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Research Article

Drug Utilization Patterns, Polypharmacy, And Adverse Drug Reactions Among Patients Attending A Tertiary Care Cardiac Emergency: A Prospective Observational Study

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ABSTRACT

Cardiac emergencies often require multiple medications for rapid stabilization and management of complex cardiovascular conditions, increasing the potential for polypharmacy and adverse drug reactions (ADRs). The present study evaluated drug utilization patterns, polypharmacy, and ADRs among patients attending a tertiary care cardiac emergency. A prospective observational study was conducted over six months, involving 700 patients whose prescriptions and available medical records were evaluated. Demographic characteristics, clinical conditions, comorbidities, prescribed medications, polypharmacy, and ADRs were recorded. A total of 3,453 individual drug entries were documented, with an average of 4.93 recorded drug entries per evaluated encounter. Antiplatelets were the most frequently utilized drug category (730; 21.14%), followed by cardiovascular drugs (680; 19.69%) and anticoagulants (450; 13.03%). Polypharmacy was identified in 294 patients (42.0%). A total of 149 ADR events/episodes were documented, of which 85 (57.05%) were mild, 48 (32.21%) were moderate, and 16 (10.74%) were severe. Polypharmacy was significantly associated with ADR occurrence ($\chi^2=62.983$, $p<0.001$), with higher ADR occurrence among patients with polypharmacy than those without (35.7% vs. 10.8%; OR=4.57, 95% CI: 3.08–6.77). Age was significantly associated with both polypharmacy and ADR

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occurrence ($p < 0.001$). The findings highlight the importance of medication review and pharmacovigilance, particularly among patients receiving multiple medications and older patients, to promote safer pharmacotherapy in cardiac emergency care.

INTRODUCTION

Cardiovascular diseases remain a major cause of morbidity and mortality worldwide and represent an important burden on healthcare systems.¹ Cardiac emergency departments manage patients with acute and potentially life-threatening conditions requiring rapid diagnosis, stabilization, and pharmacological intervention. Common presentations include acute myocardial infarction, acute coronary syndrome, hypertensive emergencies, acute pulmonary edema, acute heart failure, cardiogenic shock, life-threatening arrhythmias, pulmonary embolism, and other critical cardiovascular conditions. The complexity and severity of these conditions frequently necessitate the use of multiple medications simultaneously to achieve rapid clinical stabilization and prevent further complications.²

Drug utilization evaluation is an important component of rational pharmacotherapy and provides information regarding prescribing patterns, commonly used therapeutic classes, and medication burden in a specific patient population.³ Evaluation of drug utilization patterns can help characterize medicine use and identify opportunities for improving rational and safe pharmacotherapy.³

Polypharmacy is frequently encountered among patients with cardiovascular disease because acute cardiovascular conditions may coexist with multiple chronic diseases and risk factors. Although multiple medications may be clinically justified, increasing medication burden can increase the potential for medication-related problems and adverse outcomes.^{4,5} Older patients

may be particularly vulnerable because of multimorbidity and age-related changes that can affect medication response.⁶

ADRs represent an important medication-related problem in hospitalized and acute-care populations. Systematic reviews have demonstrated that ADRs are common among hospitalized patients and may contribute to morbidity and healthcare utilization.^{7,8} Pharmacovigilance therefore remains an important component of medication safety, particularly where multiple medicines and high-risk therapies are used.⁹

Previous studies have evaluated ADRs and polypharmacy in hospitalized populations, but an integrated assessment of drug utilization, polypharmacy, and ADR occurrence in a tertiary-care cardiac emergency remains useful for identifying patients who may require closer medication monitoring. The present study therefore evaluated these factors and examined their relationships with selected demographic and clinical characteristics.

AIM

To evaluate drug utilization patterns, polypharmacy, and adverse drug reactions among patients attending a tertiary care cardiac emergency.

OBJECTIVES

To assess the demographic and clinical characteristics of patients attending the cardiac emergency.

To evaluate the pattern of drug utilization, including commonly used therapeutic categories and individual drugs.



To determine the prevalence of polypharmacy among the study population.

To identify and assess the occurrence and severity of adverse drug reactions.

To evaluate the association between polypharmacy and adverse drug reaction occurrence.

To assess the association of selected demographic and clinical factors with polypharmacy and adverse drug reactions.

