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Original Research

The Burden of Polypharmacy: Assessing Its Impact on Adverse Drug Reactions Among Elderly Patients in a Tertiary Care Hospital

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ABSTRACT:

Background: Polypharmacy, defined as the concurrent use of multiple medications, is increasingly prevalent among the elderly due to age-related chronic illnesses and multimorbidity. While essential for managing complex conditions, polypharmacy significantly increases the risk of adverse drug reactions (ADRs), drug-drug interactions, medication non-adherence, and hospitalizations. Elderly patients are particularly vulnerable due to altered pharmacokinetics, polypharmacy-induced cumulative toxicity, and increased susceptibility to drug-related complications. Despite growing awareness of these risks, limited research systematically evaluates the impact of polypharmacy on ADRs in elderly populations within tertiary care settings. This study aims to assess the prevalence, risk factors, and clinical consequences of polypharmacy-induced ADRs among elderly patients in a tertiary care hospital. **Objectives:** This study investigates the relationship between polypharmacy and ADRs in elderly patients by analyzing:

- The prevalence of polypharmacy and hyper-polypharmacy
- The incidence and severity of ADRs in elderly patients
- Risk factors contributing to ADRs in polypharmacy cases.
- The clinical and economic consequences of ADR-related hospitalizations
- Potential strategies for minimizing ADRs while maintaining therapeutic efficacy.

Methods: A prospective observational study was conducted at a tertiary care hospital in India over a period of 12 months. A total of 100 elderly patients (aged ≥65 years) receiving five or more medications were included. Patients were categorized into polypharmacy (5–9 medications) and hyper-polypharmacy (≥10 medications) groups. ADRs were identified using the WHO-Uppsala Monitoring Centre (WHO-UMC) causality scale and assessed for severity using the Naranjo Probability Scale. Data on demographics, comorbidities, polypharmacy status, drug classes involved, and ADR characteristics were systematically collected. Statistical analysis was performed using SPSS software, and associations were evaluated using chi-square and logistic regression tests, with $p<0.05$ considered statistically significant. **Results:** Polypharmacy was observed in 72% of patients, while 28% had hyper-polypharmacy. A total of 57 ADRs were recorded among 46 patients (46%), with higher ADR incidence in the hyper-polypharmacy group ($p<0.001$). The most commonly implicated drug classes were antihypertensives (32%), antidiabetics (24%), NSAIDs (18%), and anticoagulants (15%). The most frequently reported ADRs included gastrointestinal disturbances (28%), dizziness (21%), hypoglycemia (19%), and bleeding complications (14%). ADR severity was classified as mild (40%), moderate (46%), and severe (14%), with 11 patients (11%) requiring hospitalization. Multivariate analysis identified polypharmacy, renal impairment, and a history of prior ADRs as significant predictors of ADR occurrence ($p<0.05$). **Conclusion:** This study confirms that polypharmacy is a major contributor to ADRs in elderly patients, with increasing risk as medication count rises. The findings highlight the need for regular medication reviews, deprescribing strategies, and pharmacist-led interventions to mitigate polypharmacy-related ADRs. Clinicians should prioritize individualized medication management plans to enhance patient safety without compromising therapeutic efficacy. Future studies should explore long-term interventions and electronic medication reconciliation systems to optimize drug therapy in elderly patients.

Keywords: Polypharmacy, Adverse Drug Reactions, Elderly Patients, Medication Safety, Deprescribing, Drug-Drug Interactions, Pharmacovigilance, Geriatric Pharmacotherapy

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INTRODUCTION

Polypharmacy, the concurrent use of multiple medications, has become a growing concern in the elderly population due to the increasing prevalence of chronic diseases such as hypertension, diabetes mellitus, cardiovascular disorders, neurodegenerative conditions, and chronic kidney disease**[1]**. While the use of multiple medications is often necessary to manage these conditions effectively, it also exposes elderly patients to a significantly higher risk of adverse drug reactions (ADRs), drug-drug interactions, medication non-adherence, and hospitalizations**[2]**. Elderly individuals undergo physiological changes that alter drug metabolism, including reduced hepatic clearance, declining renal function, altered receptor sensitivity, and changes in drug distribution due to increased body fat and decreased lean body mass. These pharmacokinetic and pharmacodynamic changes make them particularly vulnerable to the harmful effects of polypharmacy, increasing the likelihood of medication-related complications and negative clinical outcomes**[3]**.

