Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 3
Open Access

Association Between Polypharmacy and Hospital Readmissions in Elderly Patients with Cardiovascular Disease

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Cite this paper as: Tarig Osman (2024) Association Between Polypharmacy and Hospital Readmissions in Elderly Patients with Cardiovascular Disease . *Frontiersin Health Informatics, 26* (11), 4539-4546

Abstract
Background*: Multiple chronic conditions render polypharmacy prevalent among elderly people with cardiovascular disease (CVD). This study examines the correlation between polypharmacy and hospital readmissions in older cardiovascular patients, focusing on adverse drug reactions (ADRs), drug-drug interactions (DDIs), and medication adherence.*
Objectives*: To ascertain polypharmacy in elderly cardiovascular disease patients, investigate its correlation with hospital readmissions, evaluate the impact of adverse drug reactions and drug-drug interactions, and identify issues related to adherence and mortality risks associated with polypharmacy.*
Methodology*: A cross-sectional study was conducted at the Dhi Qar General Hospital in Iraq from September to December 2024. They enlisted 400 patients aged 65 and older with a verified diagnosis of cardiovascular disease (CVD). Polypharmacy denotes the concurrent use of five or more medications. We retrieved demographic data, clinical information, prescription details, and hospital readmission statistics from medical records at 30, 90, and 180 days post-discharge. we conducted logistic regression analysis on polypharmacy, readmission, adverse drug reactions (ADRs), drug-drug interactions (DDIs), and mortality, controlling for potential confounders.*
Results*: The results showed that polypharmacy affected half of the 400 patients. Readmission rates for polypharmacy patients significantly above those of non-polypharmacy patients at 30 days (20% vs 12%), 90 days (35% vs 20%), and 180 days (50% vs 30%) ($p < 0.05$). Patients using polypharmacy had elevated rates of adverse drug reactions (30%) and drug-drug interactions (25%), along with increased readmission occurrences. Patients using polypharmacy exhibited poorer adherence rates (60%) compared to those not on polypharmacy (80%), along with elevated rates of readmission and mortality. Patients experiencing polypharmacy exhibited a higher mortality rate at 180 days (15%) compared to 8% ($p< 0.05$). Multivariate research established polypharmacy as an independent predictor of hospital readmission and mortality.*
Conclusion*: Polypharmacy is linked to much higher rates of hospital readmission, adverse drug reactions (ADRs), drug-drug interactions (DDIs), not taking medications as prescribed, and death in older people with cardiovascular disease (CVD). These findings suggest that we should implement routine medication evaluations, the cessation of unnecessary medications, and adherence interventions to mitigate polypharmacy risks in this particularly susceptible demographic.*
Keywords*: Polypharmacy, hospital readmissions, cardiovascular disease, elderly, adverse drug reactions, drug-drug interactions, medication adherence, mortality.*

Introduction

Polypharmacy, characterized by the concurrent use of many medications, is becoming increasingly prevalent among

elderly individuals, particularly those with cardiovascular disease (CVD) (1). Comprehensive pharmacotherapy typically manages cardiovascular disease in the elderly, but it is associated with heightened adverse medication reactions, drug-drug interactions, and non-adherence, leading to diminished health and quality of life. The association between polypharmacy and hospital readmissions is particularly concerning to providers and governments aiming to enhance treatment and reduce healthcare costs.

Research has documented the prevalence of polypharmacy in elderly individuals with cardiovascular disease (CVD), with over fifty percent of patients over 65 receiving five or more prescriptions concurrently. The management of comorbidities often necessitates this surgery, but its challenges can result in hospital readmission (7). The comprehensive review by Jyrkkä et al. emphasized the dangers of polypharmacy, including falls, memory impairments, and hospitalization (8).

Hospital readmissions serve as a crucial metric for healthcare, providing insight into both quality and outcomes (9). A study reveals that older patients prescribed many drugs had a higher likelihood of readmission due to issues stemming from drug interactions or adverse effects (10). Maher et al. determined that polypharmacy elevated the risk of hospital readmissions by around 30% in older patients, necessitating caution with drugs in this demographic (11).

Second, managing polypharmacy in cardiovascular illness is challenging due to the frequently constrained therapeutic indices of prescribed antiplatelet agents, anticoagulants, and antihypertensives. The challenge of optimising CVD treatment while minimising the dangers associated with polypharmacy underscores the necessity for customised drug management regimens (13).

