

Prevalence, Prescribing Patterns, and Determinants of Polypharmacy among Geriatric Inpatients: A Retrospective Observational Study at a Tertiary Care Teaching Hospital

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Abstract

Background: Polypharmacy has become an important challenge in geriatric care owing to the high prevalence of multimorbidity and age-related physiological changes that increase susceptibility to medication-related harm. Hospitalized older adults are particularly vulnerable to adverse drug reactions, drug–drug interactions, and potentially inappropriate prescribing. This study aimed to assess the prevalence, prescribing pattern, and clinical correlates of polypharmacy among geriatric inpatients in a tertiary care teaching hospital.

Methods: A retrospective observational study was conducted over six months (January–June 2025) involving 200 hospitalized patients aged ≥ 60 years with a hospital stay of at least 48 hours. Demographic, clinical, and medication-related data were retrieved from medical records. Polypharmacy was classified as mild (2–4 drugs), moderate (5–9 drugs), and excessive (≥ 10 drugs). Potentially inappropriate medications were identified using the 2023 AGS Beers Criteria. Statistical analysis was performed using SPSS version 26.0, with $p < 0.05$ considered statistically significant.

Results: The mean age of the study population was 69.2 ± 7.3 years, and 54% were men. Patients received a mean of 8.1 ± 2.9 medications during hospitalization. Moderate polypharmacy was observed in 62% of patients, while 20% had excessive polypharmacy. Antihypertensive agents (72%), nutritional supplements (63%), antidiabetic drugs (59%), and gastroprotective medications (58%) were the most frequently prescribed therapeutic classes. Polypharmacy was significantly associated with the presence of three or more comorbidities ($p < 0.01$), prolonged hospitalization ($p < 0.05$), and concurrent use of multiple nutritional or herbal supplements ($p < 0.05$). Potential drug–drug interactions were identified in 29% of prescriptions, 17% contained potentially inappropriate medications, and 29 adverse drug reactions were documented.

Conclusion: Polypharmacy is common among hospitalized older adults and is closely linked to multimorbidity and increased medication burden. Routine medication review, medication reconciliation, and evidence-based deprescribing, supported by validated geriatric prescribing tools, may help improve medication safety and optimize therapeutic outcomes in this vulnerable population.

Keywords: Polypharmacy; Older adults; Geriatric inpatients; Potentially inappropriate medications; Beers Criteria; Drug–drug interactions; Adverse drug reactions; Deprescribing

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Introduction

Aging population is one of the most significant demographic transitions worldwide. Advances in healthcare have increased life expectancy, but have also led to a growing burden of chronic diseases and multimorbidity among older adults. Consequently, elderly patients often require multiple medications for optimal disease management, making polypharmacy an important challenge in geriatric practice [1]. Polypharmacy is commonly defined as the concurrent use of five or more medications. While the use of multiple medicines may be clinically appropriate in patients with complex health

conditions, inappropriate polypharmacy is associated with adverse drug reactions (ADRs), drug–drug interactions (DDIs), medication non-adherence, falls, cognitive impairment, prolonged hospitalization, and increased healthcare costs [2,3]. Older adults are particularly susceptible to medication-related harm because age-related physiological changes, including reduced renal and hepatic function, altered body composition, and changes in pharmacokinetic and pharmacodynamic responses, can affect drug safety and efficacy [4].

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Hospitalized geriatric patients are especially vulnerable to polypharmacy due to the presence of multiple comorbidities requiring treatment by different specialties. In addition to prescribed medications, many older adults regularly use over-the-counter medicines, multivitamins, calcium supplements, protein preparations, and herbal products. These agents can substantially increase the overall medication burden and contribute to clinically significant interactions, yet they are often overlooked during routine medication review [5]. Therefore, a comprehensive assessment of medication use should include both prescribed and non-prescribed products.

To improve medication safety in older adults, several validated screening tools have been developed to identify potentially inappropriate medications (PIMs) and optimize prescribing practices. Among these, the American Geriatrics Society (AGS) Beers Criteria and the STOPP/START criteria are widely accepted for evaluating prescribing appropriateness in geriatric patients [6,7]. Their application has been shown to reduce inappropriate prescribing and improve the quality of pharmacotherapy.

