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Medication Use Pattern in Elderly Patients with Multiple Comorbidities: An Observational Study.

Mithilesh Kumar[1], Sakina Ahmad[1], Pankaj Kumar[1]*, Kaushal Kumar Mishra[2], Satyendra Kumar Pathak[3].

[1]Tutor/Senior Resident, Department of Pharmacology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

[2]Associate Professor, Department of Pharmacology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

[3]Professor & Head, Department of Pharmacology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

Correspondence:
Pankaj Kumar.
Tutor/Senior Resident, Department of Pharmacology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

Email:
pankajjlnmch@gmail.com

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Abstract

Background: The rapid demographic transition toward an aging population has intensified challenges in managing multimorbidity and polypharmacy among elderly patients. Complex therapeutic regimens, compounded by age-related physiological changes, increase vulnerability to potentially inappropriate medications (PIMs), drug–drug interactions (DDIs), and adverse drug reactions (ADRs). ***Objective:*** This study aimed to evaluate medication use patterns, prevalence of polypharmacy, and frequency of PIMs among elderly patients with multiple comorbidities in a tertiary care hospital. ***Methods:*** A cross-sectional observational study was conducted among 250 patients aged ≥65 years with at least two chronic conditions. Data were collected from medical records and patient interviews. Prescriptions were analyzed for polypharmacy (≥5 drugs), PIMs (Beers and STOPP/START criteria), DDIs, and ADRs. ***Results:*** The mean age was 72.47 ± 6.89 years, with 57.2% male. Nearly half (48.8%) had ≥3 comorbidities, most commonly hypertension (73.6%) and diabetes mellitus (62.8%). The mean number of medications was 6.2 ± 2.1, with 70.8% meeting criteria for polypharmacy. Antihypertensives (73.6%), antidiabetics (62.8%), and proton pump inhibitors (65.2%) were the most prescribed drug classes. PIMs were identified in 29.2% of patients, most frequently long-acting benzodiazepines (10.4%) and duplicate therapy (14.0%). DDIs occurred in 31.2% of patients, ADRs in 12.8%, and 4.4% of hospitalizations were attributable to ADRs. ***Conclusion:*** Polypharmacy and inappropriate prescribing are highly prevalent among elderly patients with multimorbidity, driven largely by cardiovascular and metabolic conditions. Systematic medication reconciliation, validated screening tools, and pharmacist integration are essential to improve safety and outcomes in this vulnerable population.

Keywords: Elderly, Multimorbidity, Polypharmacy, Inappropriate Prescribing, Drug–Drug Interactions.

INTRODUCTION

The global demographic transition toward an aging population has profound implications for healthcare systems worldwide. Elderly individuals, particularly those aged 65 years and above, represent a rapidly expanding segment of society [1-4]. With advancing age, the prevalence of chronic diseases increases substantially, leading to a high burden of multimorbidity—defined as the coexistence of two or more chronic conditions in the same patient. Hypertension, diabetes mellitus, ischemic heart disease, chronic obstructive pulmonary disease, osteoarthritis, and chronic kidney disease are among the most common comorbidities encountered in this population [5, 6]. The simultaneous presence of multiple illnesses necessitates complex therapeutic regimens, often resulting in polypharmacy, which is generally described as the use of five or more medications concurrently [7, 8]. Understanding medication use patterns in elderly patients with multiple comorbidities is therefore critical for optimizing clinical outcomes, minimizing adverse drug events, and guiding rational prescribing practices.

Polypharmacy in older adults is a double edged sword. On one hand, it reflects the need to address diverse pathophysiological processes and prevent disease progression. On the other, it increases the risk of drug–drug interactions, medication errors, poor adherence, and adverse drug reactions, which may lead to hospitalizations, functional decline, and reduced quality of life. Age related physiological changes, such as altered pharmacokinetics and pharmacodynamics, further complicate medication management [10-12]. Reduced renal clearance, diminished hepatic metabolism, and changes in body composition can all influence drug distribution and elimination, making elderly patients more vulnerable to toxicity. Moreover, cognitive impairment, frailty, and socioeconomic constraints often exacerbate challenges in medication adherence and monitoring.