As the global population ages and cardiovascular disease (CVD) escalates as an epidemic, it is essential to understand the impact of polypharmacy on hospital readmissions among senior CVD patients. This can enhance the health, healthcare expenditures, and living conditions of the elderly, if properly treated (14).

This paper aims to examine the correlation between polypharmacy and hospital readmissions in elderly patients with cardiovascular disease, contributing to the growing body of knowledge on pharmacotherapy optimisation in the ill.

Methodology:

Study Design

This cross-sectional study aimed to examine the correlation between polypharmacy and hospital readmissions among senior patients with cardiovascular disease. The study was carried out in Dhi Qar, Iraq, from September 2024 to December 2024.

The study population comprised patients aged 65 and older with a history of cardiovascular disease who received treatment at Dhi Qar General Hospital during the study period. Patients were required to possess a documented diagnosis of cardiovascular disease, including ischaemic heart disease, congestive heart failure, hypertension, or atrial fibrillation. Only individuals with complete records were excluded from the study.

Inclusion and exclusion criteria

• Inclusion Criteria: Patients aged 65 years and older.

Patients have a history of at least one cardiovascular illness.

Patients who were discharged from the hospital at least once throughout the study period.

Patients administered a minimum of one pharmacological agent for the management of cardiovascular disease.

• Exclusion Criteria: o Patients lacking complete medical records or with incomplete information on medication dosage.

Patients admitted for surgical procedures rather than medical treatment.

Patients with terminal illnesses unrelated to cardiovascular disease.

Determination of Sample Size

We determined the sample size based on a prior study that reported a prevalence of around 40% of polypharmacy among older cardiovascular patients. At a 95% confidence level with a 5% margin of error, a minimum sample size of 368 individuals was required. A target population of 400 patients was selected to accommodate potential data loss from missing records.

Sampling:
We employed a straightforward, randomized selection method using the hospital records of eligible patients. All eligible patients discharged during the research were individually identified and numbered sequentially. Subjects were randomly picked by random number generation until the target sample size was achieved.

Protocols for Data Acquisition
This information was extracted from the patients' medical records using a standardised data collection form that was administered retroactively. The extracted information comprised demographic data (age, gender, income level), clinical data (cardiovascular disease, co-morbidities), and prescription data (quantity and type of medications dispensed). We aggregated hospital readmission data for 30, 90, and 180 days post-discharge.
• Medication Data: Each prescription was documented, and the total drugs per patient were aggregated. Polypharmacy denotes the concurrent use of five or more drugs.
Drug classifications, indications, and dosages were examined for adherence to recognised cardiovascular treatment guidelines.
Adverse drug reactions (ADRs) and drug-drug interactions (DDIs) were detected from the records at the time of documentation.
• Readmission Data: o Hospital readmissions were documented from electronic medical records; readmission refers to any inpatient admission occurring within 30, 90, or 180 days post-discharge.

Outcomes Metrics
The main objective was to examine the association between polypharmacy and hospital readmission during the specified timeframes (30, 90, and 180 days post-discharge). The secondary outcomes included polypharmacy, risk factors for polypharmacy, adverse drug responses, drug-drug interactions, and mortality rates during the trial period.

Data Analysis:
The results were analysed using SPSS software version 27. Demographic and clinical data were utilised to provide descriptive statistics. Continuous variables such as age and drug count were presented as means and standard deviations, whilst categorical variables like gender and comorbidities were reported as frequencies and percentages.
• Bivariate Analysis: Chi-square tests to evaluate associations between categorical variables such as polypharmacy and hospital readmission rates.
We conducted randomized t-tests for continuous variables to assess the average difference between patients who engage in polypharmacy and those who do not.
• Multivariate Analysis: Logistic regression analysis was employed to assess the connection between polypharmacy and hospital readmission, controlling for age, gender, comorbidities, and socioeconomic factors as potential confounders.
Odds ratios (OR), accompanied by 95% confidence intervals (CI), were calculated to assess the strength of the connections.

Ethical Considerations
The Institutional Review Board of the Dhi Qar Health Directorate granted ethical approval for the study. Patient anonymity ensured the dataset remained entirely confidential by eliminating personal identifiers. Data was accessible just to approved personnel, and all information was securely stored on a password-protected computer. The research posed minimal danger to patients as it was conducted exclusively through a retrospective analysis of records without any patient interaction.

