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Adverse Drug Reactions Associated with Polypharmacy in Elderly Patients

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Abstract: ***Background:*** Chronic conditions that need long-term treatment are a common problem in elderly patients and lead to the high prevalence of polypharmacy. Medication safety remains a major challenge in geriatric care, as the use of multiple medications increases the risk of adverse drug reactions (ADRs), drug–drug interactions, hospitalization, and mortality.***Objective:*** The study aimed to determine the frequency and patterns of adverse drug reactions (ADRs) associated with polypharmacy among elderly patients and to identify factors contributing to the occurrence of ADRs.***Methodology:*** This was a cross-sectional study carried out in the Department of Medicine Khyber Teaching Hospital, Peshawar from jan 2025 to june 2025. over a period of six months. Patients were recruited consecutively into the study to make up 100 elderly patients (aged ≥65 years) taking 5 or more medicines. A structured proforma was used to record demographic data, comorbidities, medication profiles and ADRs. The medications were identified as causing ADRs by clinical assessment and medication review. The analysis of the data was carried out using SPSS 26. The quantitative variables were presented in the form of mean and standard deviation, and qualitative variables were presented as frequencies and percentages. A p-value < 0.05 was deemed significant.***Results:***The 100 participants, 58% were male and 42% were female. The mean age was 72.4 ± 6.8 years. Polypharmacy (5–9 medications) was observed in 67% of patients, while 33% had hyper polypharmacy (≥10 medications). ADRs were identified in 38% of patients. The most common ADRs included dizziness (26.3%), gastrointestinal disturbances (21.1%), hypotension (18.4%), hypoglycemia (13.2%), and renal dysfunction (10.5%). Patients with ADRs had a significantly higher mean number of prescribed medications than those without ADRs (9.2 ± 2.1 vs. 6.7 ± 1.8; p=0.002). Hyper polypharmacy (p=0.01) and multiple comorbidities (p=0.03) were significantly associated with ADR occurrence.***Conclusion:***Polypharmacy is associated with adverse drug reactions in elderly people. Risk of ADR is very high with multiple comorbidities and high medication burden. Medication rational prescribing and routine review of medications are vital to enhance medication safety and minimise preventable drug-related complications.

Keywords: Polypharmacy; Elderly Patients; Adverse Drug Reactions; Drug Safety.

INTRODUCTION

Concurrently taking five or more drugs, or polypharmacy, is an important problem for the health of older people in the world. With the rise in prevalence of chronic conditions like hypertension, diabetes mellitus, ischemic heart disease, chronic kidney disease and chronic obstructive pulmonary disease, the number of medications that older people take has also significantly increased. The use of polypharmacy is associated with medication errors, drug–drug interactions, adverse drug reactions (ADRs) and poor adherence to treatment, although a combination of appropriate pharmacotherapy is also important for disease management and improving quality of life [1,2]. Physiological changes related to aging impact pharmacokinetics and pharmacodynamics. Elderly individuals are especially susceptible to complications of drug use because of decreased renal clearance, decreased hepatic metabolism, changes in body composition and increased response to some drugs. Thus, the adverse effects of medications that are relatively harmless in younger adults can be serious in older patients. The burden of ADRs in elderly care is significant due to these age-related changes and polypharmacy [3,4]. Adverse drug reactions are considered to be negative and unwanted reactions to a drug that occur at a normal therapeutic dose. ADRs are a significant contributor to morbidity and mortality at the global level and can account for a large share of hospitalisation in elderly people.Ten or more medications are likely to cause serious and possibly avoidable adverse events in elderly people. Common ADRs in this population include dizziness, falls, hypotension, cognitive impairment, gastrointestinal disturbances, bleeding complications, hypoglycemia, electrolyte imbalances and renal dysfunction [5,6].

MATERIALS AND METHODS

This was a cross-sectional study carried out in the Department of Medicine Khyber Teaching Hospital, Peshawar from jan 2025 to june 2025

Participants

This study focused on elderly patients (aged 65 years and older) seen in an outpatient clinic or admitted to the medical wards during the study period. Consecutive sampling was used to recruit patients who were taking five or more drugs for at least 3 months. The collected information included demographic data, medication history, comorbid conditions, and adverse drug reactions, which were collected through a proforma.

