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Evaluation of Drug–Drug Interactions in Polypharmacy Among Elderly Patients

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ABSTRACT

With the growing prevalence of comorbidities among the elderly population, polypharmacy has become a common practice, raising significant concerns about drug–drug interactions (DDIs). This retrospective observational study aimed to evaluate the prevalence, severity, and clinical implications of DDIs in elderly patients aged 65 years and above who were prescribed five or more medications during hospitalization at a tertiary care hospital. Data from 150 patient records were analyzed using Lexicomp® and Micromedex® drug interaction checkers. The findings revealed that 78.7% of patients experienced at least one potential DDI, with a total of 439 interactions identified—of which 55.4% were of moderate severity and 22.3% were major. A statistically significant association ($p < 0.001$) was observed between the number of medications and the occurrence of DDIs. The most frequent interacting drug classes included antihypertensives with NSAIDs, anticoagulants with antibiotics, and oral hypoglycemics with corticosteroids. The study highlights the need for routine DDI screening, rational prescribing, and interdisciplinary collaboration to enhance medication safety in geriatric care.

Key Words:

Polypharmacy, Drug–Drug Interactions, Elderly Patients, Geriatric Pharmacotherapy, Retrospective Study, Lexicomp, SPSS, Medication Safety

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1. INTRODUCTION

Life expectancy has gone up over the world, which has resulted to a big growth in the number of older people. This has also led to a rise in chronic health problems such arthritis, diabetes, heart disease, and high blood pressure. Polypharmacy is the practice of taking more than one medicine at the same time to treat certain illnesses. Polypharmacy is often important for managing a condition fully[1], but it greatly increases the danger of drug-drug interactions (DDIs), especially in older people whose bodies and metabolisms change as they get older. Elderly patients have a smaller margin of safety for medications because their kidneys and livers don't work as well, their pharmacokinetics change, and they are more sensitive to pharmaceuticals[2]. Because of this, the chance of bad outcomes from DDIs becomes higher, which could mean hospitalizations, longer stays, or even death. Even though medications are commonly used in geriatric care, DDIs often go overlooked or are not handled properly in clinical settings[3]. So, it's important to know the patterns, frequency, and clinical effects of DDIs in older people who take a lot of different medications in order to make treatment safer, make sure patients get good care, and lower the costs of healthcare[4].

1.1.Background Information

Polypharmacy, or taking five or more medications at the same time, is prevalent in geriatric care because many of them have more than one chronic illness[5]. As people get older, they usually need more complicated prescription regimens, which raises the possibility of drug-drug interactions that might make the drugs less effective, more toxic, or cause unforeseen side effects[6]. A number of studies have shown that older people are more likely to have clinically significant DDIs because they take too many medications, get the wrong prescriptions, or don't get their medications reviewed often enough. Healthcare practitioners can use computerized interaction checkers like Lexicomp® and Micromedex® to find and reduce possible DDIs, but these technologies are not always used in normal treatment[7]. So, it's important to look at how often and what kinds of DDIs are in real-life situations for older adults in order to help doctors prescribe drugs safely and promote rational pharmacotherapy[8].

1.2.Statement of the Problem

Even though polypharmacy is very common among older patients in the hospital, drug-drug interactions are often not recorded enough and not dealt with properly in clinical settings. This mistake can cause bad drug reactions[9], longer hospital stays, higher healthcare costs, and illnesses that could have been avoided. Many healthcare facilities do not regularly use validated technologies to systematically check for DDIs[10]. Also, there isn't much regional data on how bad and how many DDIs really are among senior inpatients. Because of these problems, it is very important to look into the patterns of polypharmacy and the risks of DDIs that come with it in order to make geriatric medicine safer for patients and help doctors make better decisions about what to prescribe.

1.3.Objectives of the Study

The present study was conducted with the following objectives:

- To determine the prevalence of potential drug–drug interactions among elderly patients undergoing polypharmacy in a tertiary care hospital.
- To categorize the severity of identified drug–drug interactions using clinically validated drug interaction screening tools.
- To identify the most commonly interacting drug classes and assess the patterns of clinically significant interactions.
- To examine the statistical association between the number of medications prescribed and the occurrence of drug–drug interactions in the geriatric population.