Despite increasing awareness, polypharmacy remains highly prevalent in tertiary care hospitals, where older adults often present with complex medical conditions and prolonged hospital stays. Most published studies have focused primarily on the number of prescribed medications, whereas relatively few have examined the contribution of nutritional supplements and herbal products to overall medication burden or evaluated their association with ADRs and inappropriate prescribing. Furthermore, data from Indian tertiary care teaching hospitals remain limited, despite potential differences in disease patterns, healthcare delivery, and prescribing practices.

In view of these gaps, the present study was undertaken to evaluate the prevalence and prescribing patterns of polypharmacy among geriatric inpatients admitted to a tertiary care teaching hospital. In addition to assessing medication utilization, the study examined the use of nutritional and herbal supplements, identified potential DDIs and PIMs, and explored the relationship between polypharmacy, comorbidity burden, ADRs, and length of hospital stay. The findings are expected to provide institution-specific evidence to support rational prescribing, structured medication review, and deprescribing strategies aimed at improving medication safety in older adults.

Objectives

The present study was undertaken to evaluate the burden of polypharmacy and medication use among geriatric inpatients admitted to a tertiary care teaching hospital.

Primary Objective

To determine the prevalence and prescribing patterns of polypharmacy among hospitalized geriatrics pt.

Secondary Objectives

- To characterize the medication utilization profile, including prescription medicines, nutritional supplements, protein preparations, and herbal products used by geriatric inpatients.

- To assess the association between polypharmacy and demographic and clinical variables, including age, sex, comorbidity burden, and length of hospital stay.
- To determine the frequency of potential drug–drug interactions (DDIs), adverse drug reactions (ADRs), and potentially inappropriate medications (PIMs) using validated geriatric prescribing tools such as the AGS Beers Criteria [6] and STOPP/START criteria [7].
- To evaluate the contribution of nutritional and herbal supplements to the overall medication burden among older adults.
- To generate institution-specific evidence to support medication review, deprescribing interventions, and rational prescribing practices aimed at improving medication safety in geriatric patients [8,9].

Research Hypothesis

Null Hypothesis (H₀)

There is no significant association between the degree of polypharmacy and clinical outcomes, including comorbidity burden, length of hospital stay, adverse drug reactions, or the use of nutritional and herbal supplements among hospitalized geriatric patients.

Alternative Hypothesis (H₁)

Polypharmacy is significantly associated with increased comorbidity burden, prolonged hospitalization, higher rates of adverse drug reactions, greater risk of drug–drug interactions and potentially inappropriate medication use, and increased consumption of nutritional and herbal supplements among hospitalized geriatric patients [8,9].

Materials and Methods

Study Design and Setting

This retrospective observational study was conducted at a tertiary care teaching hospital to evaluate the prevalence and prescribing patterns of polypharmacy among hospitalized geriatric patients. The study reviewed medical records of eligible patients admitted between January and June 2025 across the Departments of General Medicine, General Surgery, Orthopedics, and other clinical specialties. Reporting was guided by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for observational research [10].

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee before data collection. As the study involved retrospective analysis of anonymized medical records without direct patient interaction, the requirement for individual informed consent was waived. Patient confidentiality was maintained through de-identification of all data prior to analysis.

Study Population

Inclusion Criteria: Patients aged ≥ 60 years who were admitted during the study period and had a hospital stay of at least 48 hours were eligible for inclusion. Only records containing complete demographic, clinical, and medication-related information were analyzed.

Exclusion Criteria: Patients with incomplete medical records, those admitted for day-care procedures, individuals transferred

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from another healthcare facility after treatment initiation, and terminally ill patients with inadequate medication documentation were excluded.

Sample Size and Sampling Technique

The sample size was calculated using the single population proportion formula:

$$N = Z^2 pq / d^2$$

where Z represents the standard normal deviation at a 95% confidence level (1.96), p is the anticipated prevalence of polypharmacy, $q = 1 - p$, and d is the allowable margin of error. Based on previous hospital-based studies reporting a polypharmacy prevalence of approximately 70% among older adults, a prevalence estimate (p) of 0.70 and an absolute precision of 7% were used [13]. The minimum sample size was calculated as 165 and increased to 182 after accounting for incomplete records.

