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PREVALENCE OF POLYPHARMACY AND ITS ASSOCIATED RISKS IN ELDERLY PATIENTS WITH CHRONIC DISEASES- A CROSS-SECTIONAL STUDY

Original Article

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ABSTRACT

Background: Polypharmacy is a growing concern among the elderly, particularly those with chronic diseases, due to increased risks of adverse drug events and medication-related complications. Inappropriate medication use in older adults contributes significantly to hospitalizations and reduced quality of life.

Objective: To determine the prevalence of polypharmacy and assess its associated risks in elderly patients with chronic diseases attending tertiary care facilities in Pakistan.

Methods: A cross-sectional study was conducted over eight months in selected urban tertiary hospitals. A total of 420 elderly patients (≥60 years) with one or more chronic illnesses were enrolled through consecutive sampling. Data were collected using a structured questionnaire, prescription review, Beers Criteria, and the Medication Appropriateness Index (MAI). Descriptive statistics, chi-square tests, and logistic regression were performed using SPSS version 26, with a significance level of $p<0.05$.

Results: The prevalence of polypharmacy (≥5 medications) was 61.9%. Adverse drug events were reported in 42.9% of participants. Based on Beers Criteria, 45.2% were prescribed 1–2 potentially inappropriate medications (PIMs), while 19.1% had ≥3 PIMs. MAI assessment revealed that 26.2% were on inappropriate medication regimens. Polypharmacy was significantly associated with increased age, number of chronic diseases, and hospital visits.

Conclusion: Polypharmacy is highly prevalent among elderly patients with chronic diseases in Pakistan and is associated with substantial clinical risks. Systematic medication reviews and targeted deprescribing interventions are essential to enhance medication safety in this vulnerable population.

Keywords: Aged, Beers Criteria, Chronic Disease, Cross-Sectional Studies, Drug-Related Side Effects and Adverse Reactions, Inappropriate Prescribing, Pakistan, Polypharmacy, Risk Assessment.

INTRODUCTION

The global aging population has introduced profound challenges to healthcare systems, particularly due to the increased burden of chronic diseases. As people age, they are more likely to experience multiple long-term health conditions, leading to complex therapeutic regimens. This scenario often results in polypharmacy—a term broadly defined as the simultaneous use of five or more medications by a single patient (1). While polypharmacy may sometimes be clinically justified, especially in the management of coexisting chronic conditions, it also presents considerable risks including adverse drug reactions, drug-drug interactions, reduced medication adherence, and increased healthcare utilization (2). In elderly patients, whose physiological resilience is already diminished, these risks are significantly amplified, making the phenomenon of polypharmacy a growing public health concern. Multiple studies have drawn attention to the rising prevalence of polypharmacy among the elderly, particularly those living with conditions such as hypertension, diabetes, chronic obstructive pulmonary disease, and cardiovascular disorders (3-5). These chronic diseases often require long-term, multifaceted treatment plans, resulting in an accumulation of medications over time. For instance, a patient with diabetes may be prescribed not only antidiabetic agents but also antihypertensives, lipid-lowering drugs, and antiplatelet agents—each addressing a different aspect of their clinical profile. While such combinations aim to reduce morbidity and mortality, they also pose substantial risks when not meticulously monitored, especially in the elderly who often experience age-related changes in pharmacokinetics and pharmacodynamics (6,7).

Research has consistently highlighted the double-edged nature of polypharmacy. On one hand, it can enhance disease control when evidence-based guidelines are appropriately followed. On the other hand, it may contribute to a cascade of complications if applied indiscriminately or without regular medication reviews (8,9). The consequences range from mild discomforts such as dizziness and gastrointestinal issues to severe outcomes including falls, hospitalization, and even mortality. Elderly individuals are particularly vulnerable due to decreased renal and hepatic function, altered body composition, and increased sensitivity to certain medications. Additionally, cognitive impairment and functional limitations in this demographic further hinder their ability to adhere to complex medication regimens, increasing the likelihood of errors and non-compliance (10). Despite the clear risks associated with polypharmacy, it remains a poorly addressed issue in clinical practice. This is partly due to fragmented care systems where multiple specialists prescribe medications independently, often without comprehensive medication reconciliation. Furthermore, existing clinical guidelines frequently focus on single diseases and may inadvertently promote polypharmacy by not accounting for the cumulative effects of treating multiple conditions concurrently. There is also a notable lack of awareness among patients and caregivers regarding the dangers of taking numerous medications, which underscores the importance of educational interventions and systematic medication reviews in geriatric care (11,12).

