

DOI: <https://dx.doi.org/10.18203/2319-2003.ijbcp20262868>

Original Research Article

Drug utilization pattern of cardiovascular medications and assessment of WHO-INRUD prescribing indicators among geriatric patients in a tertiary care hospital: a cross-sectional study

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Received: 17 June 2026

Accepted: 16 July 2026

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ABSTRACT

Background: Cardiovascular disorders are a major cause of morbidity and mortality among older patients. Drug utilization studies are useful in assessment of prescribing behaviour and rational use of drugs. To study the drug utilization pattern of cardiovascular drugs and to evaluate the prescribing practices by WHO-INRUD prescribing indicators in geriatric patients of cardiovascular illnesses admitted in tertiary care hospital.

Methods: A hospital based observational cross-sectional study was carried out in Medicine wards and Intensive Care Unit of MGM Hospital, Navi Mumbai from April 2024 to March 2026. A total of 250 patients ≥ 65 years with cardiovascular illnesses were involved. The data were acquired from patient files, medication administration records and laboratory reports. The descriptive statistics were used to analyse drug consumption patterns and WHO-INRUD prescribing indicators.

Results: Of 250 patients, 62.4% were males and 37.6% females. The mean age was 70.88 ± 4.00 years. The most prevalent cardiovascular disease was hypertension (87.6%), followed by ischemic heart disease (27.2%) and heart failure (11.2%). The most common pharmacological class used was calcium channel blockers (24.8%), followed by antiplatelet medicines (24.1%). 30.02% medications were prescribed generically and 51.69% drugs were prescribed from national list of essential medicines. Antibiotic and injectable prescriptions were written for 20.03% and 29.17% of encounters, respectively.

Conclusions: Hypertension was the most frequent cardiovascular illness among geriatric people. Moderate generic prescribing and compliance with NLEM suggest the necessity of regular prescription audits for promoting rational drug use.

Keywords: Cardiovascular diseases, Drug utilization, Geriatric patients, WHO-INRUD indicators

INTRODUCTION

Cardiovascular diseases (CVDs) remain the primary cause of morbidity and mortality worldwide, accounting for a large proportion of global deaths. CVDs are more prevalent in low and middle-income countries such as India where demographic shift, urbanization and lifestyle changes have led to a rise in the prevalence of hypertension, ischemic heart disease and heart failure.^{1,2} Drug usage research (DUR) is an essential part of clinical

pharmacology. DUR is concerned with patterns of drug prescribing and with the rational use of medicines. DUR is the systematic study of the marketing, distribution, prescription and use of pharmaceuticals and their repercussions on health outcomes, as defined by the World Health Organization (WHO).

These studies are useful in identifying incorrect prescribing practices, promoting rational drug usage and improving patient safety and therapeutic outcomes.³⁻⁵ The

world is getting old rapidly and India is experiencing a huge growth in its older population. Older persons sometimes have various chronic conditions such as hypertension diabetes mellitus, chronic renal disease and cardiovascular disorders requiring long term treatment. This results in polypharmacy in this population leading to higher incidence of adverse drug responses, drug-drug interactions, prescription mistakes, poor adherence and higher healthcare costs.^{6,7}

Pharmacotherapy in the elderly is further complicated by physiological changes associated with aging altering pharmacokinetic and pharmacodynamic processes. Alterations in kidney and liver function, body composition and receptor sensitivity can impact drug response and raise a person's risk of pharmaceutical problems. Therefore, a detailed examination of prescribing procedures in older patients is needed to ensure safe and effective medication.^{8,9}

Geriatric patients hospitalized to medical wards and critical care units generally have several comorbidities and require sophisticated treatment regimens. The analysis of prescribing trends in such circumstances might provide significant information on rational use of medicines and adherence to conventional treatment standards.^{10,11} The WHO-international network for rational use of drugs (WHO-INRUD) prescription indicators is widely used to assess prescribing practices and drug consumption patterns in health care settings. These indicators are objective measurements of sensible medication usage, including generic prescribing, use of critical drugs and frequency of prescribing of antibiotics and injections.^{5,12}

Although several research have analysed the patterns of drug consumption in cardiovascular patients, data about geriatric inpatients of tertiary care facilities are scarce and especially in Western India. Regional variations in illness burden, prescribing patterns and healthcare delivery underscore the importance of institution-specific data for rational prescribing and optimal patient outcomes.¹³⁻¹⁵ Hence, the present study was undertaken to examine the prescribing pattern of cardiovascular medications in senior patients admitted to medical wards and intensive care unit of a tertiary care hospital and to analyse the prescribing practices by WHO-INRUD prescribing indicators.