A total of 200 eligible geriatric inpatient records were available during the study period. As this exceeded the minimum required sample size, all eligible records were included to improve precision and reduce selection bias. Consecutive sampling was used, whereby every eligible patient meeting the inclusion criteria was enrolled.

Data Collection

Data were extracted from hospital medical records using a structured data collection form. Information collected included demographic characteristics (age, sex, and length of hospital stay), primary diagnosis, comorbidities, and details of prescribed medications.

Medication-related variables included drug name, dosage, route, frequency, and duration of therapy. Information on multivitamins, calcium and iron supplements, protein preparations, herbal or Ayurvedic products, and other complementary therapies was also recorded. Documented adverse drug reactions (ADRs) and relevant clinical outcomes were noted.

To ensure data quality, records were reviewed using a standardized extraction format, and any discrepancies were verified against the original medical records before data entry.

Operational Definitions

For the purpose of this study, medication burden was categorized according to the total number of medications prescribed during hospitalization. Polypharmacy was defined as the concurrent use of five or more medications, consistent with commonly accepted definitions in geriatric pharmacotherapy [2]. Patients were classified into the following categories:

- **No polypharmacy:** ≤ 1 medication
- **Mild polypharmacy:** 2–4 medications
- **Moderate polypharmacy:** 5–9 medications
- **Excessive polypharmacy:** ≥ 10 medications [2]

The medication count included all prescribed therapeutic agents as well as documented nutritional supplements and herbal products. Fixed-dose combinations were considered a single medication unless individual components were prescribed separately.

Potentially inappropriate medications (PIMs) were identified using the 2023 American Geriatrics Society (AGS) Beers

Criteria, a validated tool for assessing medication appropriateness in older adults [6].

Potential drug–drug interactions (DDIs) were evaluated using standard drug interaction references routinely available within the institutional prescribing system and were recorded when clinically relevant interactions were identified.

Adverse drug reactions (ADRs) were defined as documented harmful or unintended responses to medications occurring at normally prescribed doses during hospitalization and recorded by the treating healthcare team.

Nutritional supplements included multivitamins, calcium, iron, vitamin D preparations, protein supplements, and other nutritional formulations prescribed during the hospital stay.

Herbal products included Ayurvedic, traditional, or plant-based preparations documented in the medical records.

Outcome Measures

The **primary outcome** was the prevalence of polypharmacy among hospitalized geriatric patients.

Secondary outcomes included:

- Medication utilization and prescribing patterns.
- Utilization of nutritional supplements and herbal products.
- Prevalence of potential drug–drug interactions.
- Occurrence of adverse drug reactions.
- Prevalence of potentially inappropriate medications identified using the AGS Beers Criteria [6].
- Association of polypharmacy with comorbidity burden and length of hospital stay [8,9].

Statistical Analysis

Data was entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean $\pm$ standard deviation (SD) or median with interquartile range (IQR), depending on data distribution, while categorical variables were presented as frequencies and percentages.

Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test, as appropriate. Continuous variables were compared using the Student's t -test for normally distributed data and the Mann–Whitney U test for non-normally distributed data. A two-tailed p -value <0.05 was considered statistically significant [12].

To minimize information bias, standardized data extraction procedures and predefined operational definitions were used throughout the study. Records with missing information for a specific variable were excluded only from the corresponding analysis, while all available data were retained for other statistical evaluations. This approach maximized data utilization while preserving analytical accuracy.

Results

Demographic and Clinical Characteristics

A total of 200 geriatric inpatients met the eligibility criteria and were included in the analysis. The mean age was 69.2 ± 7.3 years (range: 60–91 years), with 108 (54.0%) males and 92 (46.0%) females. Most patients were admitted under General Medicine (122; 61.0%), followed by General Surgery (36; 18.0%), Orthopedics (24; 12.0%), and other specialties (18; 9.0%). The mean hospital stay was 8.3 ± 3.6 days. Patients had

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a mean of 2.6 ± 1.1 comorbidities, with hypertension and diabetes mellitus being the most common chronic conditions.

Prevalence and Pattern of Polypharmacy

A total of 1,620 medications were prescribed, with a mean of 8.1 ± 2.9 medications per patient. Based on predefined criteria, 124 (62.0%) patients had moderate polypharmacy (5–9 medications) and 40 (20.0%) had excessive polypharmacy (≥ 10 medications). Mild polypharmacy (2–4 medications) was observed in 20 (10.0%) patients, while 16 (8.0%) received one or no medication during hospitalization (Figure 1). Overall, 164 (82.0%) patients were exposed to polypharmacy.