Several international studies have sought to quantify the prevalence of polypharmacy, with estimates varying depending on the definition used, healthcare settings, and population demographics. In general, the prevalence is reported to be higher in institutionalized elderly populations and those with multiple comorbidities. However, such figures may not fully capture the nuanced risks experienced by elderly patients living with chronic diseases in specific regional or cultural contexts. As such, local data are crucial for informing context-specific strategies aimed at mitigating the harms associated with polypharmacy. Despite growing attention in academic and clinical circles, significant knowledge gaps remain in understanding the extent and impact of polypharmacy among elderly populations, especially in non-hospitalized settings. Existing literature often lacks a focused examination of how polypharmacy manifests in elderly individuals with chronic diseases, and which specific risk factors most strongly predict adverse outcomes in this group (13,14). Moreover, there is a scarcity of data assessing the interplay between polypharmacy and variables such as functional status, cognitive decline, and socioeconomic factors, all of which can influence medication use and its outcomes. Addressing these gaps is essential for developing targeted interventions and improving the quality of life among elderly patients managing chronic illnesses. Given the growing population of older adults worldwide and the rising incidence of chronic disease, understanding and mitigating the risks associated with polypharmacy is not only clinically relevant but also a public health imperative. Therefore, this study aims to determine the prevalence of polypharmacy among elderly patients with chronic diseases and to assess the associated risks, with the objective of informing better clinical practice and policy-making in geriatric care.

METHODS

This cross-sectional study was conducted over a period of eight months, from March to October, in selected tertiary care hospitals and outpatient clinics in urban areas of Pakistan, specifically targeting regions with diverse elderly populations and accessible chronic disease

management services. The study aimed to determine the prevalence of polypharmacy and assess its associated risks among elderly patients diagnosed with chronic diseases. The selected settings provided access to a wide spectrum of elderly individuals, including those actively receiving outpatient care and those hospitalized for chronic disease management, ensuring a comprehensive sample that reflects the real-world burden of polypharmacy. The study population included elderly patients aged 60 years and above who had been diagnosed with one or more chronic diseases, such as diabetes mellitus, hypertension, chronic kidney disease, ischemic heart disease, chronic obstructive pulmonary disease, or osteoarthritis. Patients were eligible for inclusion if they were able to provide informed consent, were currently on medication for at least one chronic condition, and had complete medical records available for review. Exclusion criteria comprised patients with terminal illnesses receiving palliative care, those with acute medical or psychiatric conditions requiring immediate intervention, and individuals who declined to participate or were unable to communicate due to severe cognitive impairment or language barriers (15).

Sample size was estimated using the formula for single proportion estimation, assuming a 50% prevalence of polypharmacy based on literature to maximize the sample size, a confidence level of 95%, and a margin of error of 5%. This yielded a minimum required sample size of 384. After accounting for potential non-responses and incomplete data, the final sample size was adjusted to 420 participants. A consecutive sampling method was used, whereby all eligible elderly patients attending the study settings during the data collection period were approached until the required sample size was achieved (3,5). Data collection was carried out using a structured, interviewer-administered questionnaire developed in consultation with clinical pharmacologists and geriatricians. The tool was piloted on a small sample of similar patients to ensure clarity and relevance. Information collected included sociodemographic details, medical history, current medication use, duration and type of chronic diseases, and history of adverse drug events or hospitalizations related to medication use. Medication records were cross-verified with prescriptions and medical files to ensure accuracy. Polypharmacy was defined operationally as the concurrent use of five or more medications, irrespective of therapeutic class or formulation.

To assess the risks associated with polypharmacy, two validated tools were employed. The Medication Appropriateness Index (MAI) was used to evaluate the appropriateness of each prescribed medication based on ten criteria, including indication, dosage, and potential interactions. Additionally, the Beers Criteria—a widely accepted guideline developed by the American Geriatrics Society—was applied to identify potentially inappropriate medications (PIMs) among the elderly. These tools enabled the study to quantify not only the frequency but also the quality of polypharmacy, capturing instances where medication use may be potentially harmful or clinically unnecessary. All data were entered into IBM SPSS version 26 for statistical analysis. Descriptive statistics were calculated for all baseline variables, with frequencies and percentages reported for categorical variables, and means with standard deviations for continuous variables. The prevalence of polypharmacy was determined as a proportion of participants using five or more medications at the time of data collection. To assess associations between polypharmacy and clinical or demographic variables, chi-square tests were applied for categorical variables, and independent sample t-tests for continuous variables. Logistic regression analysis was conducted to identify independent predictors of polypharmacy and the occurrence of adverse drug events, adjusting for age, gender, number of chronic conditions, and comorbidity burden. The level of statistical significance was set at $p < 0.05$.

