INSIGHTS-JOURNAL OF
LIFE AND SOCIAL SCIENCES

INSIGHTS-JLSS
Insights-Journal of Life and Social Sciences

POLYPHARMACY AND RISK OF FALLS IN COMMUNITY-DWELLING OLDER ADULTS: A CROSS-SECTIONAL STUDY

Original Article

Huma Arooj[1]*, Ariba Shah[2], Muhammad Usama Shah[3], Tahreem Haider[4], Umaima Siddiqui[4], Areeba Farooqui[5]

[1]Lecturer, Pharmacy Department, Abasyn University, Peshawar, Pakistan.
[2]Research Manager, Ziauddin University, Karachi, Pakistan.
[3]Lecturer, Dadabhoy Institute of Higher Education, Karachi, Pakistan.
[4]Research Assistant, Baqai Medical University, Karachi, Pakistan.
[5]5th Year MBBS Student, Ziauddin Medical College, Ziauddin University, Karachi, Pakistan.

Corresponding Author: Huma Arooj, Lecturer, Pharmacy Department, Abasyn University, Peshawar, Pakistan, Humaarooj104@gmail.com

Conflict of Interest: None

Grant Support & Financial Support: None

Acknowledgment: The authors gratefully acknowledge the support of local health centers and study participants.

ABSTRACT

Background: Falls among older adults are a leading cause of injury, disability, and mortality. Polypharmacy, commonly defined as the concurrent use of five or more medications, is increasingly prevalent in elderly populations and has been implicated as a potential risk factor for falls, particularly in community-dwelling individuals.

Objective: To evaluate the association between polypharmacy and the incidence of recent falls among elderly individuals living independently in community settings.

Methods: A cross-sectional study was conducted over eight months in urban and semi-urban areas of Punjab, Pakistan. A total of 500 community-dwelling individuals aged 65 years or older were recruited through multistage sampling. Data on medication use, fall history (past 6 months), cognitive status (MMSE), and functional mobility (Timed Up and Go test) were collected via structured interviews. Polypharmacy was defined as the use of ≥5 medications. Chi-square and multivariate logistic regression were applied to determine the association between polypharmacy and fall incidence, adjusting for confounders.

Results: Out of 500 participants, 240 (48%) were identified with polypharmacy. The fall incidence was significantly higher in the polypharmacy group (32.5%) compared to those using fewer medications (12.3%). Higher fall rates were also observed in participants with poor mobility and cognitive impairment. Polypharmacy remained an independent predictor of falls even after adjusting for age, comorbidities, mobility, and cognition ($p<0.001$).

Conclusion: Polypharmacy is significantly associated with increased fall risk in community-dwelling older adults. Targeted deprescribing and medication reviews should be prioritized to reduce fall-related morbidity and promote safer aging in place.

Keywords: Aged, Cognition Disorders, Community Health, Drug Therapy, Falls, Gait Disorders, Pakistan, Polypharmacy, Risk Assessment, Self Medication.

INTRODUCTION

Falls are a major public health concern among older adults, often leading to serious consequences such as fractures, loss of independence, hospitalization, and even death. As populations age globally, the burden of fall-related injuries is expected to rise significantly, underscoring the need for a better understanding of modifiable risk factors (1,2). Among these, polypharmacy—commonly defined as the concurrent use of five or more medications—has emerged as a potential contributor to falls in elderly individuals. With the increasing prevalence of chronic conditions among older adults, polypharmacy has become a widespread and growing phenomenon, particularly in community-dwelling populations who manage their medications independently (3,4). The complexity introduced by multiple drug regimens raises important safety concerns, especially in relation to adverse drug events, drug-drug interactions, and impaired physical or cognitive function. Existing research has consistently associated polypharmacy with a range of negative health outcomes, including cognitive impairment, frailty, reduced mobility, and diminished balance—all of which are established risk factors for falls (5). Certain classes of medications such as sedatives, antipsychotics, antihypertensives, and antidepressants have been particularly implicated in increasing fall risk due to their effects on the central nervous system and blood pressure regulation (6). However, beyond the pharmacological risks associated with specific drugs, the mere number of medications—irrespective of type—has also been shown to be an independent predictor of falls. This raises critical questions about the cumulative burden of multiple drugs and their interplay in compromising an older adult's ability to safely navigate their environment (7).