The complexity of prescribing for elderly patients with multimorbidity is compounded by the lack of robust evidence from clinical trials. Most randomized controlled trials exclude older adults with multiple comorbidities, limiting the generalizability of findings to this population [13, 14]. Consequently, clinicians often rely on disease specific guidelines that do not adequately account for multimorbidity, leading to therapeutic conflicts and cumulative treatment burdens. For example, recommendations for tight glycemic control in diabetes may conflict with cardiovascular guidelines emphasizing beta blocker use, while both regimens increase the risk of hypoglycemia and bradycardia in frail elderly patients. This underscores the importance of individualized, patient centered prescribing strategies that balance risks and benefits across conditions.

Medication use patterns in elderly patients are also influenced by healthcare system factors, including prescribing practices, availability of medications, and continuity of care. In many settings, fragmented healthcare delivery results in multiple providers prescribing independently, without adequate coordination [15]. This increases the likelihood of duplicate therapies, inappropriate prescribing, and therapeutic redundancy. Inappropriate medication use, as defined by criteria such as the Beers Criteria or STOPP/START guidelines, remains a significant concern, with studies consistently reporting high rates of potentially inappropriate medications among older adults [16]. Such practices not only compromise safety but also contribute to escalating healthcare costs.

The burden of polypharmacy and inappropriate prescribing is particularly pronounced in resource limited settings, where elderly patients often face financial constraints, limited access to specialized geriatric care, and inadequate monitoring systems. In these contexts, medication use patterns may reflect not only clinical needs but also socioeconomic realities, cultural practices, and patient preferences. Understanding these patterns is essential for designing interventions that are both clinically effective and contextually appropriate.

Against this backdrop, the present study seeks to explore medication use patterns in elderly patients with multiple comorbidities. By systematically analyzing prescribing trends, drug classes utilized, prevalence of polypharmacy, and frequency of potentially inappropriate medications, this research aims to provide insights into the current state of pharmacotherapy in this vulnerable population. Such knowledge is vital for informing clinical practice, guiding policy development, and shaping educational initiatives targeted at healthcare providers. Ultimately, the goal is to promote rational prescribing, enhance medication safety, and improve health outcomes for elderly patients living with multimorbidity.

MATERIALS AND METHODS

Study Overview

This study was designed as a cross sectional observational analysis conducted in a tertiary care hospital. The primary objective was to evaluate medication use patterns among elderly patients with multiple comorbidities. The study focused on identifying prescribing trends, prevalence of polypharmacy, and the frequency of potentially inappropriate medications.

Eligibility Criteria

Patients aged 65 years and above who were admitted to medical wards or attending outpatient clinics were considered eligible. Inclusion criteria required the presence of at least two chronic comorbid conditions documented in medical records. Patients with incomplete medication histories, those unwilling to participate, and those with terminal illness receiving palliative care were excluded.

Sample Size

The sample size was calculated based on the expected prevalence of polypharmacy in elderly patients with multimorbidity, using a confidence level of 95% and a margin of error of 5%. A minimum of 200 patients was required to achieve adequate statistical power. Ultimately, 250 patients were enrolled to account for potential dropouts and incomplete data.

Outcome Parameters

The primary outcome parameters included:

- Number of medications prescribed per patient.
- Prevalence of polypharmacy (≥5 medications).
- Identification of potentially inappropriate medications (PIMs) based on Beers Criteria and STOPP/START guidelines.
- Distribution of drug classes prescribed.
- Frequency of drug–drug interactions and therapeutic duplications.

Secondary outcomes included patient adherence patterns and documentation of adverse drug reactions during hospitalization.

Data Collection

Data were collected retrospectively and prospectively from patient case records, discharge summaries, and prescription charts. Demographic details (age, sex), clinical information (diagnoses, comorbidities), and complete medication lists were extracted. Interviews with patients and caregivers were conducted when necessary to confirm medication histories and adherence practices.

Methodology

Each patient's medication profile was reviewed by two independent investigators to ensure accuracy. Drugs were classified according to the Anatomical Therapeutic Chemical (ATC) system. Polypharmacy was defined as the concurrent use of five or more medications. Potentially inappropriate medications were identified using the 2019 American Geriatrics Society Beers Criteria and corroborated with STOPP/START criteria. Drug–drug interactions were assessed using a standard drug interaction database. Discrepancies between reviewers were resolved through consensus.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 25.0. Continuous variables such as age and number of medications were expressed as mean ± standard deviation. Categorical variables such as sex, comorbidities, and drug classes were presented as frequencies and percentages.