METHODS

Study design

Hospital based observational descriptive cross-sectional study conducted in medicine wards and intensive care unit (ICU).

The study was conducted after obtaining prior approval from the institutional ethics committee (Approval no.: DHR-EC/SC/2024/06/19). All participants or their legally authorized representatives, gave written informed consent.

Study type

This was an observational, cross-sectional study.

Study place

Department of Medicine and Intensive Care Unit, MGM Hospital, Kamothe, Navi Mumbai.

Duration of study

The study was conducted over a period of two years from April 2024 to March 2026.

Sample-size

The sample size was estimated using the method for descriptive cross-sectional research where $N = Z^2 \times p \times (1-p) / d^2$, Z =standard normal deviate with the required confidence level, p is the predicted prevalence and d is the allowable margin of error. A minimum required sample size of 249 participants was estimated using an expected prevalence of 80% from previous similar hospital-based studies among older patients with cardiovascular illnesses, a 95% confidence level (Z -value of 1.96) and a margin of error of 5%. The sample size was rounded off to 250 individuals for acceptable representation and to improve dependability of the study findings. A total of 250 suitable patients were thus enrolled in the trial.

Study population

All elderly patients with CVDs admitted to ICU and Medicine wards were considered for participation in the study.

Inclusion criteria

Patients aged 65 years and older. Patients of either sex. Patients admitted in medicine wards and medicine ICU of MGM hospital. Patients who are willing to provide consent. Patients with CVDs such as ischemic heart disease (IHD), Heart failure (HF) and Hypertension (HTN)

Exclusion criteria

Patients aged <65 years were excluded. Patients attending outpatient departments, patients not willing to provide consent, patients admitted to surgical ICU (SICU).

Data collection method

Data were acquired from patient case records, medication charts and laboratory reports with the agreement of Institutional Ethics Committee. The data obtained comprised demographic variables, clinical diagnosis, associated comorbidities and medication related information. Data were then collated and evaluated and presented using tables, charts and graphs.

Patient details like age, gender, registration number at the hospital. Patient diagnosis and associated co-morbidities. Prescription details like date, number of drugs, names of individual drugs, FDCs prescribed, dosage formulations, dosing schedule.

Data analysis

Descriptive statistics were used for data analysis. The following parameters were evaluated.

Demographic characteristics

Age and gender distribution. Distribution of cardiovascular illnesses in study population. Pattern of use of drugs in various types of drugs. Different types of medications given to patients for different cardiovascular disorders. WHO-INRUD prescribing indicators. Percentage of medications prescribed by generic name. Percentage of medications prescribed from NLEM 2022. Percentage of drugs with an antibiotic prescribed. Percentage of drugs with injection prescribed.

Study variables

The independent variables were age, gender and clinical diagnosis. The dependent variables were medication usage pattern and WHO prescribing indicators.

RESULTS

Demographic characteristics of study population

A total of 250 geriatric patients diagnosed with cardiovascular diseases were included in the study. Among them, 156 (62.4%) were males and 94 (37.6%) were females (Figure 1). The mean age of the study population was 70.88 ± 4.00 years.

Clinical profile of the study population

Hypertension was the most prevalent cardiovascular disease, affecting 219 (87.6%) patients, followed by ischemic heart disease (68, 27.2%) and heart failure (28, 11.2%). Other cardiovascular conditions were observed in 8 (3.2%) patients (Table 1).

Coexisting cardiovascular conditions were frequently observed among study participants. Hypertension with heart failure was the most common combination, occurring in 30 (12.0%) patients, followed by hypertension with ischemic heart disease in 22 (8.8%) patients and ischemic heart disease with heart failure in 12 (4.8%) patients. Hypertension with other cardiovascular conditions was observed in 8 (3.2%) patients.

Additionally, hypertension with other coexisting conditions, heart failure with other coexisting conditions and ischemic heart disease with other coexisting conditions

were observed in 142 (56.8%), 9 (3.6%) and 5 (2.0%) patients, respectively (Table 2).