Despite these concerns, much of the literature has focused on institutionalized or hospitalized older populations, where the risks and patterns of medication use may differ substantially from those living independently in the community. Community-dwelling older adults often self-administer their medications without the continuous oversight found in institutional settings, making them uniquely vulnerable to the complications of polypharmacy (8,9). Furthermore, the social and environmental contexts of independent living—such as household hazards, limited access to care, or inconsistent follow-up—may interact with polypharmacy in ways that exacerbate fall risk. While some studies have attempted to explore this relationship in community-based settings, their findings have been mixed (10,11). Methodological differences, such as varying definitions of polypharmacy and falls, differing sample sizes, and inconsistent adjustment for confounding variables, have led to a lack of consensus in the literature. As a result, clinicians and policymakers still face uncertainty about the strength and nature of the association between polypharmacy and falls among elderly individuals residing in their own homes (12). This knowledge gap poses a challenge to the development of evidence-based interventions that could mitigate the risks associated with complex medication regimens in older adults who are otherwise living independently. In light of these uncertainties, there is a clear and urgent need for well-designed studies that specifically examine the association between polypharmacy and fall risk in community-dwelling older adults. A better understanding of this relationship would help inform clinical decision-making, guide medication reviews, and support public health strategies aimed at fall prevention. The present study addresses this gap by evaluating the association between polypharmacy—defined as the use of five or more medications—and the incidence of recent falls among elderly individuals living independently. The objective is to determine whether polypharmacy constitutes a significant risk factor for falls in this population, thereby contributing to the growing body of knowledge needed to promote safer aging in place.

METHODS

This cross-sectional study was conducted over a period of eight months from June 2023 to January 2024 in selected urban and semi-urban regions of Punjab, Pakistan, including community health centers, outpatient clinics, and residential communities catering to elderly populations. The primary aim was to evaluate the association between polypharmacy—operationally defined as the concurrent use of five or more prescribed or over-the-counter medications—and the incidence of recent falls among community-dwelling older adults aged 65 years and above. Participants were recruited using a multistage sampling technique to ensure representation across varying socioeconomic and educational backgrounds. Initial contact was established through community outreach programs and partnerships with local health workers. Individuals were included if they were aged 65 years or older, resided in the community independently (either alone or with family), and were capable of providing informed consent. Exclusion criteria included known neurocognitive disorders (e.g., dementia or Parkinson's disease), current hospitalization or institutionalization, severe visual or hearing impairments that could hinder data collection, and any medical condition rendering the individual non-ambulatory or bedridden.

Based on an anticipated fall prevalence of 25% in community-dwelling elderly individuals with polypharmacy and 15% in those without, with a power of 80% and an alpha level of 0.05, the required sample size was calculated to be 452 participants. To account for potential non-response or incomplete data, a 10% buffer was added, bringing the final target sample size to approximately 500 individuals (3,4).

A structured face-to-face interview was conducted by trained research assistants fluent in both Urdu and Punjabi, ensuring cultural and linguistic appropriateness in data collection. Data were collected using a standardized questionnaire developed specifically for this study, which included sections on sociodemographic characteristics, medical history, current medications, and history of falls within the past six months. A fall was defined according to the World Health Organization criteria as "an event which results in a person coming to rest inadvertently on the ground or floor or other lower level." The primary outcome variable was self-reported incidence of one or more falls within the preceding six months. Medication use was recorded by directly inspecting prescriptions, pill bottles, and self-reporting, and polypharmacy was coded as a dichotomous variable: ≥5 medications versus <5 medications.