RESULTS

Table 1 presents the baseline demographic characteristics of the 250 enrolled elderly patients. The mean age of the study population was 72.47 ± 6.89 years, with a slight male predominance (57.2%). The majority of patients resided in urban areas (66.0%), and the educational background varied, with the largest proportion having completed a secondary level of education (43.6%). These demographic factors provide a context for understanding the subsequent findings on medication use.

Table 1. Baseline Demographic Characteristics of Study Population

Variable	n (%) or Mean ± SD
Total patients	250
Age (years)	72.47 ± 6.89
Sex (Male/Female)	143 (57.2%) / 107 (42.8%)
Residence (Urban/Rural)	165 (66.0%) / 85 (34.0%)
Education level	
Primary	78 (31.2%)
Secondary	109 (43.6%)
Graduate	63 (25.2%)

Table 2 outlines the distribution of comorbidities among the study participants, confirming a high burden of multimorbidity. Hypertension was the most prevalent condition, affecting nearly three-quarters of the patients (73.6%), followed closely by diabetes mellitus (62.8%) and osteoarthritis (41.2%). A significant proportion of the population had ischemic heart disease (36.4%) and COPD (30.0%). Notably, almost half of the patients (48.8%) had three or more comorbidities, which directly correlates with the high mean number of medications observed (6.2 ± 2.1), underscoring the complex clinical management required for this population.

Table 2. Distribution of Comorbidities

Comorbidity	Number of Patients	Percentage (n = 250)	95% CI of %
Hypertension	184	73.6	68.0 – 78.6
Diabetes mellitus	157	62.8	56.7 – 68.6
Ischemic heart disease	91	36.4	30.6 – 42.6
Chronic kidney disease	58	23.2	18.2 – 29.0
COPD	75	30.0	24.5 – 36.1
Osteoarthritis	103	41.2	35.2 – 47.4
≥3 comorbidities	122	48.8	42.6 – 55.0

Mean number of medications per patient was 6.2 ± 2.1. A vast majority of patients (70.8%) were on five or more medications, meeting the criteria for polypharmacy, while a notable subset (13.2%) experienced excessive polypharmacy, defined as the use of ten or more drugs. Conversely, only a small fraction (7.6%) were on single-drug therapy [Table 3].

Table 3. Medication Use Pattern

Variable	Number of Patients	Percentage (n = 250)	95% CI of %
Polypharmacy (≥5 drugs)	177	70.8	65.1 – 75.9
Excessive polypharmacy (≥10 drugs)	33	13.2	9.5 – 18.2
Single drug therapy	19	7.6	4.9 – 11.6
Two to four drugs	54	21.6	16.9 – 27.2

Table 4 details the most commonly prescribed drug classes, which directly reflect the prevalent comorbidities. Antihypertensives (73.6%) and antidiabetics (62.8%) were the most frequently used classes, consistent with the high rates of hypertension and diabetes. The high usage of proton pump inhibitors (65.2%) is noteworthy and may represent a potential area for overtreatment or inappropriate prescribing. Other commonly prescribed classes included antiplatelets/anticoagulants (48.4%), analgesics/NSAIDs (43.2%), and lipid-lowering agents (36.8%), painting a comprehensive picture of the pharmacotherapeutic burden in this population.

Table 4. Commonly Prescribed Drug Classes

Drug Class	Number of Patients	Percentage (n = 250)	95% CI of %
Antihypertensives	184	73.6	68.0 – 78.6
Antidiabetics	157	62.8	56.7 – 68.6
Antiplatelets/Anticoagulants	121	48.4	42.2 – 54.6
Analgesics/NSAIDs	108	43.2	37.1 – 49.5
Bronchodilators	75	30.0	24.5 – 36.1
Proton pump inhibitors	163	65.2	59.1 – 70.9
Lipid lowering agents	92	36.8	31.0 – 43.0

Table 5 reveals a significant prevalence of potentially inappropriate medication (PIM) use, as identified by the Beers and STOPP criteria. Overall, nearly one-third of the patients (29.2%) were prescribed at least one PIM. The most frequent issues included duplicate therapy from the same drug class (14.0%) and the use of long-acting benzodiazepines (10.4%). Of particular concern is the prescription of NSAIDs in patients with chronic kidney disease (7.6%), a practice that poses a high risk for adverse renal outcomes. This high rate of PIMs underscores a critical gap in prescribing quality for this vulnerable population.