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the primary study hospital. All participants provided written informed consent prior to inclusion in the study, with procedures conducted in accordance with the Declaration of Helsinki. Special care was taken to ensure confidentiality and voluntary participation, and participants were informed of their right to withdraw from the study at any point without affecting their medical care. The methodological rigor, use of validated tools, and statistical robustness ensure that the findings of this study will provide a meaningful contribution to understanding the extent and implications of polypharmacy among elderly patients with chronic diseases in Pakistan.

RESULTS

A total of 420 elderly patients aged 60 years and above were enrolled in the study. The mean age of participants was 68.4 years (±6.9), with a slightly higher proportion of females (55.2%) compared to males (44.8%). The educational background varied, with 24.8% having no formal education, while 30.5%, 23.3%, and 21.4% had attained primary, secondary, and tertiary education respectively. Out of the total participants, 260 individuals (61.9%) were found to be using five or more medications concurrently, meeting the criteria for polypharmacy. The remaining 160 participants (38.1%) were taking fewer than five medications. This finding underscores a substantial prevalence of polypharmacy among elderly patients with chronic conditions attending tertiary care and outpatient clinics in the region. Adverse drug events were reported by 42.9% of the participants, whereas 57.1% did not experience any noticeable adverse effects related

to their medication regimen. This considerable rate of adverse outcomes suggests a strong clinical relevance of monitoring polypharmacy and its potential complications in this population.

The analysis based on the Beers Criteria revealed that 35.7% of participants were not taking any potentially inappropriate medications (PIMs). However, 45.2% were found to be using one to two PIMs, and 19.1% had three or more PIMs prescribed. These findings raise significant concerns about prescribing quality and medication safety in geriatric pharmacotherapy. Further evaluation through the Medication Appropriateness Index (MAI) indicated that only 33.3% of the medication regimens were deemed appropriate. A large proportion (40.5%) of the sample fell into the marginally inappropriate category, while 26.2% of patients were on highly inappropriate regimens as defined by an MAI score greater than five. Bar charts illustrating the prevalence of polypharmacy and incidence of adverse drug events are attached for visual interpretation. These charts offer a clear depiction of the burden and risks associated with polypharmacy in the study population.

Table 1: Demographics

Variable	Value
Age (mean ± SD)	68.4 ± 6.9 years
Gender	
Male	188 (44.8%)
Female	232 (55.2%)
Education	
No formal	104 (24.8%)
Primary	128 (30.5%)
Secondary	98 (23.3%)
Tertiary	90 (21.4%)

Table 2: Polypharmacy Prevalence

Polypharmacy Status	Frequency	Percentage
<5 Medications	160	38.10%
≥5 Medications (Polypharmacy)	260	61.90%

Table 3: Adverse Drug Events

Adverse Drug Events	Frequency	Percentage
No	240	57.10%
Yes	180	42.90%

Table 4: Beers Criteria Results

PIMs Detected (Beers Criteria)	Frequency	Percentage
None	150	35.70%
1-2 Medications	190	45.20%
≥3 Medications	80	19.10%

Table 5: Medication Appropriateness Index Scores

MAI Score Category	Frequency	Percentage
Appropriate (0-2)	140	33.30%
Marginally Inappropriate (3-5)	170	40.50%
Inappropriate (>5)	110	26.20%