Functional status was assessed using the Timed Up and Go (TUG) test, while cognitive screening was conducted using the Urdu-translated version of the Mini-Mental State Examination (MMSE) to control for potential confounding (13). Participants were also asked about comorbidities such as diabetes, hypertension, arthritis, and visual impairment, which were verified through medical records when available. All data were anonymized and securely stored in a password-protected database to maintain confidentiality. Statistical analysis was conducted using SPSS version 26. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. Continuous variables were reported as means and standard deviations, while categorical variables were presented as frequencies and percentages. To examine the association between polypharmacy and recent falls, the Chi-square test was used for bivariate analysis, followed by multivariate logistic regression to adjust for potential confounders including age, gender, comorbidities, cognitive status, and functional mobility scores. As data followed a normal distribution, assumptions for parametric testing were met. The level of statistical significance was set at $p < 0.05$. Ethical approval was obtained from the Institutional Review Board (IRB) of the relevant institute. All participants provided written informed consent prior to their inclusion in the study, with verbal consent accepted in cases of limited literacy, witnessed and documented by an impartial third party. The study adhered to the ethical principles outlined in the Declaration of Helsinki and was conducted with the utmost respect for participant autonomy, privacy, and well-being.

RESULTS

The study included a total of 500 community-dwelling older adults with a mean age of 72.4 ± 5.6 years. Among the participants, 43.6% were male and 56.4% were female. Most individuals (62.0%) had education above the primary level, while 38.0% had primary-level education or less. A large majority (76.0%) lived with their families, and common comorbid conditions included hypertension (59.0%), diabetes (42.0%), and visual impairment (32.0%). Among the total participants, 260 individuals (52.0%) were taking fewer than five medications, and 240 individuals (48.0%) were identified as having polypharmacy (≥5 medications). A significant difference was observed in fall incidence between these groups. The group with polypharmacy experienced a notably higher incidence of falls (32.5%) compared to the group without polypharmacy (12.3%). Timed Up and Go (TUG) test results further demonstrated a gradient in fall risk based on mobility status. Participants with normal mobility (TUG <10 seconds) reported only 10 falls among 210 individuals. Those with mild mobility risk (TUG 10–14 seconds) had 35 falls among 170 participants, and those with high risk (TUG >14 seconds) recorded 65 falls among 120 participants. Cognitive assessment using the Mini-Mental State Examination (MMSE) revealed that fall incidence increased with cognitive impairment severity. Among those with normal cognition (MMSE ≥24), only 30 falls were recorded in 320 participants. In contrast, 40 falls each were recorded in groups with mild (MMSE 18–23) and moderate-to-severe (MMSE <18) cognitive impairment, though these groups comprised fewer participants, suggesting a disproportionately higher fall rate. Overall, the results demonstrated a clear association between polypharmacy and increased fall incidence, with corroborating trends observed in functional mobility and cognitive status. These findings support the hypothesis that complex medication regimens and physical or cognitive decline jointly elevate fall risk in independently living elderly individuals.

Table 1: Demographic Characteristics of Participants (N = 500)

Variable	N (%) or Mean ± SD
Age (mean ± SD)	72.4 ± 5.6
Gender	
Male	218 (43.6%)
Female	282 (56.4%)
Education	
Primary or below	190 (38.0%)
Above primary	310 (62.0%)

Variable	N (%) or Mean ± SD
Living Style	
Alone	120 (24.0%)
with Family	380 (76.0%)
Hypertension	295 (59.0%)
Diabetes	210 (42.0%)
Visual Impairment	160 (32.0%)

Table 2: Association Between Polypharmacy and Fall Incidence

Polypharmacy Status	Number of Participants	Participants with Falls	Fall Incidence (%)
<5 Medications	260	32	12.3%
≥5 Medications	240	78	32.5%

Table 3: Fall Incidence by Timed Up and Go (TUG) Score

TUG Score Category	Participants	Falls Observed
<10 sec (Normal)	210	10
10–14 sec (Mild Risk)	170	35
>14 sec (High Risk)	120	65