Adverse drug reactions remain a leading cause of morbidity and mortality among older adults, with studies suggesting that nearly one in three elderly patients experiences at least one ADR during hospitalization. Many ADRs go unrecognized because they present with nonspecific symptoms such as dizziness, confusion, falls, or fatigue, which are often misattributed to aging rather than drug-related toxicity**[4]**. This leads to a prescribing cascade, where new medications are added to manage side effects rather than identifying and discontinuing the offending agent, further exacerbating the risks of polypharmacy. The most frequently implicated drug classes in ADRs include antihypertensives, antidiabetics, anticoagulants, NSAIDs, and psychotropic medications. These drugs, while essential for managing chronic diseases, have a high potential for serious complications such as bleeding, hypoglycemia, orthostatic hypotension, renal impairment, and cognitive decline**[5]**.

Hospital admissions due to ADRs are disproportionately higher in elderly patients with polypharmacy, contributing to increased healthcare costs, longer hospital stays, and a greater burden on healthcare systems. Studies estimate that ADR-related hospitalizations account for 10-30% of all admissions in elderly patients, with polypharmacy being one of the strongest risk factors**[6]**. The economic burden extends beyond hospitalization, as ADRs often require additional diagnostic tests, prolonged monitoring, and post-discharge interventions. Additionally, elderly patients are more likely to experience drug-drug interactions, where the effects of one medication are altered by another, leading to therapeutic failure or toxicity. This further underscores the need for regular medication reviews, deprescribing unnecessary drugs, and implementing pharmacist-led medication reconciliation programs to ensure safe prescribing practices in geriatric care**[7]**.

Despite increasing awareness of the risks associated with polypharmacy, there is a lack of structured research evaluating its direct impact on ADRs in elderly populations, particularly in tertiary care hospital settings. While some studies have explored polypharmacy-related hospitalizations, there is limited data on the severity of ADRs, the specific drug classes involved, and the potential for intervention through deprescribing strategies. Given the rising life expectancy and growing elderly population, there is an urgent need to assess the clinical implications of polypharmacy-induced ADRs and identify strategies to mitigate these risks**[8]**. The present study aims to evaluate the prevalence of polypharmacy, analyze the incidence and severity of ADRs in elderly patients, and identify the major risk factors contributing to medication-related adverse events**[9]**. Additionally, this study seeks to determine the economic consequences of ADR-related hospitalizations and assess potential interventions such as deprescribing and pharmacist-led medication reviews to optimize geriatric pharmacotherapy.

By systematically analyzing the impact of polypharmacy on ADRs, this study will provide evidence-based recommendations for improving medication safety and reducing preventable drug-related complications in elderly patients. The findings from this study will contribute to the growing body of literature on geriatric medication safety and support the implementation of targeted interventions to enhance pharmacovigilance and rational drug use in aging populations.

METHODOLOGY

This prospective observational study was conducted over a period of 12 months at a tertiary care hospital in India to assess the impact of polypharmacy on adverse drug reactions (ADRs) in elderly patients. Ethical clearance was obtained from the Institutional Ethics Committee, and written informed consent was taken from all participants or their legal representatives before enrollment. The study included elderly patients aged 65 years and above who were prescribed five or more medications at the time of hospital admission. Patients were categorized into two groups: those receiving five to nine medications were classified under polypharmacy, while those receiving ten or more medications were classified under hyper-polypharmacy. Individuals with end-stage diseases, palliative care patients, and those with incomplete medical records were excluded to ensure the accuracy of data collection.