Results:
A. Results presentation:

1. Descriptive Statistics

Table 1: Demographic Characteristics of Elderly Cardiovascular Patients by Polypharmacy Status

Variable	Overall Population (%)	Polypharmacy Group (≥5 Medications)	Non-Polypharmacy Group (<5 Medications)
Total Patients	400	200 (50%)	200 (50%)
Age (Mean ± SD)	75 ± 7 years	77 ± 6 years	73 ± 6 years
Gender			
Male	180 (45%)	85 (42.5%)	95 (47.5%)
Female	220 (55%)	115 (57.5%)	105 (52.5%)
Socioeconomic Status			
Low	280 (70%)	160 (80%)	120 (60%)
Middle	80 (20%)	30 (15%)	50 (25%)
High	40 (10%)	10 (5%)	30 (15%)

This table shows demographic characteristics by polypharmacy status, highlighting trends in socioeconomic status, gender, and age between the two groups.

2. Clinical Characteristics

Table 2: Clinical Characteristics and Comorbidities Among Polypharmacy and Non-Polypharmacy Groups

Clinical Condition	Overall Population (%)	Polypharmacy Group (%)	Non-Polypharmacy Group (%)
Ischemic Heart Disease	240 (60%)	150 (75%)	90 (45%)
Hypertension	280 (70%)	160 (80%)	120 (60%)
Congestive Heart Failure	120 (30%)	90 (45%)	30 (15%)
Atrial Fibrillation	80 (20%)	50 (25%)	30 (15%)
Diabetes Mellitus	200 (50%)	140 (70%)	60 (30%)
Chronic Kidney Disease	100 (25%)	80 (40%)	20 (10%)
Chronic Obstructive Pulmonary Disease	80 (20%)	60 (30%)	20 (10%)

This table provides a breakdown of the prevalence of cardiovascular and comorbid conditions by polypharmacy status.

3. Hospital Readmission Rates

Table 3: Hospital Readmission Rates at 30, 90, and 180 Days by Polypharmacy Status

Readmission Time Frame	Polypharmacy Group (%)	Non-Polypharmacy Group (%)	p-value*	Odds Ratio (95% CI)
30-Day Readmission	40 (20%)	24 (12%)	<0.05	1.82 (1.1–3.1)
90-Day Readmission	70 (35%)	40 (20%)	<0.01	2.13 (1.4–3.2)
180-Day Readmission	100 (50%)	60 (30%)	<0.001	2.38 (1.6–3.5)

*Note: p-values indicate significance of the differences in readmission rates between polypharmacy and non-polypharmacy groups.
This table demonstrates the association between polypharmacy and readmission rates within 30, 90, and 180 days, showing a statistically significant higher risk in polypharmacy patients.

4. Adverse Drug Reactions (ADRs) and Drug-Drug Interactions (DDIs)

Table 4: Prevalence of Adverse Drug Reactions (ADRs) Among Polypharmacy and Non-Polypharmacy Groups

Outcome	Polypharmacy Group (%)	Non-Polypharmacy Group (%)	p-value	Odds Ratio (95% CI)
Adverse Drug Reactions	60 (30%)	20 (10%)	<0.001	3.50 (2.1–5.9)
Drug-Drug Interactions	50 (25%)	10 (5%)	<0.001	5.87 (2.8–12.3)
Most Common ADRs				
Dizziness	20 (10%)	8 (4%)		
Hypotension	15 (7.5%)	5 (2.5%)		
Gastrointestinal Symptoms	12 (6%)	3 (1.5%)		

This table indicates a significantly higher incidence of ADRs and DDIs among polypharmacy patients. Dizziness, hypotension, and gastrointestinal symptoms are the most common ADRs reported.

5. Medication Adherence

Table 5: Prevalence of Drug-Drug Interactions (DDIs) Among Polypharmacy and Non-Polypharmacy Groups

Medication Adherence Level	Polypharmacy Group (%)	Non-Polypharmacy Group (%)	p-value	Odds Ratio (95% CI)
High Adherence	120 (60%)	160 (80%)	<0.01	0.50 (0.3–0.8)
Low Adherence	80 (40%)	40 (20%)		

This table reflects that polypharmacy patients have significantly lower adherence levels, which correlates with increased readmissions.

6. Mortality Rates

Table 6: Mortality Rates Within 180 Days by Polypharmacy Status

Mortality within 180 Days	Polypharmacy Group (%)	Non-Polypharmacy Group (%)	p-value	Odds Ratio (95% CI)
Mortality	30 (15%)	16 (8%)	<0.05	1.98 (1.1–3.6)

The table suggests a higher mortality rate among polypharmacy patients, indicating that polypharmacy may be an independent risk factor for mortality in elderly cardiovascular patients.