MATERIALS AND METHODS

STUDY DESIGN AND SETTING

A prospective observational study was conducted in the Cardiac Emergency Department of a tertiary care institute. The study was initiated after obtaining approval from the Institutional Review Board and Institutional Ethics Committee. Patient cases were identified and documented by the investigators from the participating hospital.

STUDY DURATION AND STUDY POPULATION

The study was conducted over a period of six months. All patients attending the cardiac emergency department during the study period were considered for evaluation. A total of 700 patient prescriptions and available medical records were reviewed. Relevant demographic, clinical, and medication-related information was systematically collected.

INCLUSION CRITERIA

Patients were included if they attended the cardiac emergency department during the study period, had a documented cardiac or cardiovascular clinical condition, had a prescription or medical

record available for evaluation, and had sufficient demographic and medication-related information for assessment.

EXCLUSION CRITERIA

Patients were excluded if their prescriptions or medical records were incomplete or contained insufficient information for evaluation. Duplicate records or records without adequate medication-related information were also excluded.

DATA COLLECTION

Data were collected from patient prescriptions and available medical records using a structured data-collection format. Demographic characteristics, presenting cardiac condition, documented comorbidities, prescribed medications, family history of coronary artery disease, number and type of medications, polypharmacy status, and occurrence and severity of ADRs were recorded.

ASSESSMENT OF DRUG UTILIZATION

Drug utilization was evaluated by recording the individual medications prescribed to the study population and categorizing them according to their major therapeutic classes. The total number of drug entries, average number of drugs per evaluated encounter, commonly utilized individual drugs, essential medicines, generic prescriptions, fixed-dose combinations, and injectable preparations were evaluated.

ASSESSMENT OF POLYPHARMACY

Patients were classified according to their recorded polypharmacy status.

ASSESSMENT OF ADVERSE DRUG REACTIONS



ETHICAL CONSIDERATIONS

The study received ethical clearance from the Institutional Human Ethics Committee of Nargund College of Pharmacy, Bengaluru (Ref. No. NCP/IHEC/-CERTI-025/2025; dated 17/07/2025; committee meeting held on 15/07/2025). The study was conducted in accordance with the permission granted by the Institutional Human Ethics Committee. For Toufik Sarkar, who was affiliated with a different institution during case-data collection, relevant institutional permission from his college was obtained for collection of case data. Patient information was handled confidentially and used only for research purposes.

STATISTICAL ANALYSIS

The collected data were entered, organized, and analyzed using IBM SPSS Statistics version 32.0. Categorical variables were expressed as frequencies and percentages. Associations between categorical variables were evaluated

using the Pearson chi-square test. For appropriate 2×2 comparisons, odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. The associations evaluated included age with polypharmacy, sex with polypharmacy, clinical condition with polypharmacy, polypharmacy with ADR occurrence, polypharmacy with ADR severity, age with ADR occurrence, and sex with ADR occurrence. A p-value <0.05 was considered statistically significant.

RESULTS

DEMOGRAPHIC CHARACTERISTICS

A total of 700 patients attending the tertiary care cardiac emergency were evaluated. Among them, 490 (70.0%) were male and 210 (30.0%) were female. The largest proportion belonged to the 40–59-year age group (398; 56.86%), followed by 60–79 years (163; 23.29%), 0–39 years (80; 11.43%), and ≥ 80 years (59; 8.43%).

TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

Age group (years)	n	%
0–39	80	11.43
40–59	398	56.86
60–79	163	23.29
≥ 80	59	8.43
Total	700	100.00

COMORBIDITIES

The recorded comorbidities included diabetes mellitus (262), hypertension (186), hypothyroidism (52), diabetes mellitus with hypertension (112), hypertension with hyperthyroidism (9), dyslipidemia (52), and hypertension with hypothyroidism (27). These categories were not mutually exclusive because individual patients could have more than one documented comorbidity.

FAMILY HISTORY

A positive family history of coronary artery disease was documented in 56% of patients, whereas 44% had no documented family history.

CLINICAL CONDITIONS

Acute myocardial infarction was the most frequently recorded clinical condition, accounting for 456 patients (65.14%), followed by unstable angina/acute coronary syndrome (63; 9.00%) and



hypertensive emergency (50; 7.14%). Acute (5.14%), while acute pulmonary edema accounted severe heart failure accounted for 36 patients for 30 (4.29%).