Sample Size Calculation

The impacts of ADRs are not limited to clinical symptoms. They are associated with longer hospital stays, higher healthcare costs, loss of function, diminished healthcare quality of life and mortality. In addition, the burden of ADR related hospitalizations is a heavy burden on healthcare systems, especially in developing countries where resources are scarce. Therefore, the early identification and prevention of ADRs are an integral part of the care of geriatric patients [7,8]. Several factors affect the incidence of ADRs in geriatric patients. These include advanced age, female gender, multiple comorbidities, inappropriate prescribing, self-medication, inability to monitor medications and impaired renal or hepatic function. Hyper polypharmacy (the use of 10 or more medicines) has been identified as one of the most significant risk factors for adverse drug events. To reduce the use of potentially inappropriate medicines, regular medication reviews have been recommended, as has the use of prescribing tools (Beers Criteria and STOPP/START criteria) [9]. Despite the rising public awareness about medication safety, there is still a lack of awareness about ADRs in many healthcare environments. Information on the prevalence and predictors of ADRs related to polypharmacy in the elderly is still scarce. To create effective preventive strategies and better patient outcomes, it is essential to know the frequency, patterns, and associated risk factors of ADRs. Hence, this study was done to determine adverse drug reactions of polypharmacy in elderly patients and factors that are likely to cause these [10].

Study Objectives

To find out how often and in what pattern the adverse drug reactions occur in elderly people who take multiple drugs, and to identify demographic and clinical risk factors for ADRs in this group.

Based on the expected prevalence of ADR of 50%, 95% confidence level and 10% margin of error, the minimum sample size required was determined to be 96 patients. A total of 100 elderly patients were included in the study to compensate for the incomplete data and potential exclusions.

Inclusion Criteria

- Patients aged ≥65 years.
- Having ≥5+ prescribed medications.

Exclusion Criteria

- Patients who require critical care but cannot give medical information.
- People whose health records are not complete.

Diagnostic and Management Strategy

Potential ADRs were detected by clinical assessment, medication history, laboratory tests and physician

evaluation. Suspected reactions recorded, causal determination made and if necessary, therapeutic modification or supportive measures taken.

Statistical Analysis

The data were entered and analysed using SPSS version 26. All quantitative data were reported as mean ± SD, and categorical data were reported as percentages and frequencies. Chi-square test and independent t-test were used to determine the associations between variables. The p-value < 0.05 was regarded as statistically significant.

RESULTS

A total of 100 elderly patients were enrolled in the study. Of these, 58 (58%) were male and 42 (42%) were female. The overall mean age was 72.4 ± 6.8 years, with ages ranging from 65 to 89 years. Hypertension (72%), diabetes mellitus (58%), ischemic heart disease (35%), and chronic kidney disease (18%) were the most common comorbid conditions observed. Polypharmacy involving 5–9 medications was identified in 67 (67%) patients, while hyper polypharmacy (≥10 medications) was observed in 33 (33%) patients. Adverse drug reactions were documented in 38 (38%) participants. The most frequently reported ADRs included dizziness in 10 (26.3%) patients, gastrointestinal disturbances in 8 (21.1%), hypotension in 7 (18.4%), hypoglycemia in 5 (13.2%) and renal dysfunction in 4 (10.5%). Patients who developed ADRs were prescribed a significantly higher number of medications compared to those without ADRs (9.2 ± 2.1 versus 6.7 ± 1.8; p=0.002). Hyper polypharmacy demonstrated a significant association with ADR occurrence (p=0.01). Similarly, the presence of three or more comorbidities was significantly associated with ADR development (p=0.03). Gender was not significantly associated with ADR occurrence (p=0.41). ADR-related hospitalization occurred in 12 (12%) patients, highlighting the clinical burden associated with medication-related complications among elderly individuals.

Table 1. Demographic and Clinical Characteristics of Study Participants (n = 100)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	58	58.0
Female	42	42.0
Age Group (Years)		
65–69	28	28.0
70–74	34	34.0
75–79	22	22.0
≥80	16	16.0
Comorbidities		
Hypertension	72	72.0
Diabetes Mellitus	58	58.0
Ischemic Heart Disease	35	35.0
Chronic Kidney Disease	18	18.0
Chronic Obstructive Pulmonary Disease	15	15.0

Values are presented as frequencies and percentages. Mean age of participants was 72.4 ± 6.8 years.

Table 2. Medication Burden Among Elderly Patients (n = 100)

Number of Medications	Frequency (n)	Percentage (%)
5–7 medications	41	41.0
8–9 medications	26	26.0
≥10 medications (Hyper polypharmacy)	33	33.0
Total	**100**	**100.0**

Polypharmacy was defined as the concurrent use of 5–9 medications, while hyper polypharmacy was defined as the use of 10 or more medications.

Table 3. Pattern of Adverse Drug Reactions Among Study Participants (n = 38)

Adverse Drug Reaction	Frequency (n)	Percentage (%)
Dizziness	10	26.3
Gastrointestinal disturbances	8	21.1
Hypotension	7	18.4
Hypoglycemia	5	13.2
Renal dysfunction	4	10.5
Electrolyte imbalance	2	5.3
Allergic reactions	2	5.3
Total ADR Cases	**38**	**100.0**

ADRs were identified through clinical assessment, medication review, and relevant laboratory investigations. Percentages were calculated among patients who developed ADRs (n = 38).