Table 4: Fall Incidence by MMSE Cognitive Score

MMSE Score Category	Participants	Falls Observed
≥24 (Normal Cognition)	320	30
18–23 (Mild Cognitive Impairment)	130	40
<18 (Moderate-Severe Impairment)	50	40

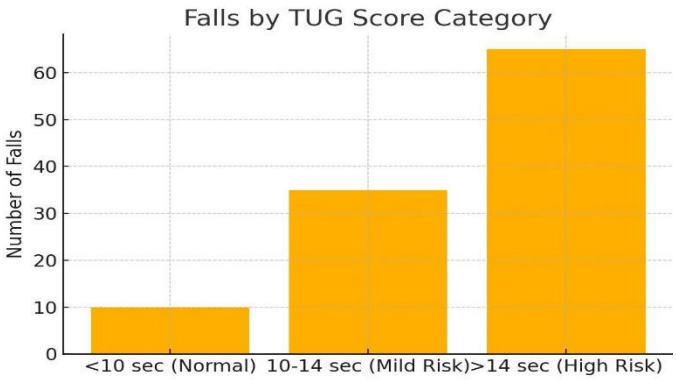

Figure 1 Falls by TUG Scores Category

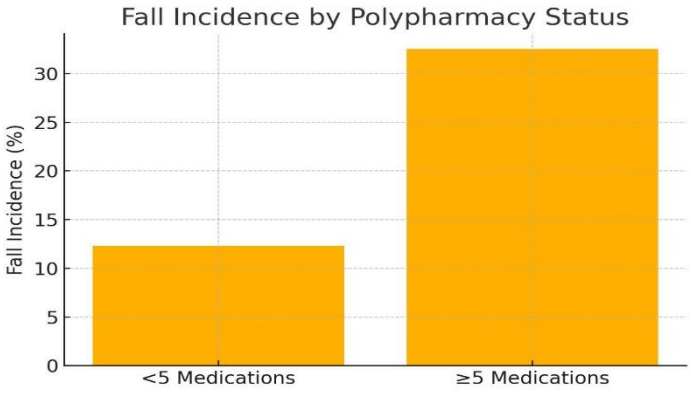

Figure 2 Fall Incidence by Polypharmacy Status

DISCUSSION

The results of this study demonstrated a significant association between polypharmacy and increased incidence of falls among community-dwelling older adults. These findings reinforce the body of literature that positions polypharmacy, particularly the use of fall-risk-increasing drugs (FRIDs), as a key modifiable factor contributing to fall risk in the elderly. In this cohort, individuals using five or more medications had a markedly higher fall incidence (32.5%) compared to those on fewer medications (12.3%). This pattern remained consistent even after adjusting for cognitive impairment and functional mobility—factors independently associated with fall risk. The observed association is consistent with prior research from multiple international cohorts. Polypharmacy alone was associated

with an elevated fall risk, the presence of FRIDs—particularly sedatives, antidepressants, and anticholinergics—intensified this risk significantly (14,15). Similarly, a study demonstrated that using two or more FRIDs independently predicted falls in a low-income U.S. population of older adults, even when total medication count was low (16).

The strength of the current study lies in its exclusive focus on community-dwelling older adults—a group often underrepresented in fall-related polypharmacy research. Many existing studies prioritize hospitalized or institutionalized populations, where medication regimens and fall dynamics differ considerably. For instance, as reported polypharmacy-related fall risk in inpatients, but acknowledged differing external risk profiles in community settings (17-19). Functionally, mobility impairment measured by the Timed Up and Go (TUG) test and cognitive decline assessed via MMSE also correlated with higher fall risk, aligning with findings from a study, which observed that a polypharmacy threshold of five or more medications was linked to both impaired gait and cognition (20) Nevertheless, the study is not without limitations. The cross-sectional design limits causal inference, as temporal relationships between medication use and fall events cannot be definitively established. Self-reported fall data, though standardized using WHO criteria, remain susceptible to recall bias. Medication lists were verified where possible, yet over-the-counter drug use and adherence were not comprehensively captured. Additionally, while statistical adjustments were made for major confounders, residual confounding cannot be ruled out. Another important consideration is the heterogeneity of medications classified under polypharmacy. Not all drugs pose equal fall risk, and some may be clinically necessary despite their association with adverse events. This supports findings of a study that, polypharmacy only increased fall risk when combined with antidepressants or benzodiazepines (21,22).