TABLE 2. DISTRIBUTION OF CLINICAL CONDITIONS AND POLYPHARMACY STATUS

Clinical condition	Polypharmacy, n	No polypharmacy, n	Total, n	%
Acute myocardial infarction	210	246	456	65.14
Unstable angina / ACS	25	38	63	9.00
Hypertensive emergency	20	30	50	7.14
Acute pulmonary edema	12	18	30	4.29
Acute severe heart failure	2	34	36	5.14
Cardiogenic shock	6	9	15	2.14
Aortic dissection	5	10	15	2.14
Life-threatening arrhythmia	6	9	15	2.14
Cardiac tamponade	3	7	10	1.43
Massive pulmonary embolism	5	5	10	1.43
Total	294	406	700	100.00

POLYPHARMACY

Polypharmacy was identified in 294 of 700 patients (42.0%), whereas 406 patients (58.0%) were classified as having no polypharmacy.

TABLE 3. DISTRIBUTION OF POLYPHARMACY AMONG STUDY PARTICIPANTS

Polypharmacy status	n	%
Polypharmacy	294	42.0
No polypharmacy	406	58.0
Total	700	100.0

DRUG-COUNT DISTRIBUTION

A total of 3,453 individual drug entries were recorded across 700 evaluated prescriptions/patient encounters, corresponding to

an average of 4.93 recorded drug entries per evaluated encounter. Among the recorded drug entries, 1,504 (43.56%) were in the 0–4 drug-entry category, 1,894 (54.84%) in the 5–8 category, and



55 (1.59%) in the 9–12 category. These values interpreted as the number of patients or represent individual drug entries and should not be prescriptions in each category.

TABLE 4. DISTRIBUTION OF RECORDED DRUG ENTRIES

Drug-entry category	Recorded drug entries, n	%
0–4	1,504	43.56
5–8	1,894	54.84
9–12	55	1.59
Total	3,453	100.00

MAJOR DRUG CATEGORIES

Antiplatelets were the most frequently recorded major drug category, accounting for 730 entries (21.14%), followed by cardiovascular drugs (680; 19.69%), other drugs (558; 16.16%), anticoagulants (450; 13.03%), and diuretics (360; 10.43%).

TABLE 5. DISTRIBUTION OF MAJOR DRUG CATEGORIES

Drug category	n	%
Antiplatelets	730	21.14
Cardiovascular drugs	680	19.69
Others	558	16.16
Anticoagulants	450	13.03
Diuretics	360	10.43
Hypolipidemics	310	8.98
GIT drugs	210	6.08
Opioids	105	3.04
NSAIDs	33	0.96
Antibiotics	17	0.49
Total	3,453	100.00

TOP 10 MOST FREQUENTLY RECORDED INDIVIDUAL DRUGS

Aspirin was the most frequently recorded individual drug, with 350 entries (10.14%), followed by clopidogrel (250; 7.24%), atorvastatin (190; 5.50%), enoxaparin (180; 5.21%), and metoprolol (170; 4.92%).

TABLE 6. TOP 10 MOST FREQUENTLY RECORDED INDIVIDUAL DRUGS

Rank	Drug	n	% of drug entries
1	Aspirin	350	10.14
2	Clopidogrel	250	7.24
3	Atorvastatin	190	5.50
4	Enoxaparin	180	5.21
5	Metoprolol	170	4.92
6	Unfractionated heparin	140	4.05
7	Nitroglycerin	130	3.77



8	Pantoprazole	130	3.77
9	Ticagrelor	90	2.61
10	Amiodarone	90	2.61

INDIVIDUAL DRUG DISTRIBUTION

The detailed distribution demonstrated the use of multiple agents across antiplatelet, anticoagulant, hypolipidemic, cardiovascular, gastrointestinal, diuretic, antibiotic, opioid, NSAID, and other emergency-drug categories. Within the antiplatelet category, aspirin (350; 10.14%) and clopidogrel (250; 7.24%) were most frequently recorded. Among anticoagulants, enoxaparin (180; 5.21%) and unfractionated heparin (140; 4.05%) were most frequently recorded. Atorvastatin was the most frequently recorded hypolipidemic (190;

5.50%), while furosemide was the most frequently recorded diuretic (220; 6.37%).

MEDICATION-USE INDICATORS

Of the 3,453 recorded drug entries, 2,785 (80.65%) were from the Essential Medicines List, 152 (4.40%) were prescribed by generic name, 443 (12.83%) were fixed-dose combinations, and 456 (13.21%) were injectable medicines. These indicators were not mutually exclusive and therefore were not expected to sum to 100%.