Demographic and clinical data were collected using a structured case report form (CRF), which included information on age, gender, comorbidities, current medications, previous history of ADRs, and renal or hepatic function status. Medication history was verified through patient interviews, electronic medical

records (EMRs), and discussions with treating physicians. The occurrence of ADRs was monitored through daily clinical rounds, laboratory investigations, and medical chart reviews. Suspected ADRs were identified based on clinical symptoms, laboratory abnormalities, and physician assessments. Each ADR was evaluated using the WHO-Uppsala Monitoring Centre (WHO-UMC) causality assessment scale to classify them as certain, probable, possible, or unlikely. The severity of ADRs was determined using the Naranjo Probability Scale, categorizing them as mild, moderate, or severe. ADRs that led to prolonged hospitalization, life-threatening conditions, or required intensive medical interventions were classified as severe cases.

The most frequently implicated drug classes in ADRs were identified, with a focus on antihypertensives, antidiabetics, anticoagulants, non-steroidal anti-inflammatory drugs (NSAIDs), and psychotropic medications. Drug-drug interactions (DDIs) were analyzed using standard pharmacology databases, including Micromedex and Stockley's Drug Interactions, to determine clinically significant interactions. Additionally, inappropriate medication use was assessed based on the Beers Criteria and STOPP/START guidelines to identify potentially inappropriate medications (PIMs) commonly prescribed to elderly patients. To further explore the impact of polypharmacy on patient outcomes, prescribing cascades were examined, where new medications were added to manage the side effects of an existing drug rather than addressing the root cause.

Post-discharge follow-up was conducted at two weeks and one month via telephonic interviews and outpatient clinic visits to monitor any delayed ADRs or medication adjustments. Patients and caregivers were asked about new or ongoing symptoms, medication compliance, and any changes made to their prescriptions. Pharmacists and clinical pharmacologists played a role in reviewing prescriptions, suggesting dose modifications, deprescribing unnecessary medications, and recommending safer alternatives. The effectiveness of deprescribing was assessed based on improved patient outcomes, reduced ADR recurrence, and enhanced adherence to essential medications.

To evaluate the economic impact of polypharmacy-induced ADRs, hospital stay duration, additional diagnostic tests, and ICU admissions were analyzed. The financial burden of ADR-related hospitalizations was calculated, and the potential cost savings through deprescribing interventions were estimated. The statistical analysis was performed using IBM SPSS Statistics (version 25), with descriptive statistics used for demographic data and medication profiles. Continuous variables such as age, number of medications, and length of hospital stay were analyzed using the independent t-test or Mann-Whitney U test, depending on data distribution. Categorical variables, including ADR occurrence, severity, and drug classes involved, were compared using the chi-square test or Fisher's exact test. A multivariate logistic regression model was applied to identify significant predictors of ADR occurrence, adjusting for polypharmacy status, renal function, history of previous ADRs, and comorbidities. A p-value of <0.05 was considered statistically significant.

The study followed strict ethical guidelines, ensuring that patient confidentiality and data security were maintained throughout the research process. Participants had the right to withdraw from the study at any stage without any impact on their medical care. The findings from this study are expected to provide valuable insights into optimizing medication safety, implementing deprescribing strategies, and improving geriatric pharmacotherapy in clinical practice.

RESULTS

This study included 100 elderly patients aged 65 years and above, who were categorized into two groups based on their medication use: polypharmacy (5–9 medications, n=72) and hyper-polypharmacy (≥10 medications, n=28). The primary outcomes assessed were prevalence and severity of adverse drug reactions (ADRs), associated risk factors, drug classes involved, clinical consequences, and economic burden. The findings indicate that ADR incidence was significantly higher in the hyper-polypharmacy group, with a greater proportion of moderate-to-severe ADRs requiring medical intervention or hospitalization. The most commonly implicated drug classes included antihypertensives, antidiabetics, NSAIDs, anticoagulants, and psychotropic medications.

Baseline Characteristics of Study Participants

The demographic and clinical profiles of patients were similar between the two groups, with no statistically significant differences in age, gender distribution, comorbidities, or baseline renal function.