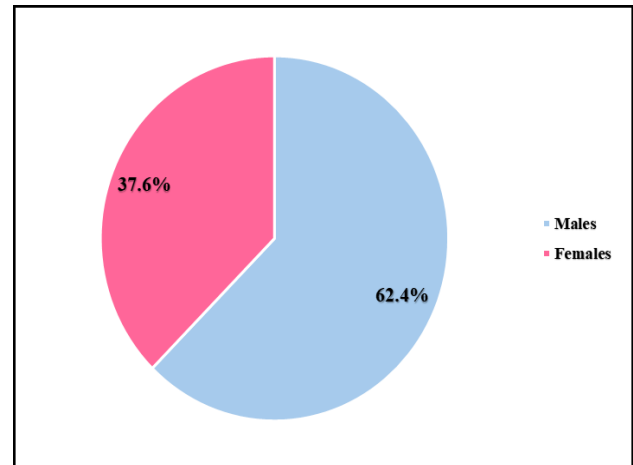


Figure 1: Gender distribution of study population (n=250).

Drug utilisation pattern

Calcium channel blockers (170, 24.8%) and antiplatelet agents (165, 24.1%) were the most frequently prescribed cardiovascular drug classes. Other commonly prescribed classes included adrenergic blockers (79, 11.5%), diuretics (75, 10.9%), miscellaneous cardiovascular drugs (72, 10.5%), statins (55, 8.0%) and RAAS inhibitors (49, 7.1%). Potassium channel openers and nitrates accounted for 1.9% and 0.8% of prescriptions, respectively (Table 3).

Among antiplatelet agents, aspirin was the most prescribed drug (110 (66.6%)), followed by clopidogrel (54 (32.7%)). Amlodipine was the most frequently prescribed calcium channel blocker (76 (44.7%)). Among diuretics, loop diuretics accounted for most prescriptions (51 (68.0%)), with furosemide being the predominant agent (43 (84.3%)).

Angiotensin receptor blockers constituted most RAAS inhibitor prescriptions (46 (93.8%)), with telmisartan accounting for 42 (91.3%) prescriptions within this subgroup. Atorvastatin was the only statin prescribed during the study period. Among adrenergic antagonists, beta-blockers were the most prescribed subgroup (41 (51.8%)), with metoprolol accounting for the majority of prescriptions (30 (73.2%)).

Fixed dose combinations

The most frequently prescribed fixed-dose combination was aspirin+clopidogrel+statin (30 (36.5%)), followed by aspirin+statin (25 (30.4%)). Among antihypertensive combinations, ARB-thiazide combinations accounted for 15.8% of prescriptions. Other prescribed combinations included loop diuretic+potassium-sparing diuretic, beta-blocker+thiazide diuretic, ARB+beta-blocker and ARB+calcium channel blocker combinations (Table 4).

WHO prescribing indicators

A total of 706 medications were evaluated using WHO-INRUD prescribing indicators. Of these, 365 (51.69%) medications were prescribed from the national list of

essential medicines (NLEM) 2022, while 212 (30.02%) were prescribed by generic name. Antibiotics and injections were prescribed in 144 (20.03%) and 206 (29.17%) encounters, respectively (Table 5).

Table 1: Distribution of cardiovascular diseases among study participants (n=250).

Sr. No.	CVDs	No. of patients (N)	(%)
1	HTN	219	87.6
2	IHD	68	27.2
3	HF	28	11.2
4	Other CVDs	8	3.2

Table 2: Distribution of cardiovascular diseases & other concurrent diseases (n=250).

Sr. No.	CVD	No. of patients (N)	(%)
1	HTN+HF	30	12
2	HTN+IHD	22	8.8
3	IHD+HF	12	4.8
4	HTN+other cardiovascular conditions	8	3.2
5	HTN+other coexisting conditions	142	56.8
6	HF+other coexisting conditions	9	3.6
7	IHD+other coexisting conditions	5	2

Table 3: Pattern of cardiovascular drug class utilization in study participants.

Sr. No	Class of drug	No. of drugs prescribed (N)	(%)
1	CCBs	170	24.8
2	Antiplatelets	165	24.1
3	Adrenergic blockers	79	11.5
4	Diuretics	75	10.9
5	Statins	55	8.0
6	RAAS inhibitors	49	7.1
7	Potassium channel openers	13	1.9
8	Nitrates	6	0.8
9	Miscellaneous	72	10.5

Table 4: Distribution of fixed dose combinations.