7. Multivariate Analysis Results

Table 7: Multivariate Analysis of Factors Associated with Hospital Readmissions

Variable	Odds Ratio (95% CI)	p-value
Polypharmacy (≥5 Meds)	1.82 (1.4–2.5)	<0.001
Age (>80 years)	1.50 (1.1–2.2)	<0.01
Diabetes Mellitus	1.35 (1.1–1.8)	<0.05
Chronic Kidney Disease	1.75 (1.3–2.4)	<0.01
Low Medication Adherence	1.60 (1.2–2.1)	<0.05

This multivariate analysis table displays the factors significantly associated with hospital readmissions. Polypharmacy emerges as a strong predictor of readmissions, even after adjusting for other variables.

B. Analysis of findings:

1. Demographic characteristics

The demographic data indicated that the average age of participants was approximately 75, with a slight majority of women (55%) compared to men (45%). This age distribution is characteristic of older cardiovascular patients and reflects the elevated prevalence of cardiovascular disease within this demographic. The elevated percentage of women corresponds with national data indicating that women have a longer lifespan and develop chronic diseases at a later age.

Seventy percent of the observed population belonged to the low-income socioeconomic class, whereas a mere ten percent constituted the high-income class. This may also influence access to healthcare resources and pharmacological therapy, as socioeconomic position disproportionately impacts adherence, access to superior care, and the capacity to manage numerous pharmaceutical regimens. These demographics may elucidate the prevalence of polypharmacy and its associated over-representation of detrimental side effects.

2. Clinical attributes

Heart disease and prevalent co-morbidities were ubiquitous, as anticipated in this demographic. The predominant cardiovascular diseases were hypertension (70%) and ischaemic heart disease (60%), both of which can be managed with various drugs. The presence of comorbidities, including diabetes (50%) and chronic kidney disease (25%), underscores the necessity for multi-drug therapy.

The high incidence of comorbidities in this cohort underscores the necessity for polypharmacy to manage concurrent chronic illnesses. However, it also poses concerns of side effects, prescription interactions, and hospital readmissions, particularly in senior patients with many diagnoses whose health is already compromised.

3. Rates of Hospital Readmission

The readmission study indicated a substantial correlation between polypharmacy and hospital readmissions at all assessed time intervals. Within 30 days, 20% of polypharmacy patients were re-hospitalized, compared to 12% of non-polypharmacy patients. The pattern persisted at 90 days (35% vs 20%) and 180 days (50% vs 30%), with polypharmacy patients continually exhibiting a higher likelihood of readmission.

The statistically significant ($p < 0.05$) correlation between polypharmacy and readmission indicates that each new medicine elevates the probability of bad outcomes and hospitalization, as per a previous study. This outcome aligns with existing evidence and underscores the need for drug management and perhaps deprescribing initiatives for elderly cardiovascular patients experiencing complex polypharmacy.

4. Adverse Drug Reactions and drug-drug Interactions.

The occurrence of adverse drug reactions (ADRs) and drug-drug interactions (DDIs) significantly differed between polypharmacy and non-polypharmacy cohorts. Thirty percent of patients on polypharmacy and ten percent of those on fewer drugs experienced adverse drug reactions (ADRs); prevalent reactions included dizziness, hypotension, and gastrointestinal problems. Similarly, drug-drug interactions (DDIs) were markedly higher in the polypharmacy group (25%) compared to the non-polypharmacy group (5%).

Given that patients on polypharmacy are highly susceptible to adverse drug reactions (ADRs) and drug-drug interactions (DDIs), the concomitant use of many drugs may significantly increase the risk of side effects, potentially leading to hospital readmissions. The most prevalent adverse drug reactions (dizziness, hypotension) pose greater risks for senior individuals, as they may result in falls and other issues necessitating urgent medical intervention. The occurrence of drug-drug interactions (DDIs) among patients undergoing polypharmacy, especially those on cardiovascular drugs, highlights a facet of intricate treatment regimens that may lead to unwanted side effects, exacerbating patients' ailments.

5. Compliance with medication

Adherence to medicine was significantly lower in polypharmacy, with only 60 percent of polypharmacy patients reporting high adherence compared to 80 percent of non-polypharmacy patients. The reduced compliance likely results from the necessity of managing many drugs, compounded by age-related cognitive decline and financial constraints.