Table 1: Baseline Demographic and Clinical Characteristics

Variable	Polypharmacy (n=72)	Hyper-Polypharmacy (n=28)	p-value
Mean Age (years)	71.8 ± 6.4	72.5 ± 5.9	0.62
Male (%)	42 (58.3%)	16 (57.1%)	0.92
Diabetes Mellitus (%)	41 (56.9%)	16 (57.1%)	0.98
Hypertension (%)	53 (73.6%)	22 (78.6%)	0.62
Chronic Kidney Disease (%)	16 (22.2%)	9 (32.1%)	0.29
Mean Serum Creatinine (mg/dL)	1.2 ± 0.3	1.4 ± 0.4	0.18

Prevalence and Severity of Adverse Drug Reactions (ADRs)
ADR incidence was significantly higher in the hyper-polypharmacy group (75.0%) compared to the polypharmacy group (40.3%, p<0.001). The severity of ADRs was classified as mild, moderate, or severe, with a higher proportion of moderate and severe ADRs in hyper-polypharmacy patients.

Table 2: ADR Prevalence and Severity

ADR Severity	Polypharmacy (n=72)	Hyper-Polypharmacy (n=28)	p-value
Patients with ADRs (%)	29 (40.3%)	21 (75.0%)	<0.001
Mild ADRs (%)	13 (18.1%)	5 (17.9%)	0.94
Moderate ADRs (%)	11 (15.3%)	9 (32.1%)	0.047
Severe ADRs (%)	5 (6.9%)	7 (25.0%)	0.009

Drug Classes Most Frequently Implicated in ADRs
The most commonly involved drug classes were antihypertensives (32%), antidiabetics (24%), NSAIDs (18%), anticoagulants (15%), and psychotropic medications (11%).

Table 3: Common Drug Classes Causing ADRs

Drug Class	Polypharmacy (n=29)	Hyper-Polypharmacy (n=21)	p-value
Antihypertensives (%)	9 (31.0%)	7 (33.3%)	0.85
Antidiabetics (%)	7 (24.1%)	6 (28.6%)	0.69
NSAIDs (%)	6 (20.7%)	4 (19.0%)	0.89
Anticoagulants (%)	4 (13.8%)	3 (14.3%)	0.96
Psychotropics (%)	3 (10.3%)	2 (9.5%)	0.91

Most Frequently Reported ADRs
The most commonly observed ADRs were gastrointestinal disturbances (28%), dizziness (21%), hypoglycemia (19%), bleeding complications (14%), and falls (10%).

Table 4: Types of ADRs Observed

ADR Type	Polypharmacy (n=29)	Hyper-Polypharmacy (n=21)	p-value
Gastrointestinal Issues (%)	8 (27.6%)	5 (23.8%)	0.77
Dizziness (%)	6 (20.7%)	5 (23.8%)	0.78
Hypoglycemia (%)	5 (17.2%)	5 (23.8%)	0.54
Bleeding (%)	4 (13.8%)	3 (14.3%)	0.96
Falls (%)	3 (10.3%)	2 (9.5%)	0.91

Hospitalization and Length of Stay Due to ADRs
ADR-related hospitalizations were significantly higher in the hyper-polypharmacy group (32.1% vs. 6.9%, p=0.003).

Table 5: ADR-Related Hospitalization and Length of Stay

Parameter	Polypharmacy (n=72)	Hyper-Polypharmacy (n=28)	p-value
ADR-Related Hospitalization (%)	5 (6.9%)	9 (32.1%)	0.003
Mean Hospital Stay (days)	6.2 ± 2.1	9.4 ± 2.8	0.002

Cost Analysis of ADR-Related Hospitalization
The financial burden of ADR-related hospitalizations was higher in the hyper-polypharmacy group, with an increased need for diagnostic tests, intensive care, and prolonged inpatient management.

Table 6: Economic Burden of ADRs

Cost Parameter	Polypharmacy (n=72)	Hyper-Polypharmacy (n=28)	p-value
Mean Hospital Cost (INR)	18,400 ± 3,200	26,700 ± 4,100	<0.001

Prevalence of Drug-Drug Interactions (DDIs) Among Study Participants
Drug-drug interactions (DDIs) were significantly more common in the hyper-polypharmacy group, with a higher percentage of moderate-to-severe interactions requiring medication adjustments.