TABLE 7. MEDICATION-USE INDICATORS

Indicator	n	% of drug entries
Essential medicines	2,785	80.65
Generic medicines	152	4.40
Fixed-dose combinations	443	12.83
Injectable medicines	456	13.21

ADVERSE DRUG REACTIONS

A total of 149 ADR events/episodes were recorded. Of these, 85 (57.05%) were mild, 48

(32.21%) were moderate, and 16 (10.74%) were severe.

TABLE 8. DISTRIBUTION OF ADVERSE DRUG REACTIONS ACCORDING TO SEVERITY

ADR severity	n	%
Mild	85	57.05
Moderate	48	32.21
Severe	16	10.74
Total	149	100.00

FREQUENTLY REPORTED ADVERSE DRUG REACTIONS

Headache was the most frequently reported ADR (12; 8.05%), followed by nausea and hypotension

(10 each; 6.71%), dizziness (9; 6.04%), constipation and diarrhea (8 each; 5.37%), and vomiting, fatigue, and bradycardia (7 each; 4.70%). Gastric irritation and hypokalemia were each reported in 6 cases (4.03%).

TABLE 9. MOST FREQUENTLY REPORTED ADVERSE DRUG REACTIONS



ADR	n	% of ADRs
Headache	12	8.05
Nausea	10	6.71
Hypotension	10	6.71
Dizziness	9	6.04
Constipation	8	5.37
Diarrhea	8	5.37
Vomiting	7	4.70
Fatigue	7	4.70
Bradycardia	7	4.70
Gastric irritation	6	4.03
Hypokalemia	6	4.03

INFERENCE STATISTICAL ANALYSIS

Pearson chi-square analysis demonstrated a statistically significant association between age group and polypharmacy ($\chi^2=31.507$, $df=3$, $p<0.001$). The proportion of polypharmacy was 25.0% in patients aged 0–39 years, 37.7% in those aged 40–59 years, 58.3% in those aged 60–79 years, and 49.2% among patients aged ≥ 80 years. A statistically significant association was also observed between clinical condition and polypharmacy ($\chi^2=24.339$, $df=9$, $p=0.004$); this association was considered exploratory because some clinical-condition categories contained relatively small numbers. A strong statistically significant association was observed between polypharmacy and ADR occurrence ($\chi^2=62.983$,

$df=1$, $p<0.001$). ADRs occurred in 105 of 294 patients (35.7%) with polypharmacy compared with 44 of 406 patients (10.8%) without polypharmacy. The odds of an ADR were approximately 4.57 times higher among patients with polypharmacy (OR=4.57, 95% CI: 3.08–6.77). No statistically significant association was observed between polypharmacy and ADR severity ($\chi^2=1.507$, $df=2$, $p=0.471$). Age group was significantly associated with ADR occurrence ($\chi^2=34.215$, $df=3$, $p<0.001$), with ADR occurrence of 10.0%, 16.3%, 33.7%, and 35.6% across the four age groups, respectively. Sex was not significantly associated with polypharmacy ($\chi^2=0.493$, $df=1$, $p=0.483$) or ADR occurrence ($\chi^2=0.020$, $df=1$, $p=0.888$).

TABLE 10. ASSOCIATION BETWEEN SELECTED VARIABLES

Association	χ^2	df	p-value	Interpretation
Sex vs. polypharmacy	0.493	1	0.483	Not significant
Age group vs. polypharmacy	31.507	3	<0.001	Significant
Clinical condition vs. polypharmacy	24.339	9	0.004	Significant*
ADR occurrence vs. polypharmacy	62.983	1	<0.001	Significant
ADR severity vs. polypharmacy	1.507	2	0.471	Not significant



Age group vs. ADR occurrence	34.215	3	<0.001	Significant
Sex vs. ADR occurrence	0.020	1	0.888	Not significant

*Exploratory interpretation because some clinical-condition categories contained small numbers.