Table 4. Factors Associated with Adverse Drug Reactions

Variable	ADR Present (n=38)	ADR Absent (n=62)	P-value
Mean number of medications	9.2 ± 2.1	6.7 ± 1.8	0.002
Hyper polypharmacy (≥10 drugs)	19 (50.0%)	14 (22.6%)	0.010
≥3 Comorbidities	24 (63.2%)	24 (38.7%)	0.030
Male Gender	24 (63.2%)	34 (54.8%)	0.410
ADR-related hospitalization	12 (31.6%)	0 (0.0%)	<0.001

Statistical significance was assessed using Chi-square test for categorical variables and independent sample t-test for continuous variables. A p-value ≤0.05 was considered statistically significant. Hyper polypharmacy and multiple comorbidities were significantly associated with increased risk of adverse drug reactions

DISCUSSION

The present study aimed to assess the adverse drug reactions (ADRs) of polypharmacy in elderly patients and to find the factors that lead to the occurrence of ADRs in elderly patients with polypharmacy. The results showed that 38% of the participants had at least one ADR, underlining the high level of medication-related complications in the geriatric population. This prevalence is similar to the recent reports of incidences of ADR ranging from 25% to 45% in older people who have received several drugs [11]. This difference between studies could be explained by the differences in study design, healthcare setting, how patients were detected, and patient characteristics. The average age of the participants of our study was 72.4 ± 6.8 years, which falls within the range of 70 to 75 years achieved by Ahmed et al. and Zazzara et al. [12]. Advanced age has been identified as a risk factor for ADRs due to the physiological changes that occur in the elderly and lead to a greater risk of harm from medications. These findings have also been confirmed by multicenter studies, which showed that the incidence of ADRs was directly proportional to the age of patients [13]. Polypharmacy continues to be one of the most powerful predictors of the onset of ADR. Patients with ADRs had a significantly greater number of medication prescriptions than patients without ADRs (9.2 ± 2.1 vs. 6.7 ± 1.8, p = 0.002) in the current study. These results are congruent with recent research that demonstrates that the risk of ADRs is significantly raised with increasing numbers of drugs (above 5) and further increased with hyper polypharmacy [14,15]. The association is mostly attributed to the increased opportunities for drug–drug interactions, drug cascading, and medication errors. Our hyper polypharmacy rate was 33%, and was significantly associated with the occurrence of ADRs (p=0.01). The same results were achieved by Dagnew et al. and Marangoni et al., who found hyper polypharmacy to be an independent risk factor for adverse drug events in inpatients, the elderly [16]. The findings highlight the need for frequent medication review and deprescribing initiatives to decrease unnecessary medication burden in older people. In terms of the pattern of adverse drug reactions, dizziness, gastrointestinal disturbances, hypotension, and hypoglycemia were the most frequently reported reactions. Similar results were reported in recent studies where medications that interact with the cardiovascular system, antidiabetic medications, and central nervous system drugs were found to represent a significant percentage of ADRs in elderly people [17,18]. Certain symptoms are of concern, such as dizziness and hypotension, which raise the risk of falls, fractures, functional decline, and subsequent

hospitalization. The other key finding of the present study was the significant relationship between the occurrence of ADR and multiple comorbidities (p=0.03). More chronic conditions rendered patients more likely to experience ADRs than fewer chronic conditions. The same has been described in more recent research on geriatric studies [19], suggesting that multimorbidity often requires complex treatment combinations that expose patients to potentially dangerous combinations. Therefore, disease burden and medication burden should be taken into account when assessing the elderly patient [20]. Our study showed that 12% of participants were hospitalized due to ADRs. This is similar to the rates reported in recent systematic reviews that have suggested that around 10-15% of hospital admissions in older people are associated with medicines [20]. This is a considerable economic and clinical cost, and it is an indicator of the need for preventive interventions among high-risk patients.

Limitations

There were several shortcomings to this study. The results may not be generalizable due to the small sample size and single-center design. These included the cross-sectional design of the study, which did not allow for evaluation of long-term outcomes or causality. Furthermore, the lack of clinical documentation and patient recall may have led to underreporting of some adverse drug reactions.

CONCLUSION

Multiple drug usage is frequent in elderly patients, and adverse drug reactions are also frequently observed. Polypharmacy, hyperpolypharmacy, and multiple comorbidities are significant risk factors for ADR. Medication review, rational prescribing, and deprescribing are effective ways to reduce preventable drug-related complications, enhance the safety of patients, and maximize therapeutic benefits in the increasingly elderly population.

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