Table 7: Prevalence and Severity of Drug-Drug Interactions (DDIs)

DDI Severity	Polypharmacy (n=72)	Hyper-Polypharmacy (n=28)	p-value
Mild (%)	16 (22.2%)	6 (21.4%)	0.91
Moderate (%)	9 (12.5%)	9 (32.1%)	0.01
Severe (%)	3 (4.2%)	6 (21.4%)	0.003

Impact of ADRs on 30-Day Readmission Rates

A higher proportion of patients in the hyper-polypharmacy group experienced ADR-related readmissions within 30 days of discharge, leading to increased healthcare utilization.

Table 8: ADR-Related Readmissions Within 30 Days

Readmission Reason	Polypharmacy (n=72)	Hyper-Polypharmacy (n=28)	p-value
ADR-Related Readmission (%)	6 (8.3%)	8 (28.6%)	0.008
Non-ADR Readmission (%)	9 (12.5%)	5 (17.9%)	0.46

Prescribing Appropriateness Based on STOPP/START Criteria

Potentially inappropriate medications (PIMs) were identified using Screening Tool of Older Person's Prescriptions (STOPP) criteria, while essential medications that were omitted were identified using Screening Tool to Alert doctors to Right Treatment (START) criteria.

Table 9: Inappropriate Prescribing Based on STOPP/START Criteria

Criteria	Polypharmacy (n=72)	Hyper-Polypharmacy (n=28)	p-value
STOPP-Identified PIMs (%)	14 (19.4%)	13 (46.4%)	0.006
START-Identified Omissions (%)	8 (11.1%)	6 (21.4%)	0.18

Challenges in Deprescribing Perceived by Physicians

A survey among treating physicians revealed key challenges in deprescribing, with concerns about withdrawal effects, patient reluctance, and lack of alternative non-pharmacological interventions being major barriers.

Table 10: Physician-Reported Barriers to Deprescribing

Challenge	% of Physicians Reporting (n=50)
Fear of withdrawal effects	38 (76.0%)
Patient reluctance	32 (64.0%)
Lack of non-drug alternatives	27 (54.0%)
Limited time for medication review	19 (38.0%)

The findings confirm that hyper-polypharmacy significantly increases the risk of ADRs, drug-drug interactions, inappropriate prescribing, and hospital readmissions in elderly patients. These results underscore the urgent need for routine medication reviews, pharmacist-led deprescribing initiatives, and evidence-based prescribing strategies to mitigate polypharmacy-related risks in geriatric care.

DISCUSSION

This study highlights the significant impact of polypharmacy and hyper-polypharmacy on adverse drug reactions (ADRs), drug-drug interactions (DDIs), hospital readmissions, and prescribing appropriateness in elderly patients. The findings reveal that hyper-polypharmacy (≥10 medications) is strongly associated with an increased risk of ADRs, a higher incidence of severe drug interactions, and greater healthcare utilization, reinforcing the need for systematic medication review and deprescribing strategies in geriatric care**[10]**.

Polypharmacy and ADR Risk: Comparison with Existing Literature

The study found that 75% of patients in the hyper-polypharmacy group experienced at least one ADR, significantly higher than the 40.3% ADR rate observed in the polypharmacy group ($p<0.001$). These findings are consistent with previous studies by Maher et al. (2020) and Johnell & Klarin (2021), which reported that polypharmacy increases ADR risk due to cumulative drug exposure, altered pharmacokinetics in elderly patients, and a higher likelihood of drug-drug interactions**[11]**. The WHO defines polypharmacy as a major public health concern, emphasizing that patients on multiple medications are at a higher risk of unrecognized ADRs, leading to prescribing cascades. The present study reinforces this concept, demonstrating that hyper-polypharmacy patients were more likely to experience moderate-to-severe ADRs ($p=0.009$), requiring hospitalization, intensive monitoring, or medical intervention.

The most common ADRs observed in this study—gastrointestinal disturbances (28%), dizziness (21%), hypoglycemia (19%), bleeding complications (14%), and falls (10%)—were similar to findings from studies by Salahudeen et al. (2019) and Onder et al.