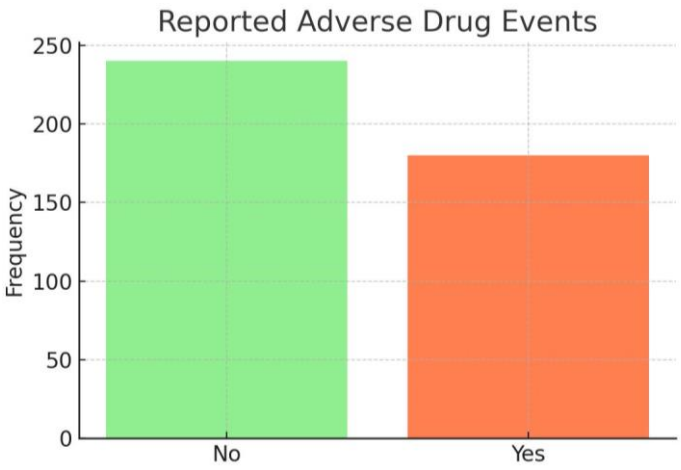

Figure 1 Reported Adverse Drug Events

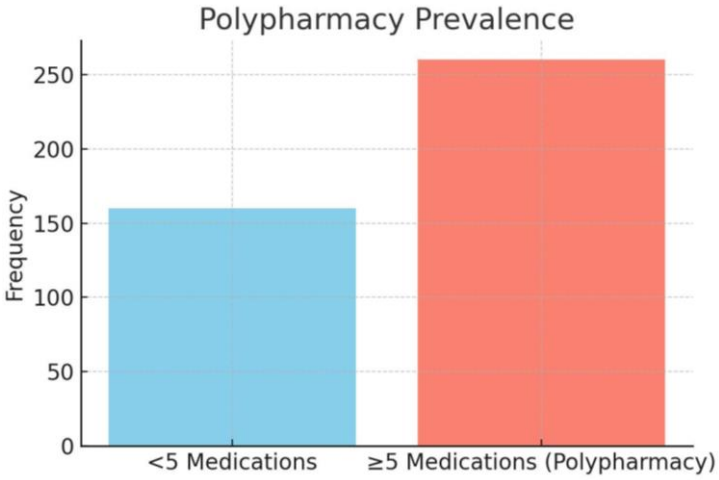

Figure 2 Polypharmacy Prevalence

DISCUSSION

The findings of this study add to the expanding body of evidence indicating that polypharmacy is a widespread concern among elderly individuals with chronic diseases. The prevalence of polypharmacy in the current cohort was found to be 61.9%, aligning with reports from other countries that have shown similarly high prevalence rates among older populations with multiple comorbidities. For instance, a recent study from Iraq noted a polypharmacy prevalence of 27% among elderly patients, particularly those with diabetes and cardiovascular conditions (16), while Brazilian data from a large national survey reported a 23.8% prevalence, with strong associations with chronic non-communicable diseases (17). The relationship between polypharmacy and adverse outcomes, such as drug-related events, was notable in the present study, with 42.9% of participants reporting such incidents. This supports findings from other regions, where polypharmacy has been linked to increased risks of hospitalization, drug-drug interactions, and mortality. For instance, a prospective study in the U.S. reported that elderly patients with both polypharmacy and chronic kidney disease faced significantly higher risks of all-cause and cardiovascular mortality (18).

Additionally, a large-scale assessment in Poland demonstrated that 19.1% of older adults engaged in chronic polypharmacy, with an average of 8.3 medications used daily, emphasizing the persistence and clinical weight of the problem (19). Similarly, inappropriate medication use, as detected through tools such as the Beers Criteria and Medication Appropriateness Index in this study, corresponded with previously reported concerns about the quality of pharmacotherapy in the elderly (20). In our sample, 26.2% had regimens deemed inappropriate, a proportion that reflects global trends and underscores the need for vigilant prescribing practices. These findings highlight a pressing need for routine medication reviews, particularly using structured tools like the Beers Criteria, to reduce the use of potentially inappropriate medications (PIMs). Evidence shows that identifying high-risk patients and implementing deprescribing strategies can significantly reduce adverse events and improve outcomes (21,22). However, systematic implementation remains inconsistent, particularly in lower-middle-income settings such as Pakistan, where access to geriatric care and clinical pharmacists is limited.

While the strength of this study lies in its use of validated clinical tools and inclusion of both outpatient and hospitalized populations, certain limitations must be acknowledged. The cross-sectional design limits causal inference, and potential recall bias may have influenced self-reported adverse drug events. Furthermore, while the study setting in urban tertiary care institutions allowed for structured data collection, it may not reflect medication use patterns in rural or under-resourced areas where documentation practices are less stringent. The lack of data on medication adherence and over-the-counter drug use is another limitation that might underestimate the true extent of polypharmacy and its associated risks. Future research should consider longitudinal approaches to assess the long-term outcomes of polypharmacy and its management. Interventional studies on deprescribing protocols and the role of pharmacist-led reviews in Pakistani settings could offer scalable strategies to mitigate risk. Moreover, further exploration of sociodemographic and behavioral predictors of inappropriate prescribing may help tailor interventions more effectively. In conclusion, the high prevalence of polypharmacy and associated risks identified in this study point to a growing challenge in the management of elderly patients with

chronic illnesses. As the elderly population continues to expand globally and within Pakistan, this issue demands urgent attention from clinicians, health systems, and policymakers. Strategic implementation of medication review protocols and increased awareness of polypharmacy's consequences may serve as critical steps in optimizing care for this vulnerable population.

CONCLUSION

This study demonstrated a high prevalence of polypharmacy among elderly patients with chronic diseases, accompanied by significant risks such as adverse drug events and inappropriate prescribing. These findings underscore the urgent need for routine medication reviews and deprescribing strategies in geriatric care. Integrating structured tools and multidisciplinary approaches can enhance medication safety and improve health outcomes in aging populations.

AUTHOR CONTRIBUTION

Author	Contribution
Afaq Qayyum	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Ramsha Irfan	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
Shaista Hamid	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Ahmed Mustafa	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Israr*	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Azeem Ur Rehman	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Mariam Shahid	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Saleem Asghar Shar Baloch	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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