Significant (p=0.000)	Significant (p<0.001)	Lower income → higher dependence
Area of Living	Significant (p=0.000)	Significant (p<0.001)	Urban elderly more partially dependent
Marital Status	Significant (p=0.000)	Significant (p<0.001)	Widowhood increases vulnerability
Physical Activity	Significant (p=0.000)	Significant (p<0.001)	Bed-bound at highest risk
Surgical History	Significant (p=0.000)	Significant (p<0.001)	Past surgery increases dependence
Musculoskeletal Impairment	Significant (p=0.000)	Significant (p<0.001)	Strong predictor of both outcomes
Diabetes Mellitus	Significant (p=0.025)	Significant (p=0.025)	Chronic disease burden
Cardiovascular Disease	Significant (p=0.015)	Significant (p=0.015)	Higher partial dependence
Dental Problems	Significant (p=0.000)	Significant (p<0.001)	Oral health affects independence
Financial Support Type	Significant (p=0.000)	Significant (p<0.001)	Pension-dependent at higher risk
Hypertension	Not Significant (p=0.581)	Not Significant (p=0.581)	—
Type of Family	Not Significant (p=0.065)	Not Significant (p=0.065)	—
Washroom Type	Not Significant (p=0.183)	Not Significant (p=0.183)	—
Social Support System	Not Significant (p=0.612)	Not Significant (p=0.612)	—
Urinary Incontinence	Not Significant (p=0.092)	Not Significant (p=0.092)	—
Osteoarthritis	Not Significant (p=0.123)	Not Significant (p=0.123)	—

DISCUSSION

This study provides an integrated community-level evaluation of functional dependence and fall risk among 500 elderly residents of Ludhiana, Punjab. The mean Katz ADL score was 5.80 (median=6, SD=0.63, mean percentage=96.67%), with scores ranging from 3 to 6. These findings are broadly consistent with those reported by Indra Devi and Sasidharan (2023), who similarly found that most community-dwelling elderly could perform basic ADLs independently, with a small fraction exhibiting partial dependence.[12] The mean FRAT score was 7.90 (median=7, SD=2.54), with scores ranging from 5 to 17. These findings are concordant with Karadag Arli and Yildiz (2018), who reported that a significant proportion of community-dwelling elderly remain in the low-risk category, while a smaller subset with advancing age and greater comorbidity burden falls into moderate or high-risk categories.[13]

The finding that 96% of participants were functionally independent aligns with data from Boyer et al. (2022), whose cohort study found that a significant proportion of community-residing elderly retained independence in basic ADLs, although a subset showed evidence of frailty and pre-frailty with functional limitations.[14] Similarly, Veerapu et al. (2016) reported that falls occurred in 27.6% of community-dwelling elderly in India, with the majority at low risk for falls at the time of assessment.[15] The relatively low levels of functional dependence and fall risk observed in this study may reflect the younger distribution of the sample and the buffering effect of predominantly family-based social support, which characterizes the study population.

The significant moderate negative correlation ($r = -0.448$, $p<0.001$) between functional dependence and fall risk scores is a central finding of this study. Speechley and Tinetti (1991) demonstrated a comparable inverse relationship between functional independence and fall risk, noting that more dependent older adults had markedly higher rates of injurious falls.[16] Ek et al. (2019) further substantiated this relationship by demonstrating that

functional status effectively stratified fall risk across low-, medium-, and high-risk categories, providing a tiered framework for prevention resource allocation.[17] The Longitudinal Ageing Study in India (Nagarkar and Kulkarni, 2022) similarly found that difficulties in ADL tasks such as rising from a chair or climbing steps—were significantly associated with an increased risk of falls, reinforcing the importance of integrating functional and fall risk assessments in routine geriatric screening.[18]

Among the significant sociodemographic determinants identified, advancing age (>80 years) emerged as the strongest predictor of partial functional dependence and elevated fall risk, consistent with the well-established literature on age-related physiological decline. Physical inactivity, particularly being confined to bed, was highly significantly associated with both outcomes, reinforcing the pivotal role of mobility in preserving functional independence. These findings align with Alshammari et al. (2018), who reported significant associations between fall history and age, female sex, and compromised health status in a large community-based cohort.[19] Musculoskeletal impairment, prior surgical history, cardiovascular disease, and diabetes mellitus were also significantly associated with both outcomes, underscoring the compounding effect of chronic disease burden on geriatric independence and fall susceptibility.

Socioeconomic variables including lower educational attainment, reduced family income, widowhood, and financial dependence on pension were associated with higher functional dependence and fall risk. These findings reflect the broader social determinants of health that shape aging trajectories, particularly in low- and middle-income settings such as India. The unexpected finding that urban elderly exhibited greater partial dependence than rural counterparts may be attributable to reduced habitual physical activity, altered family support dynamics, or built-environment factors that differ between the two settings.

Regarding fall prevention, Bekele and Allene (2019) found in a community-based study that female sex, foot and lower-extremity problems, and depressive symptoms significantly increased fall risk among urban community-dwelling elderly, while use of assistive devices was associated with a higher probability of falls when used as a response to pre-existing instability.[21] These multi-factorial determinants call for comprehensive, personalized assessment approaches. Evidence from Bonner and MacCulloch (2013) demonstrates that structured instructional modules that incorporate staff education, environmental risk assessment, and targeted fall prevention strategies can meaningfully reduce fall rates even in high-risk institutional settings—principles directly applicable to community-based interventions informed by the present study.[20]

LIMITATIONS

The study was conducted in selected community areas of Ludhiana and may not be representative of all geographic and socioeconomic contexts in Punjab or India. The cross-sectional design prevents causal inferences. Non-probability sampling may introduce selection bias. Formal cognitive assessment using a validated neuropsychological tool was not conducted. Residents of institutional care facilities were not included in the study. Future longitudinal studies with larger, more diverse samples are warranted to establish causality and evaluate the sustained impact of preventive interventions.

CONCLUSIONS

The majority of community-dwelling elderly in Ludhiana, Punjab are functionally independent and at low risk for falls. Nevertheless, a clinically significant minority—characterized by advanced age, widowhood, physical inactivity, musculoskeletal impairment, prior surgical history, and chronic diseases such as diabetes and cardiovascular disease—are at elevated risk for both functional decline and falls. The significant moderate inverse correlation ($r = -0.448$, $p<0.001$) between functional dependence and fall risk confirms that these conditions are closely intertwined and must be evaluated concurrently in routine geriatric care.

Community nurses and primary health workers are recommended to incorporate the Katz ADL Index and FRAT into standard geriatric screening protocols. An instructional module developed on the basis of these findings—targeting identified high-risk subgroups with balance training, strength exercises, environmental hazard reduction, and health education—holds promise for promoting independence and reducing fall-related morbidity among the elderly. Longitudinal multicentric studies are warranted to establish causal relationships and evaluate the effectiveness of such community-based interventions.

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