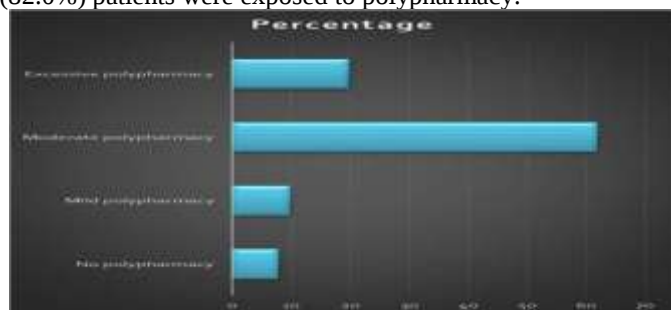


Figure 1

Medication Utilization Profile

Antihypertensive agents were the most frequently prescribed medications (144; 72.0%), followed by nutritional supplements (126; 63.0%), antidiabetic drugs (118; 59.0%), gastroprotective agents (116; 58.0%), analgesics (92; 46.0%), antibiotics (76; 38.0%), and lipid-lowering agents (66; 33.0%). (Figure 2)

Nutritional supplements and protein preparations were prescribed to 126 (63.0%) and 76 (38.0%) patients, respectively. Herbal or Ayurvedic products were documented in 22 (11.0%) patients. (Figure 3)

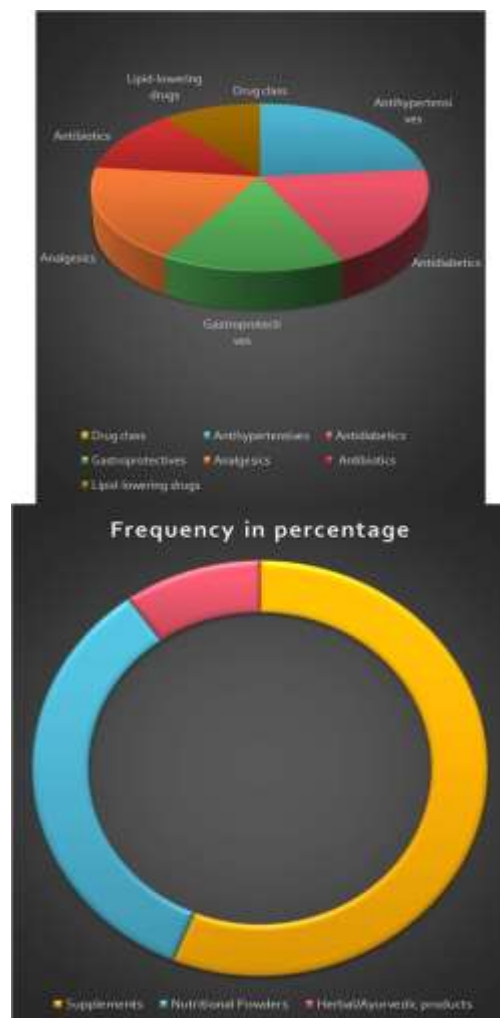


Figure 2 and Figure 3

Association of Polypharmacy with Clinical Characteristics

Patients with three or more comorbidities were significantly more likely to experience moderate or excessive polypharmacy than those with fewer comorbid conditions ($p < 0.01$). Similarly, hospitalization exceeding seven days was associated with a higher prevalence of polypharmacy ($p = 0.03$).

Use of two or more nutritional or herbal supplements was significantly associated with increased medication burden ($p = 0.02$). No significant association was observed between gender and degree of polypharmacy ($p = 0.28$).

Medication Safety Assessment

Potential drug–drug interactions (DDIs) were identified in 58 (29.0%) patients. Most interactions required clinical monitoring rather than treatment discontinuation.

According to the 2023 AGS Beers Criteria, 34 (17.0%) patients received at least one potentially inappropriate medication (PIM). Adverse drug reactions (ADRs) were documented in 29 (14.5%) patients, with gastrointestinal disturbances, dizziness, electrolyte abnormalities, and hypotension being the most commonly reported events. Most ADRs were mild to moderate and resolved with appropriate management.