Table 5. Potentially Inappropriate Medications (PIMs)

PIM Category (Beers/STOPP)	Number of Patients	Percentage (n = 250)	95% CI of %
Long-acting benzodiazepines	26	10.4	7.2 – 14.8
First generation antihistamines	17	6.8	4.3 – 10.7
NSAIDs in CKD patients	19	7.6	4.9 – 11.6
Duplicate therapy (same class)	35	14.0	10.2 – 19.0
Total patients with ≥1 PIM	73	29.2	23.8 – 35.2

Table 6 presents the clinically significant outcomes related to medication safety and patient behavior. Drug-drug interactions were common, with 20.4% of patients experiencing minor interactions and 10.8% experiencing major interactions. Documented adverse drug reactions (ADRs) occurred in 12.8% of patients, and a small but important percentage (4.4%) of hospitalizations were attributed to these ADRs. Furthermore, non-adherence was reported by 16.8% of patients. These findings directly link the complex medication regimens and PIM use to tangible negative consequences, including patient harm and healthcare utilization.

Table 6. Drug–Drug Interactions and Adverse Events

Interaction/ADR Type	Number of Patients	Percentage (n = 250)	95% CI of %
Minor drug–drug interactions	51	20.4	15.8 – 26.0
Major drug–drug interactions	27	10.8	7.5 – 15.4
Documented adverse drug reactions	32	12.8	9.2 – 17.6
Hospitalizations due to ADRs	11	4.4	2.5 – 7.8
Non-adherence reported	42	16.8	12.6 – 22.1

DISCUSSION

Our study highlights the substantial clinical significance of polypharmacy, potentially inappropriate medications (PIMs), drug–drug interactions (DDIs), and adverse drug reactions (ADRs) in elderly patients with multimorbidity. To

contextualize these findings, it is essential to compare them systematically with prior studies across diverse healthcare settings.

We observed a polypharmacy prevalence of 70.8% and excessive polypharmacy in 13.2% of patients. This figure is higher than that reported in community-based studies but consistent with hospital-based cohorts. For instance, Guisado-Clavero et al. (2019) reported polypharmacy in 45.9% of patients aged 65–79 and 61.8% in those aged 80–94, reflecting lower rates in primary care compared to our hospitalized cohort [17]. Similarly, Slabaugh et al. (2010) found 39.4% of Italian outpatients exposed to polypharmacy, again substantially lower than our findings [18]. These differences underscore the impact of illness severity and healthcare setting: hospitalized patients, by definition, have more advanced disease and require more complex regimens.

In contrast, Mohan and Jayaram (2021) reported an average of 6.07 drugs per prescription in an Indian tertiary care hospital, closely mirroring our mean of 6.2 ± 2.1 medications [19]. This consistency across similar settings strengthens the validity of our findings. Likewise, Mizokami et al. (2012) reported a mean of 4.9 ± 3.6 drugs in Japanese hospitalized elderly, slightly lower but still indicative of substantial polypharmacy [20]. Taken together, these comparisons confirm that polypharmacy is a global phenomenon, with prevalence varying by healthcare setting and patient population.

Our study identified cardiovascular and metabolic conditions as the predominant drivers of polypharmacy, with antihypertensives prescribed in 73.6% and antidiabetics in 62.8% of patients. This aligns with Payne et al. (2014), who found cardiovascular conditions to be associated with the greatest number of additional medications in Scottish primary care [21]. Similarly, Mohan and Jayaram (2021) reported cardiovascular diseases and diabetes as the most common comorbidities driving polypharmacy in India [19]. Mizokami et al. (2012) also demonstrated that hypertension, hyperlipidemia, diabetes, and angina were all associated with polypharmacy prevalence exceeding 50% [20]. These consistent findings across continents highlight the universal role of chronic cardiovascular and metabolic diseases in driving medication burden.