Despite these limitations, the findings offer valuable clinical insights. They suggest that routine medication reviews—especially those that identify FRIDs—should be integral to fall prevention strategies in community healthcare settings. Deprescribing protocols, pharmacist-led interventions, and geriatric assessments may all play roles in mitigating fall risk through rational pharmacotherapy. As noted by a study, although the relationship between polypharmacy and falls is complex and confounded by multimorbidity, a monotonic increase in fall risk with each additional drug persists (23). Future research should consider longitudinal designs to better clarify causality, incorporate pharmacodynamic data, and evaluate targeted deprescribing trials to reduce fall incidence. Investigating the interaction between medication types, comorbid conditions, and social determinants of health in fall dynamics would further enrich understanding and inform policy In conclusion, the current findings contribute to a growing consensus that polypharmacy, especially when it includes high-risk medications, is a significant predictor of falls among older adults living independently. Addressing polypharmacy through comprehensive, personalized, and regularly updated medication plans may substantially reduce fall-related morbidity in this vulnerable population.

CONCLUSION

This study established a strong association between polypharmacy and increased fall incidence among community-dwelling older adults, with risk further amplified by impaired mobility and cognition. The findings underscore the critical need for regular medication reviews and cautious prescribing practices to mitigate fall risk. Targeted interventions addressing polypharmacy can significantly enhance the safety and independence of elderly individuals aging in place.

AUTHOR CONTRIBUTION

Author	Contribution
Huma Arooj*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Ariba Shah	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Usama Shah	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Tahreem Haider	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Umaima Siddiqui	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Areeba Farooqui	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