2. METHODOLOGY

The study's goal was to find out how common drug-drug interactions (DDIs) are in older people who take more than one medication and how important they are for their health. Because more and more older people have more than one health problem, they often take more than one drug, which increases the likelihood of bad interactions. The technique was set up to systematically find and study these interactions by employing clinical records and technologies for detecting drug interactions.

2.1.Description Of Research Design

This study used a retrospective observational methodology. We looked at patient medical records to find out what medications were administered and to see how common and what kinds of drug-drug interactions were happening among older people who were taking a lot of medications at once.

2.2.Sample Details

The sample was made up of older patients, 65 and older, who were admitted to the internal medicine and geriatrics departments of a tertiary care hospital for six months. People who were given five or more drugs while they were in the hospital were included. People who didn't have complete medication records were not included. The study looked at 150 patient records in all.

2.3.Instruments And Materials Used

This study established a standard form for extracting data that includes patient information, clinical diagnoses, and drugs that were prescribed. The Lexicomp® Drug Interaction Checker and the Micromedex® Drug Interaction Database were used to find and sort drug-drug interactions. Both of these are evidence-based tools that are often used in clinical pharmacology.

2.4.Procedure And Data Collection Methods

With prior ethical approval and agreement, the hospital's electronic health records system was used to get patient records. We got the relevant information on age, gender, diagnosis, and drug prescriptions. We used interaction screening methods to look for possible DDIs in each list of medications. We put interactions into groups based on how serious they were (small, moderate, or severe) and how important they were to the patient.

2.5.Data Analysis Techniques

This research used SPSS version 26.0 to enter and analyze the data. We figured out descriptive statistics like means, frequencies, and percentages. We used chi-square testing to find out if there was a link between the number of drugs and the number of DDIs. We also looked at how bad DDIs were based on things like the patient's age group and how many other health problems they had.

3. RESULTS

This part talks about the results of a study that looked at drug-drug interactions (DDIs) among older people who were taking a lot of different drugs. We got information from 150 records of older patients who were treated in the internal medicine and geriatrics departments of a tertiary care hospital. The study looked at how common, what kinds, and how serious DDIs are, as well as how they are related to patient demographics and the amount of drugs they use.

3.1. Demographic Profile of Participants

Out of 150 patients, 87 (58%) were male and 63 (42%) were female. The majority belonged to the age group of 71–80 years (n = 63, 42%), followed by 61–70 years (n = 49, 32.7%), and above 80 years (n = 38, 25.3%).

Table 1: Age and Gender Distribution of Participants

Age Group (Years)	Male	Female	Total
61–70	27	22	49
71–80	38	25	63
>80	22	16	38
Total	**87**	**63**	**150**