We found that 29.2% of patients had at least one PIM, with long-acting benzodiazepines (10.4%) and first-generation antihistamines (6.8%) being most frequent. This prevalence is strikingly similar to Buck et al. (2009), who reported 23–23.3% of outpatients with ≥1 PIM in US centers [22]. Despite differences in prescribing patterns—propoxyphene and fluoxetine being common in the US versus benzodiazepines and antihistamines in India—the overall burden is comparable, suggesting inappropriate prescribing is a global issue.

Mohan and Jayaram (2021) reported PIMs in 3.47% of total prescribed drugs using Beers criteria, which differs methodologically from our patient-level analysis. Nevertheless, both studies converge on the conclusion that inappropriate prescribing is a significant concern in Indian geriatric care [19]. Maher et al. (2014) further emphasized that nearly 50% of older adults take at least one unnecessary medication, reinforcing the clinical importance of our findings [23].

Finally, Madhusoodanan and Bogunovic (2004) highlighted the risks of benzodiazepine use in elderly patients, particularly long-acting agents, which we identified as frequent PIMs [24]. Their documentation of adverse effects such as falls, cognitive impairment, and sedation supports our classification and underscores the need for deprescribing strategies.

Our study documented 20.4% minor and 10.8% major DDIs, with clear clinical consequences. This aligns with Prakash et al. (2025), who reported minor DDIs in 68.32% and major DDIs in 16.41% of hospitalized elderly in India [25]. Both studies confirm that major DDIs are associated with adverse outcomes, including prolonged hospital stays and higher rates of serious adverse events. The concordance across different Indian healthcare settings highlights the pervasive nature of DDI-related complications.

Maher et al. (2014) also emphasized that polypharmacy is directly linked to DDIs and poor outcomes, supporting our inference that the high rates of DDIs observed are attributable to complex regimens [23]. Moreover, Guisado-Clavero et al. (2019) demonstrated that prescribing follows recognizable clusters, suggesting that interventions targeting common drug combinations could reduce DDI risk [17].

We found 12.8% of patients experienced ADRs, with 4.4% of hospitalizations attributable to ADRs. This resonates with Gurwitz et al. (2003), who reported 50.1 ADRs per 1,000 person-years in ambulatory care, with 27.6% preventable [26]. Although denominators differ, both studies confirm that ADRs are common and often preventable. Gurwitz et al. identified prescribing and monitoring errors as frequent contributors, providing actionable targets for intervention [26]. Their finding that cardiovascular drugs, diuretics, and hypoglycemics were most commonly associated with preventable ADRs corresponds to our observation that these drug classes dominate prescribing in elderly populations.

Our study identified duplicate therapy in 14.0% of patients, reinforcing concerns about unnecessary prescribing. Maher et al. (2014) similarly reported that nearly half of older adults take medications that are not medically necessary [23]. Guisado-Clavero et al. (2019) provided further insight by identifying six distinct prescribing clusters, demonstrating that medication regimens are patterned rather than random [17]. This supports our observation of frequent prescribing for cardiovascular, metabolic, and gastrointestinal conditions, and suggests that cluster-based interventions could efficiently reduce polypharmacy.

This study has several limitations that should be considered when interpreting the findings. The single-center design conducted at a tertiary care hospital may limit the generalizability of results to primary care settings or other geographic regions. Additionally, the study did not assess long-term clinical outcomes following hospital discharge or evaluate the impact of deprescribing interventions. Finally, the relatively small sample size may limit the statistical power for subgroup analyses.

CONCLUSION

This study demonstrates that polypharmacy is highly prevalent among elderly patients. The strong associations observed between complex medication regimens and clinically significant drug-drug interactions, adverse drug reactions, and prolonged hospitalizations underscore the substantial patient safety and healthcare utilization burden imposed by suboptimal prescribing practices. Our results highlight the critical need for systematic implementation of medication reconciliation, regular application of validated screening tools such as Beers and STOPP/START criteria, and integration of clinical pharmacists into multidisciplinary geriatric care teams. Furthermore, the disease-specific patterns of polypharmacy observed suggest that targeted interventions for patients with cardiovascular, metabolic, and neuropsychiatric conditions may yield the greatest benefit. Ultimately, adopting patient-centered, individualized prescribing strategies that prioritize medication safety, minimize therapeutic redundancy, and align treatment goals with patient preferences and life expectancy is essential to improve clinical outcomes and quality of life for this vulnerable population.

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