DISCUSSION

The present prospective observational study evaluated drug utilization patterns, polypharmacy, and ADRs among patients attending a tertiary care cardiac emergency. The findings demonstrate substantial medication use and a clinically important burden of polypharmacy and ADRs in this setting. The predominance of acute myocardial infarction and the frequent use of antiplatelets, anticoagulants, lipid-lowering agents, and cardiovascular drugs are consistent with the intensive pharmacological management required for acute coronary syndromes.²

A total of 3,453 individual drug entries were recorded across 700 evaluated encounters, with antiplatelets representing the largest therapeutic category. Aspirin, clopidogrel, atorvastatin, enoxaparin, and metoprolol were among the most frequently recorded individual medicines. Drug-utilization assessment provides a useful description of medicine-use patterns and can support evaluation of rational prescribing and medication safety.³

Polypharmacy was present in 42.0% of patients. Multiple medicines may be necessary in acute cardiovascular care, but increasing medication burden can complicate medication management and increase the potential for medication-related harm. WHO guidance on medication safety in polypharmacy emphasizes systematic medication review and a multidisciplinary approach to reduce

avoidable medication-related harm.⁴ The significant association between age and polypharmacy in the present study further supports closer medication review among older patients.

A total of 149 ADR events/episodes were documented, with most reactions classified as mild. Headache, nausea, hypotension, dizziness, constipation, diarrhea, vomiting, fatigue, and bradycardia were among the most frequently reported reactions. The documented ADR events in this study are broadly comparable with findings reported in prospective hospital-based literature, although direct comparisons should be made cautiously because study populations, ADR definitions, ascertainment methods, and clinical settings differ.^{7,8}

The strongest finding was the association between polypharmacy and ADR occurrence. ADRs occurred in 35.7% of patients with polypharmacy compared with 10.8% of those without polypharmacy, and the odds of an ADR were 4.57 times higher among patients with polypharmacy. This finding is biologically and clinically plausible because multiple medicines increase the opportunity for adverse effects, interactions, and medication-related problems. Evidence syntheses have similarly linked polypharmacy with adverse outcomes, particularly among older adults.⁵

Polypharmacy was not significantly associated with ADR severity in the present study. Thus, the data support an association between medication burden and the occurrence of ADRs but do not demonstrate that polypharmacy alone determines whether a reaction will be mild, moderate, or



severe. Other factors, including the specific medicine involved, dose, patient characteristics, comorbidities, and the nature of the underlying acute illness, may influence severity.

Age was significantly associated with ADR occurrence, with higher occurrence in the older age groups. This finding is consistent with evidence that older adults in acute-care settings are at increased risk of ADRs and medication-related harm.⁶ In contrast, sex was not significantly associated with either polypharmacy or ADR occurrence in this study.

The significant association between clinical condition and polypharmacy should be interpreted cautiously because some clinical-condition categories contained small numbers. Nevertheless, variation in medication burden across acute cardiovascular presentations is clinically plausible because treatment intensity depends on the severity and type of cardiovascular emergency.

The high proportion of recorded drug entries classified as essential medicines (80.65%) indicates substantial use of medicines considered important for patient care. Generic prescribing accounted for 4.40% of recorded drug entries. Because the medication-use indicators were not mutually exclusive, they should be interpreted independently rather than as components of a 100% distribution.

From a clinical pharmacy perspective, these findings support systematic medication review and active pharmacovigilance in cardiac emergency care. Pharmacist participation in medication-related review has been associated with reductions in adverse drug events in hospital settings, supporting the potential value of integrating clinical pharmacy services into multidisciplinary emergency cardiovascular care.^{10,11}

STUDY LIMITATIONS

The study was conducted in a single tertiary-care cardiac emergency over six months, which may limit generalizability to other settings. The study was observational, so the observed associations do not establish causality. ADRs were identified from available clinical and medication-related information, and the supplied study material did not document use of a standardized ADR causality scale. In addition, 149 ADR events/episodes were recorded in the dataset; therefore, this number should not be interpreted as an incidence rate unless each recorded ADR is confirmed to represent a unique patient.

CONCLUSION

The present study demonstrated substantial medication use among patients attending a tertiary care cardiac emergency, with antiplatelets, cardiovascular drugs, anticoagulants, and diuretics representing major components of pharmacotherapy. Polypharmacy was observed in 42.0% of patients, while a total of 149 ADR events/episodes were documented, with mild reactions being the most frequently reported. A significant association was observed between polypharmacy and ADR occurrence, with patients exposed to polypharmacy having higher odds of experiencing an ADR. Age was significantly associated with both polypharmacy and ADR occurrence, whereas sex was not significantly associated with either outcome. Polypharmacy was not significantly associated with ADR severity. These findings highlight the importance of systematic medication review, rational prescribing, and active pharmacovigilance in cardiac emergency settings, particularly among older patients and those receiving multiple medications. Integration of clinical pharmacy services into cardiac emergency care may help identify medication-related risks, facilitate early



detection and management of ADRs, and promote safer pharmacotherapy.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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