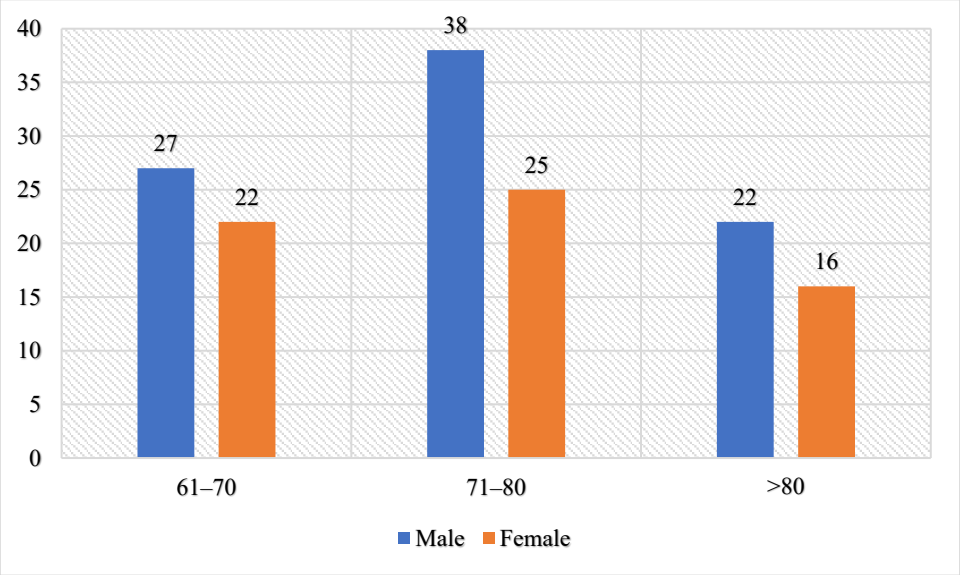

Figure 1: Graphical Representation of Age and Gender Distribution of Participants

Table 1 indicates how old and what gender the 150 elderly patients in the study were. Most of the people who took part (42%) were between the ages of 71 and 80. The next biggest group was between the ages of 61 and 70 (32.7%), and the last group was over 80 (25.3%). The sample had a significantly higher percentage of males (58%) than females (42%). The most males were in the 71–80 age range. This distribution is typical of a geriatric hospital population, as older men commonly have several health problems that need them to be hospitalized.

3.2. Number of Medications Prescribed

The number of medications prescribed per patient ranged from 5 to 14. The highest frequency was observed in the 6–8 drug category (n = 67), followed by 9–11 drugs (n = 53), and 5 drugs (n = 19). Only 11 patients received more than 11 drugs.

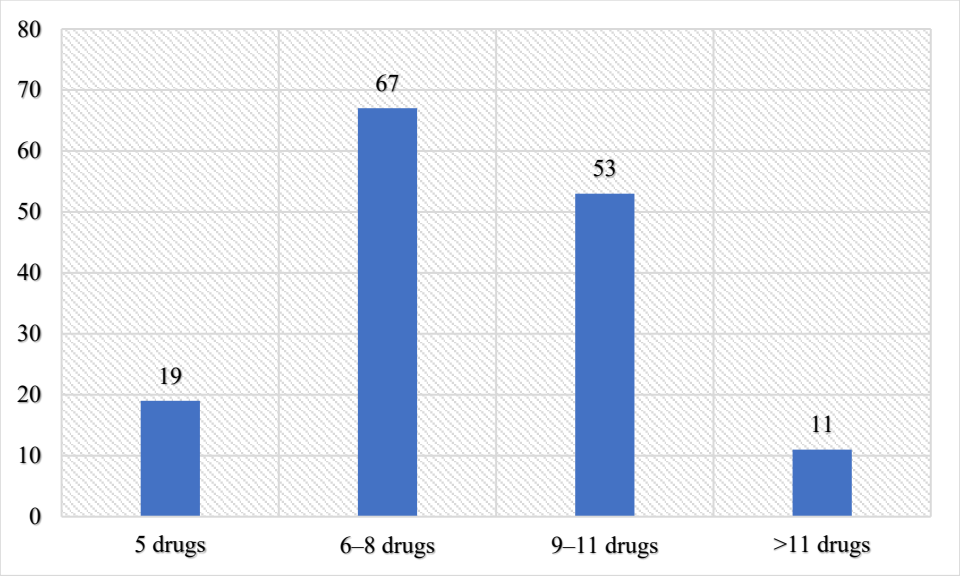

Figure 2: Distribution of Patients Based on Number of Medications Prescribed

3.3. Prevalence And Severity of Drug–Drug Interactions

Out of 150 patients, 118 (78.7%) experienced at least one potential DDI. A total of 439 drug–drug interactions were identified. These were categorized based on severity:

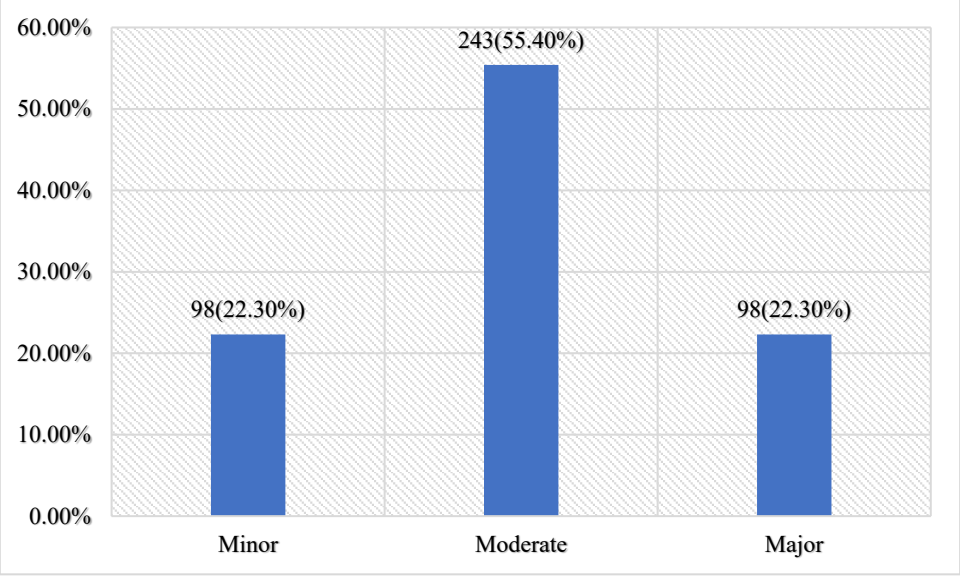

Figure 3: Severity Classification of Identified Drug–Drug Interactions

Figure 3 shows how serious the 439 drug-drug interactions found in older adults were. Most of the interactions were of intermediate severity (55.4%), which means they could have a big effect on the patient and need to be watched or the dose changed. There were 22.3% of both minor and significant interactions, which shows that even though many interactions may not have much clinical significance, a large number of them posed serious hazards that could have bad effects if not handled correctly.

3.4. Frequently Interacting Drug Classes

The most common interacting drug classes included:

- Antihypertensives and NSAIDs
- Anticoagulants and antibiotics
- Oral hypoglycemics and corticosteroids

Table 2: Common Drug Class Interactions Observed

Drug Class 1	Drug Class 2	Frequency of Interaction
Antihypertensives	NSAIDs	64
Anticoagulants	Antibiotics	52
Oral Hypoglycemics	Corticosteroids	39
Beta Blockers	Calcium Channel Blockers	36
Diuretics	ACE Inhibitors	31

Table 3 shows the drug classes that the elderly patients most often interacted with. There were 64 interactions between antihypertensives and NSAIDs, which was the most. Anticoagulants and antibiotics had 52 interactions, which was the second most. It was also typical for oral hypoglycemics and corticosteroids (39), beta blockers and calcium channel blockers (36), and diuretics and ACE inhibitors (31) to interact with each other. These results show how important it is to keep an eye on drug combinations that affect the heart and metabolism, since they can cause serious drug-drug interactions in older people who take a lot of drugs.

3.5. Statistical Analysis

A chi-square test was conducted to examine the association between the number of medications and the presence of drug–drug interactions.

Table 3: Chi-Square Test - Association between Number of Drugs and DDIs

Variable	Value
Pearson Chi-Square	23.982
df	3
Asymp. Sig. (2-sided)	0

The findings of a chi-square test that looked at the link between the number of drugs prescribed and the number of drug-drug interactions (DDIs) are shown in Table 3. The Pearson Chi-Square value of 23.982 with 3 degrees of freedom and a p-value of 0.000 shows that there is a statistically significant link ($p < 0.05$). This means that older individuals are far more likely to get DDIs when the number of medications they take goes up.