REFERENCES

1. Helissey C, Geiss R, Baldini C, Noret A, Frelaut M, Rodrigues M, et al. [Why and how to assess older people with cancer?]. Bull Cancer. 2021;108(5):513-20.
2. Portlock GE, Smith MD, van Poelgeest EP, Welsh TJ. Therapeutic dilemmas: cognitive enhancers and risk of falling in older adults-a clinical review. Eur Geriatr Med. 2023;14(4):721-32.
3. Capiau A, Huys L, van Poelgeest E, van der Velde N, Petrovic M, Somers A. Therapeutic dilemmas with benzodiazepines and Z-drugs: insomnia and anxiety disorders versus increased fall risk: a clinical review. Eur Geriatr Med. 2023;14(4):697-708.
4. Bayrak M, Kaşali K, Güner M, Cadirci K, Kılıç AF, Binici DN. Risk factors influencing fall risk in geriatric patients with type 2 diabetes: a comprehensive analysis. Aging Male. 2025;28(1):2469614.
5. Phelan EA, Williamson BD, Balderson BH, Cook AJ, Piccorelli AV, Fujii MM, et al. Reducing Central Nervous System-Active Medications to Prevent Falls and Injuries Among Older Adults: A Cluster Randomized Clinical Trial. JAMA Netw Open. 2024;7(7):e2424234.
6. Corvaisier M, Brangier A, Annweiler C, Spiesser-Robelet L. Preventable or potentially inappropriate psychotropics and adverse health outcomes in older adults: systematic review and meta-analysis. J Nutr Health Aging. 2024;28(4):100187.
7. Damoiseaux-Volman BA, Raven K, Sent D, Medlock S, Romijn JA, Abu-Hanna A, et al. Potentially inappropriate medications and their effect on falls during hospital admission. Age Ageing. 2022;51(1).
8. Li SJ, Hwang HF, Yu WY, Lin MR. Potentially inappropriate medication use, polypharmacy, and falls among hospitalized patients. Geriatr Gerontol Int. 2022;22(10):857-64.
9. Gagnon ME, Talbot D, Tremblay F, Desforges K, Sirois C. Polypharmacy and risk of fractures in older adults: A systematic review. J Evid Based Med. 2024;17(1):145-71.
10. Brito T, Da Conceição VEM, De Farias Sussuarana C, Jucá F, Lago R, De Araújo KS, et al. Polypharmacy and drug classes in fall risk among older adults. Geriatrics Gerontology and Aging. 2023.
11. Xue L, Boudreau RM, Donohue JM, Zgibor JC, Marcum ZA, Costacou T, et al. Persistent polypharmacy and fall injury risk: the Health, Aging and Body Composition Study. BMC Geriatr. 2021;21(1):710.
12. Blum MR, Sallevelt B, Spinewine A, O'Mahony D, Moutzouri E, Feller M, et al. Optimizing Therapy to Prevent Avoidable Hospital Admissions in Multimorbid Older Adults (OPERAM): cluster randomised controlled trial. Bmj. 2021;374:n1585.
13. Volgman AS, Nair G, Lyubarova R, Merchant FM, Mason P, Curtis AB, et al. Management of Atrial Fibrillation in Patients 75 Years and Older: JACC State-of-the-Art Review. J Am Coll Cardiol. 2022;79(2):166-79.
14. Érszegi A, Csupor D, Bodó G, Engi Z, Bahar MA, Matuz M, et al. High rate of potentially inappropriate medication use in older people: a case-control study. Geroscience. 2024;46(5):5217-33.
15. Wedmann FM, Conca A, Di Gregorio P, Florio V, Toscano M, Giupponi G. Falls at the interface between geriatric and psychiatric patients: a critical review from a psychopharmacological perspective. Riv Psichiatr. 2023;58(5):195-204.
16. Boyce R, Ie K, Chou E, Albert S. Fall Risk-Increasing Drugs, Polypharmacy, and Falls Among Low-Income Community-Dwelling Older Adults. Innovation in Aging. 2021;5.
17. Duarte Y, Ramos KA, Colosimo E, De Andrade F. Effect of polypharmacy and Fall-Risk-Increasing Drugs (FRIDs) on falls among Brazilian older adults: The SABE cohort study. Archives of gerontology and geriatrics. 2023;115:105127.
18. Effect of comorbidities and polypharmacy on fall risk among older adults. International Journal of Human and Health Sciences (IJHHS). 2022.
19. Catalani F, Patetta LMA, Campello E, Fino R, Novello S, Occhipinti G, et al. DOACs for Older adults with Atrial Fibrillation and Falls: Results from the prospective single-centre DOAFF study. Thromb Res. 2024;238:78-84.
20. Lee J, Negm A, Peters R, Wong EKC, Holbrook A. Deprescribing fall-risk increasing drugs (FRIDs) for the prevention of falls and fall-related complications: a systematic review and meta-analysis. BMJ Open. 2021;11(2):e035978.
21. Robertson S, Peacock EE, Scott R. Benzodiazepine Use Disorder: Common Questions and Answers. Am Fam Physician. 2023;108(3):260-6.
22. K SA, Alsousi S, AlMishqab M, Alawami M, Almearaj J, Alhashim H, et al. Associations between polypharmacy and potentially inappropriate medications with risk of falls among the elderly in Saudi Arabia. BMC Geriatr. 2023;23(1):222.
23. Borda MG, Landi F, Cederholm T, Venegas-Sanabria LC, Duque G, Wakabayashi H, et al. Assessment and management of frailty in individuals living with dementia: expert recommendations for clinical practice. Lancet Healthy Longev. 2025;6(1):100666.