Given that inadequate adherence correlates with readmission rates in polypharmacy patients, initiatives to enhance adherence should encompass regimen modification when feasible, as well as education and counselling on adherence. Inadequate adherence resulting from the complexity of polypharmacy may significantly contribute to readmission rates, as patients may neglect to take their medications or cease treatment, potentially exacerbating their disease.

6. Mortality Rates

Mortality rates were elevated in the polypharmacy cohort, with 25% of patients succumbing within 180 days, in contrast to merely 8% in the non-polypharmacy cohort. The difference was statistically significant ($p < 0.05$), indicating that polypharmacy constitutes an independent risk factor for mortality among senior cardiovascular patients.

The elevated mortality rate in polypharmacy patients may be attributed to the cumulative effects of several chronic illnesses, adverse drug reactions, and drug-drug interactions that exacerbate cardiovascular issues and overall health deterioration. This finding suggests that the mortality risk associated with polypharmacy must be taken into account while treating elderly patients, and that discontinuing unnecessary medications can enhance survival rates.

7. Results of Multivariate Analysis

In the multivariate regression analysis, polypharmacy was the only factor that could be used to predict hospital readmissions (odds ratio = 1.82). This was true even when other factors like age, comorbidities (like diabetes or chronic kidney disease), and socioeconomic status were taken into account. Significant predictors included advanced age (>80 years), diabetes, chronic renal disease, and inadequate medication adherence.

The data indicate that polypharmacy posed the greatest risk, whereas other factors such as age, comorbidity, and compliance also influenced the likelihood of hospital readmission. The paradoxical role of patient care in elderly cardiovascular patients necessitates the incorporation of multiple approaches, including polypharmacy.

Synopsis of Results

Our results align with existing literature, demonstrating that polypharmacy adversely affects hospital readmissions, adverse drug reactions, drug-drug interactions, adherence, and mortality in elderly patients with cardiovascular disease. The high correlation between polypharmacy and adverse outcomes, even after controlling for confounding variables, indicates that polypharmacy constitutes an independent risk factor for health. These findings suggest the necessity of targeted treatments to mitigate polypharmacy risks: regular medication assessments, minimizing unnecessary prescriptions, and enhancing adherence through streamlined treatment protocols and education.

Discussion

This study's results provide significant insights into the substantial influence of polypharmacy on hospital readmissions among older cardiovascular patients, corroborating existing research on the detrimental effects of polypharmacy in the elderly population. The elevated hospital readmissions, adverse drug reactions (ADRs), drug-drug interactions (DDIs), poor adherence, and death rates among polypharmacy patients exemplify the complexity and demands of multimodal care for this demographic.

Is there a correlation between polypharmacy and hospital readmissions?

Our investigation revealed that patients experiencing polypharmacy had a significantly higher likelihood of readmission within 30-, 90-, and 180-days post-discharge, corroborating prior findings that polypharmacy poses an early risk for hospitalization among elderly individuals (15). As a patient is prescribed additional medications, the likelihood of adverse reactions, dosage mistakes, and issues necessitating hospitalization increases. Consistent with prior research, we observed that patients on polypharmacy exhibited an average hospitalization rate that was twice as high within 180 days compared to those on fewer medications, underscoring the necessity of medication monitoring for elderly patients with cardiovascular disease (18, 19).

Polypharmacy in the older cardiovascular demographic is particularly concerning due to the pharmacological complexity of cardiovascular disease medications, which frequently include antihypertensives, anticoagulants, and other high-risk drugs. Despite being essential for the management of cardiovascular disorders, these therapies pose risks of interaction and adverse consequences when used concurrently with other comorbidities, such as diabetes

and chronic kidney disease (20, 21). This complexity results in elevated readmission rates and imposes significant burdens on healthcare systems by escalating costs and affecting healthcare expenditures (22). Pharmacokinetics and drug-drug interactions in polypharmacy contribute to adverse drug reactions and interactions.

The data showed that patients who were taking multiple drugs had much higher rates of adverse drug reactions (ADRs) and drug-drug interactions (DDIs). This is in line with previous research that multiple drug interactions often have bad effects (23). These adverse drug reactions (dizziness, hypotension, gastrointestinal problems) were prevalent among polypharmacy patients and presumably contributed to readmissions, as such reactions are linked to falls, dehydration, and other acute conditions requiring hospitalisation (24). Similar results have been found in earlier studies, showing that adverse drug reactions (ADRs) and drug-drug interactions (DDIs) are very difficult for older patients whose kidneys or livers don't work as well, which makes it harder for drugs to be broken down and increases the risk of side effects (25, 26).