Table 4: Cross-tabulation of DDIs by Number of Medications

No. of Medications	Patients with DDIs	Patients without DDIs	Total Patients
5	10	9	19
6–8	55	12	67
9–11	47	6	53
>11	6	5	11

Total	**118**	**32**	**150**

Table 4 shows how the number of medications taken affects the number of drug-drug interactions (DDIs). The more drugs a patient took, the more likely they were to have DDIs. For example, 52.6% of patients taking 5 drugs had DDIs, whereas 82.1% of patients taking 6–8 drugs had DDIs, 88.7% of patients taking 9–11 drugs had DDIs, and 54.5% of patients taking more than 11 drugs had DDIs. This trend shows that polypharmacy is strongly linked to a higher risk of DDIs, especially in people who are taking between 6 and 11 drugs.

4. DISCUSSION

This study looked at how common, serious, and pattern-like drug-drug interactions (DDIs) were among older patients who were taking multiple medications in a tertiary care hospital. As people get older, they often have more than one health problem at the same time. Taking more than one prescription at the same time raises major concerns about possible drug-drug interactions (DDIs), which could make treatment less effective. The results of this study give us important information about how often and what kinds of DDIs happen, how they relate to the number of drugs taken, and the drug classes that tend to interact with each other in geriatric clinical practice.

4.1.Interpretation Of Results

The results showed that 78.7% of older patients had at least one possible DDI, and there were a total of 439 interactions found. Moderate interactions made up the highest number (55.4%), which means that even while they aren't immediately life-threatening, they need to be closely watched by a doctor, have their doses changed, or be replaced. The fact that there are so many substantial DDIs (22.3%) shows how likely it is that this group will have serious problems.

There was a strong link between the number of drugs and the number of DDIs ($\chi^2 = 23.982$, $p < 0.001$). Patients who took 6 to 11 medicines had the highest risk, with up to 88.7% developing DDIs. This shows a definite link between the number of drugs used and the number of DDIs. This backs up what other studies have found about polypharmacy and a higher incidence of DDI.

Antihypertensives with NSAIDs, anticoagulants with antibiotics, and oral hypoglycemics with corticosteroids were the pharmacological classes that interacted the most. In geriatric care, these combinations are often given to people with chronic disorders such diabetes, high blood pressure, heart disease, and infections. However, they have a high risk of drug-drug interactions, especially when not closely monitored.

4.2.Comparison with Existing Studies

The results of this study are in line with those of other international and regional studies that stress how common and important drug-drug interactions (DDIs) are in older people who take a lot of different medications. For example, Bojuwoye et al. (2022)[11] found that more than 70% of elderly outpatients in South Africa were at risk of DDIs, with NSAIDs, antihypertensives, and antibiotics being the most common drug classes involved. This is similar to our study, where antihypertensives and NSAIDs had the highest interaction rate. Alemayehu et al. (2024)[12] did a systematic review and meta-analysis in Ethiopia and found that polypharmacy

greatly raised the risk of moderate to major DDIs among older people. This confirmed our finding that there is a link between the number of medications and the severity of interactions. Sheikh-Taha and Asmar (2021)[13] did a study in the United States that looked at older people with heart disease. They found that most of them were given interacting medications, often without enough monitoring. This is in line with our findings that show that drug classes related to heart disease are major causes of DDIs. Alhumaidi et al. (2023)[14] identified a similar trend in Saudi Arabia, where the number of DDIs increased as the number of medications increased. This supports the statistically significant ($p < 0.001$) link we found between polypharmacy and DDI occurrence. Adem and Tegegne (2022)[15] also said that up to 60% of senior cardiovascular patients in Ethiopia had at least one severe DDI. The patterns of interaction severity they found were quite similar to the moderate and major proportions we found in our group. These studies all support the results of the current analysis and show that organized DDI monitoring is important all over the world, especially for older people who are more likely to be at risk for polypharmacy-related problems. The fact that different healthcare systems use the same screening criteria shows how important it is for elderly pharmacotherapy to involve people from many different fields around the world.

4.3.Implications of Findings

These results have substantial clinical implications for the use of drugs in older people. First, because DDIs are so common, DDI screening should be a regular element of medication review for older patients, especially when they are admitted to the hospital. Medication reconciliation and therapy optimization should be done by clinical pharmacists to find and reduce potentially hazardous interactions.