(2022). These ADRs were primarily associated with antihypertensives, antidiabetics, NSAIDs, anticoagulants, and psychotropic drugs, suggesting that high-risk medications in elderly patients should be reviewed periodically to minimize adverse effects**[12]**.

Drug-Drug Interactions and Prescribing Inappropriateness

A key finding of this study was the higher prevalence of clinically significant DDIs in the hyper-polypharmacy group, with 32.1% of patients experiencing moderate interactions and 21.4% experiencing severe interactions (p=0.003). Severe DDIs often resulted in increased drug toxicity, therapeutic failure, and unanticipated ADRs, requiring dose modifications or discontinuation. These results align with research by Gupta et al. (2021) and Hines et al. (2020), who highlighted that polypharmacy increases the complexity of medication regimens, making patients more susceptible to dangerous drug interactions**[13]**.

The application of STOPP/START criteria revealed that 46.4% of hyper-polypharmacy patients had at least one potentially inappropriate medication (PIM), compared to 19.4% in the polypharmacy group (p=0.006). This finding underscores the high prevalence of suboptimal prescribing practices in elderly patients and highlights the need for integrated clinical decision-support systems to guide appropriate medication use. The START criteria also identified essential medication omissions in 21.4% of hyper-polypharmacy patients, emphasizing that polypharmacy is not only a concern of excessive prescribing but also inappropriate deprescribing or omission of necessary therapy**[14]**.

Clinical Consequences: Hospitalizations and Readmissions

The study confirmed that ADR-related hospitalizations and extended hospital stays were significantly higher in hyper-polypharmacy patients (p=0.003). A substantial 32.1% of hyper-polypharmacy patients required hospitalization due to ADRs, compared to only 6.9% in the polypharmacy group. These findings correlate with research by Zhang et al. (2018) and Budnitz et al. (2021), which demonstrated that polypharmacy is a leading contributor to preventable hospital admissions among elderly patients. Furthermore, ADR-related readmissions within 30 days of discharge were significantly higher in hyper-polypharmacy patients (p=0.008), further emphasizing the long-term impact of medication-related complications on healthcare utilization**[15]**.

Economic analysis revealed that ADR-related hospitalization costs were significantly higher in hyper-polypharmacy patients, with an average cost of INR 26,700 compared to INR 18,400 in the polypharmacy group (p<0.001). This reinforces existing evidence from van der Linden et al. (2020), which showed that increased medication burden directly contributes to rising healthcare expenditures, primarily through hospital admissions, extended inpatient stays, and additional diagnostic testing.

Challenges in Deprescribing and Medication Optimization

Despite the well-established risks of polypharmacy, this study identified significant barriers to deprescribing among physicians, including concerns about withdrawal effects (76%), patient reluctance (64%), and lack of non-drug alternatives (54%). These challenges align with findings from Reeve et al. (2019), which emphasized that physician hesitation, limited deprescribing guidelines, and patient resistance hinder efforts to optimize medication regimens. Addressing these concerns requires structured deprescribing interventions, pharmacist-led medication reconciliation, and greater patient education on medication risks.

Several studies, including Scott et al. (2020) and Farrell et al. (2021), have highlighted the benefits of pharmacist-driven deprescribing protocols, which have been shown to reduce ADR incidence, improve patient adherence, and enhance clinical outcomes. The findings of this study further support the need for routine medication reviews, deprescribing initiatives, and multidisciplinary team-based approaches to reduce polypharmacy risks.

Clinical Implications and Recommendations

The study findings suggest several key recommendations for improving medication safety in elderly patients:

1. Routine Medication Reviews: Periodic medication assessments should be incorporated into geriatric care plans, especially for patients on ten or more medications.
2. Pharmacist-Led Deprescribing Programs: Pharmacist involvement in medication reconciliation, deprescribing, and patient education can significantly reduce inappropriate prescribing and ADR risk.
3. Integration of STOPP/START Criteria in Clinical Practice: These tools should be standardized in electronic medical records (EMRs) to help identify potentially inappropriate prescriptions.
4. Targeted Education on Polypharmacy Risks: Healthcare providers and patients should receive structured education on medication safety, risk minimization, and non-drug alternatives where applicable.
5. Research on Long-Term Outcomes of Deprescribing: Further studies should assess the impact of deprescribing interventions on long-term patient outcomes, ADR recurrence, and healthcare costs.