The elevated DDI rate in this study exemplifies the risks associated with the concurrent use of cardiovascular medicines and treatments for other chronic ailments. The narrow therapeutic indices of anticoagulants, antihypertensives, and similar agents can alter their effects when combined with other drugs, often leading to life-threatening complications (27). This fits with what Pasina et al. found, which is that people who take a lot of different medications have a much higher chance of having serious drug interactions. Because of this, doctors need to carefully look over their patients' medication schedules and keep an eye out for interactions (28).

Impact of Polypharmacy on Pharmacological Utilisation and Adherence to Medication.

Research indicates that an increasing number of drugs leads to a notable decline in adherence in polypharmacy patients (29). Adherence challenges in polypharmacy patients may arise from the complex execution of regimens that differ in duration, cognitive demand, and adverse effects, potentially exacerbated by cognitive deterioration and socioeconomic limitations in the elderly (30, 31). Research demonstrates that diminished adherence results in detrimental outcomes, as patients who consistently fail to follow regimens are more vulnerable to disease progression and complications (32).

The intricacy of polypharmacy contributed to nonadherence, which may partially explain the elevated readmission rates observed in this study. When patients are unable to adhere to their drug regimens, their health outcomes deteriorate, leading to increased visits to emergency rooms and hospitalizations. Streamlined prescription regimens, adherence education, reminders, and personalized doses may enhance compliance and decrease the incidence of hospital readmissions in this population (33, 34).

Mortality Rates in Patients Undergoing Polypharmacy

We identified a markedly elevated mortality rate among polypharmacy patients, corroborating findings from prior studies that indicate polypharmacy as an independent risk factor for mortality in older individuals with chronic illnesses (35). The elevated mortality rate may result from the cumulative physiological stress of several chronic illnesses, in addition to the potential detrimental effects of specific medications on organ systems (36). Furthermore, elevated ADRs and DDIs in polypharmacy patients may exacerbate pre-existing cardiovascular problems, potentially leading to increased mortality (37).

The association between polypharmacy and mortality is concerning, necessitating that clinicians meticulously evaluate the advantages and disadvantages of each medication prescribed to elderly cardiovascular patients. We must approach polypharmacy with caution, ensuring regular drug monitoring and deprescribing unnecessary medications when possible, as it is essential for managing chronic diseases (38).

Clinical implications and recommendations

This study indicates that the optimal approach to managing polypharmacy in older cardiovascular patients is through effective interventions. Possible interventions encompass:

1. Regular Medication Evaluations: Routine assessments of medications, particularly for high-risk elderly patients, can reveal and eliminate superfluous prescriptions to reduce adverse drug reactions (ADRs) and drug-drug interactions (DDIs) (39).
2. Deprescribing Protocols: Implementing deprescribing protocols, which involve the systematic removal of unnecessary or potentially detrimental drugs, may enhance patient outcomes and reduce hospital readmissions (40).
3. Help with Adherence: Using programs that encourage adherence, like teaching patients how important it is to take their medications as prescribed, keeping track of their doses, and streamlining their schedules, could help with

the problems that come with taking multiple medications and lead to better adherence, which could lower the number of readmissions (41).
4. Enhanced Screening for Adverse Drug Reactions and Drug-Drug Interactions: Improved oversight of polypharmacy patients, particularly those undergoing intricate cardiovascular treatment, can avert and manage adverse drug reactions and drug-drug interactions prior to hospitalization (42).
Constraints of the Research
Several constraints should be acknowledged. The cross-sectional design precludes the establishment of causal correlations between polypharmacy and hospital readmissions. Secondly, the study was retrospective and reliant on medical records, which may be incomplete on adverse drug reactions (ADRs), drug-drug interactions (DDIs), and adherence. The sample size was limited to a single hospital in Dhi Qar; hence, the findings cannot be extrapolated to other contexts. Subsequent studies may employ a prospective design and encompass more diverse groups to validate these findings and further explore the causal association between polypharmacy and health. Conclusion
The findings indicate that polypharmacy significantly predicts hospital readmissions, adverse drug reactions, drug-drug interactions, reduced adherence, and heightened mortality in senior cardiovascular patients. These findings emphasize that suitable therapy might mitigate the dangers of polypharmacy through regular medication assessments, the elimination of contraindications, and adherence strategies. When healthcare practitioners successfully address these obstacles, elderly individuals with cardiovascular disease can achieve improved health and quality of life, thereby reducing the healthcare burden associated with polypharmacy.

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