Second, doctors should focus on reasonable prescribing procedures, especially for patients with a lot of other health problems, to keep them from taking drugs they don't need. Integrating clinical decision-support systems into hospital electronic health records can help prescribers by sending them information in real time about combinations that could be dangerous.

The data show how important it is for doctors, nurses, and pharmacists to work together to care for older patients. Polypharmacy can be less risky if people talk to one other and evaluate their treatment plans from time to time.

4.4.Limitations of the Study

While the study provides valuable insights, it is not without limitations:

- The retrospective design used existing medical records, which may not have provided all the information they needed.
- The research only looked at possible DDIs found by software techniques; it didn't look at real clinical outcomes or bad occurrences.
- The study took place at only one tertiary care hospital, which may make it hard to apply the results to other healthcare settings or areas.
- Some factors, like kidney or liver function, length of treatment, and patient compliance, were not included, even though they can have a big effect on the clinical relevance of DDIs.

4.5.Suggestions For Future Research

To build upon these findings, future studies should consider the following directions:

- Doing prospective cohort studies that keep track of both the number of DDIs and the clinical outcomes in older people.
- Making the study more representative and generalizable by include more centres or geographic areas.
- Adding pharmacokinetic and pharmacodynamic factors, like organ function and drug levels, to get a better picture of how DDIs really affect people.
- Creating and testing intervention models, including digital alert systems or pharmacist-led drug reviews, to see how well they work at lowering the number of DDIs.
- Looking at how much healthcare providers know about polypharmacy and DDIs in geriatric care and how they prescribe medications.

5. CONCLUSION

This study brings attention to the important issue of drug-drug interactions (DDIs) in elderly patients who are taking many medications in a hospital setting. As geriatric care gets more complicated and more people have many chronic illnesses, the risk of bad drug interactions goes up a lot. A study of 150 records of senior patients showed strong evidence that the more medications a person takes, the more likely they are to have clinically significant DDIs, many of which have moderate to serious hazards. These results show how important it is to manage medications proactively, evaluate patients regularly, and be on the lookout for problems in geriatric pharmacotherapy to keep patients safe.

5.1.Summary Of Key Findings

- 78.7% of elderly patients experienced at least one potential DDI.
- A total of 439 DDIs were identified, with 55.4% classified as moderate, and 22.3% each as major and minor.
- The prevalence of DDIs increased with the number of medications prescribed, with the highest rates observed in patients taking 6–11 drugs.
- Statistically significant association was found between the number of medications and the incidence of DDIs ($p < 0.001$).
- The most frequent interacting drug classes included antihypertensives with NSAIDs, anticoagulants with antibiotics, and oral hypoglycemics with corticosteroids.

5.2.Significance of the Study

This study adds to the expanding body of evidence about how polypharmacy affects the care of older people. It shows how important it is to include systematic DDI screening in regular clinical procedures, especially for older people who are more likely to have bad drug reactions. The results represent a starting point for making prescriptions safer, improving medication regimes, and strengthening the roles of clinical pharmacists and decision-support systems in caring for older patients. The study helps raise awareness of possible pharmaceutical dangers and helps drive evidence-based therapeutic options by finding the patterns and severity of DDIs.

5.3.Recommendations

Based on the study's findings, the following recommendations are proposed:

1. Use clinical software (like Lexicomp or Micromedex) to do routine DDI screening on older patients before giving them drugs.
2. Encourage doctors, pharmacists, and nurses to work together to make sure that all medications are reviewed and that the risk of DDI is lower.
3. To cut down on unneeded polypharmacy, make sure to review treatment plans often, especially when a patient is admitted to the hospital, transferred, or discharged.
4. Add clinical decision-support capabilities to electronic health records so that they can send real-time alarms about drug combinations that could be dangerous.
5. Hold training and awareness events for healthcare professionals to emphasize safe prescribing practices that are specific to the requirements of older adults.
6. Support future research that looks at how to prevent bad outcomes from DDIs and tests different ways to help in different healthcare settings.

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