Strengths and Limitations of the Study

This study has several strengths, including its prospective design, systematic ADR monitoring, use of validated causality assessment tools (WHO-UMC scale, Naranjo Probability Scale), and incorporation of STOPP/START criteria for prescribing evaluation. Additionally, the study provides real-world evidence on ADR-related hospitalizations and economic costs in a tertiary care setting, making the findings clinically relevant for geriatric practice.

However, certain limitations should be acknowledged. The sample size (n=100) was relatively small, which may limit the generalizability of the findings to larger populations. Additionally, the follow-up period was limited to 30 days, preventing long-term evaluation of ADR recurrence and deprescribing outcomes. Furthermore, the study was conducted in a single tertiary care center, which may not fully capture prescribing trends and medication safety challenges in rural or primary healthcare settings. Future studies with larger cohorts, extended follow-up durations, and multicenter participation are needed to further validate these findings and refine deprescribing strategies.

CONCLUSION

This study provides compelling evidence that polypharmacy, particularly hyper-polypharmacy involving ten or more medications, significantly increases the risk of adverse drug reactions (ADRs), drug-drug interactions (DDIs), inappropriate prescribing, and healthcare burden in elderly patients. The findings reveal that the incidence of ADRs was markedly higher in the hyper-polypharmacy group, with a greater proportion of moderate-to-severe reactions requiring medical intervention or hospitalization. The most frequently implicated drug classes included antihypertensives, antidiabetics, NSAIDs, anticoagulants, and psychotropic medications, with ADRs manifesting primarily as gastrointestinal disturbances, dizziness, hypoglycemia, bleeding complications, and falls. Furthermore, the prevalence of clinically significant DDIs was substantially higher in hyper-polypharmacy patients, indicating the complexity of managing multiple medications and the increased likelihood of unintended pharmacological effects.

The findings underscore the urgent need for routine medication reviews, pharmacist-driven deprescribing interventions, and evidence-based prescribing strategies to mitigate polypharmacy-related risks in elderly patients. Regular medication assessments should be integrated into geriatric care to identify unnecessary or harmful drugs while ensuring the continued use of essential medications. Pharmacist-led deprescribing programs can play a crucial role in improving medication safety, enhancing adherence, and reducing ADR-related hospitalizations. Additionally, the incorporation of clinical decision-support tools, such as the STOPP/START criteria, into electronic medical records, can help physicians make informed prescribing decisions and minimize inappropriate medication use. Educating healthcare providers and patients about the risks of polypharmacy, safe medication management, and the benefits of deprescribing is also essential for fostering a more proactive approach to medication safety.

This study provides compelling evidence that hyper-polypharmacy significantly increases the risk of ADRs, drug-drug interactions, hospitalization, and economic burden in elderly patients. Given the rising elderly population and the growing prevalence of multimorbidity, systematic medication reviews, pharmacist-led deprescribing, and clinical decision-support tools should be integrated into routine geriatric care to minimize polypharmacy-related risks. By optimizing prescribing practices, healthcare providers can reduce ADR-related hospitalizations, improve medication adherence, and enhance overall patient outcomes in elderly populations.

While this study provides valuable insights into the impact of polypharmacy, further research is needed to explore the long-term effects of deprescribing interventions, patient adherence to medication adjustments, and the cost-effectiveness of pharmacist-led medication optimization programs. Future studies should focus on multicentred trials with larger cohorts and extended follow-up periods to validate deprescribing strategies and refine geriatric prescribing guidelines. Given the increasing aging population and the rising burden of chronic diseases, implementing structured medication management approaches will be crucial for improving patient safety, reducing preventable ADR-related hospitalizations, and promoting rational prescribing in elderly populations.

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