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Key Findings

Polypharmacy was highly prevalent, affecting 82.0% of hospitalized older adults. Higher comorbidity burden and longer hospital stay were significantly associated with increased medication use. Nutritional supplements contributed substantially to overall medication burden, while nearly one-third of patients experienced potential DDIs and 17.0% received at least one PIM. These findings highlight the importance of regular medication review and optimization to improve medication safety in geriatric inpatients.

Discussion

This study demonstrates a high prevalence of polypharmacy among hospitalized older adults, with more than 80% of patients receiving five or more medications and one-fifth exposed to excessive polypharmacy. The mean medication count exceeded eight drugs per patient, reflecting the complexity of managing multimorbidity in geriatric inpatients. These findings highlight the need for regular medication review as an essential component of inpatient geriatric care.

The prevalence observed in this study is consistent with reports from both developed and developing countries, where hospitalization and multimorbidity are major drivers of increased medication use [14–16]. Similar Indian studies have also reported high rates of polypharmacy among elderly inpatients, largely due to the coexistence of multiple chronic conditions requiring long-term treatment [17,18]. The relatively high medication burden observed in the present study may be attributed to the tertiary care setting, where patients often present with advanced disease, multiple comorbidities, and the need for multidisciplinary management.

Multimorbidity was the strongest determinant of polypharmacy. Patients with three or more chronic illnesses were significantly more likely to receive multiple medications, a finding consistent with previous evidence [19]. Although guideline-directed therapy improves disease outcomes, increasing medication burden may also increase the risk of adverse events, emphasizing the need to balance therapeutic benefits against potential harms in older adults.

An important finding was the extensive use of nutritional supplements, including multivitamins, calcium, iron, vitamin D, and protein preparations. Nearly two-thirds of patients received at least one nutritional supplement, and their use was significantly associated with higher medication burden. While supplementation may be justified in patients with documented deficiencies, indiscriminate prescribing can increase treatment costs, reduce adherence, and contribute to adverse effects and drug interactions [20]. These findings underscore the importance of including nutritional products in routine medication reviews.

Herbal and Ayurvedic products were documented in a smaller proportion of patients but remain clinically relevant. Herbal medicines are often perceived as safe and may not be routinely disclosed by patients. However, several herbal products can alter drug metabolism or potentiate pharmacological effects, increasing the risk of clinically significant interactions [21].

Routine documentation of herbal medicine use should therefore be incorporated into medication history-taking.

Potential drug–drug interactions were identified in nearly one-third of patients, while 17% received at least one potentially inappropriate medication according to the AGS Beers Criteria [6]. These findings are comparable to previous studies reporting persistent use of potentially inappropriate medications despite increased awareness of geriatric prescribing recommendations [22]. Routine use of validated tools such as the AGS Beers Criteria and STOPP/START criteria may facilitate safer prescribing and support deprescribing when appropriate.

Adverse drug reactions were documented in 14.5% of patients and were predominantly mild to moderate. Although retrospective data may underestimate the true incidence because of incomplete documentation, the findings support existing evidence linking higher medication burden with increased medication-related harm [23]. Age-related physiological changes further increase susceptibility to adverse effects, highlighting the need for individualized prescribing and ongoing monitoring.

The study provides real-world evidence from a tertiary care teaching hospital and offers a broader assessment of medication burden by including nutritional supplements and herbal products. However, its retrospective, single-center design may limit generalizability. Underreporting of ADRs, over-the-counter medicines, and herbal products is also possible. In addition, post-discharge outcomes, medication adherence, and long-term clinical impact could not be evaluated.

Future multicenter prospective studies should evaluate interventions such as pharmacist-led medication review, deprescribing programs, and electronic clinical decision-support systems to determine their effectiveness in reducing inappropriate polypharmacy and improving clinical outcomes [24].

Conclusion

Polypharmacy was highly prevalent among hospitalized geriatric patients and was strongly associated with multimorbidity and increased use of nutritional supplements. The substantial burden of potential drug–drug interactions, potentially inappropriate medications, and adverse drug reactions highlights the need for structured medication review, deprescribing strategies, and multidisciplinary care. Integration of geriatric prescribing tools into routine clinical practice may improve medication safety and therapeutic outcomes in older adults.

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