Sr. No.	FDCs	Frequency	(%)
1	Aspirin+Clopidogrel+Statin	30	36.5
2	Aspirin+Statin	25	30.4
3	ARBs+Thiazides	13	15.8
4	Loop diuretic+Potassium sparing diuretic	7	8.5
5	Beta blocker+Thiazides	4	4.8
6	ARBs+Beta blockers	2	2.4
7	ARBs+CCBs	1	1.2

Table 5: WHO prescribing indicators (n=250).

Sr. No.	WHO prescribing indicators	Number (N)	(%)
1	Percentage of patients with an antibiotic prescribed	144	20.03
2	Percentage of medications prescribed from the NLEM, 2022	365	51.69
3	Percentage of drugs prescribed by generic name	212	30.02
4	Percentage of drugs with an injection prescribed	206	29.17

DISCUSSION

The present study was conducted to analyse the drug utilization pattern of cardiovascular drugs and prescribing procedures in geriatric patients admitted in the Medicine wards and intensive care unit of a tertiary care hospital. Cardiovascular disorders are a leading cause of morbidity in the elderly and rational prescribing is necessary in the context of physiological changes with age, multiple comorbidities and higher risk of adverse medication reactions.^{8,9,17}

In the 250 patients included in the study, males accounted for 62.4% and females 37.6% of the study population. The mean age was 70.88±4.00 years. Male patients were predominant which agrees with other studies reporting a higher burden of cardiovascular illnesses in men. Similar findings were also found by Prabhakaran et al and Rodgers et al who demonstrated a higher prevalence of cardiovascular illnesses in males, particularly in the first decades of life.^{16,18} However, the reduction of the cardioprotective effects of oestrogen after menopause raises the cardiovascular risk in females, which may explain the high percentage of female patients found in the present study.¹⁸

Hypertension was the most common cardiovascular disease and was present in 87.6% of patients, followed by ischemic heart disease (27.2%) and heart failure (11.2%). These results agree with earlier research that found hypertension to be the most common cardiovascular condition among the elderly and a major contributor to cardiovascular morbidity and mortality.^{16,19} The fact that a large proportion of patients acquire ischemic heart disease and heart failure further underscores the importance of hypertension as an essential risk factor for the development of severe cardiovascular problems.^{19,20} A significant number of individuals reported more than one cardiovascular disease. The most frequent combination was hypertension and heart failure, followed by hypertension and ischemic heart disease, then ischemic heart disease and heart failure. Similar findings have been reported in prior studies indicating that older individuals often suffer from various cardiovascular illnesses simultaneously, leading to an increased disease burden and complexity of care.^{20,21}

Besides cardiovascular disorders, numerous patients had related non-cardiovascular comorbidities such as cerebrovascular accidents, chronic renal disease, sepsis, acute kidney damage and respiratory infections. The study highlights the complex health care needs of elderly patients and the importance of comprehensive assessment and interdisciplinary management.^{17,22,23} In the analysis of cardiovascular drug consumption, the most common pharmacological types used were calcium channel blockers and antiplatelet medicines then adrenergic blockers, diuretics, statins and RAAS inhibitors. The increased prevalence of calcium channel blockers may be explained by their proven efficacy and safety in hypertensive senior

people. The high consumption of antiplatelet drugs indicates their important role in the prevention of thrombotic cardiovascular events and in the secondary prevention of ischemic heart disease.^{19,24,25} Chikatipalli et al, Hatami et al and Tiwari et al have also reported similar prescribing patterns.^{13-15,26}

Aspirin was the single most prescribed antiplatelet drug and amlodipine was the single most prescribed calcium channel blocker. The most often used angiotensin receptor blocker was telmisartan; atorvastatin was the only statin prescribed and furosemide was the most employed diuretic. These prescribing patterns are in line with the current treatment guidelines and suggest a preference for well-established drugs that have proven efficacy and safety in older persons.^{19,24,25} Fixed dose combinations were commonly prescribed in the present study. The most prescribed combinations were aspirin, clopidogrel and statins, followed by aspirin and statins and angiotensin receptor blocker-thiazide combinations. These combinations are widely recommended for the treatment of atherosclerotic cardiovascular disease and hypertension and can improve patient adherence by reducing the pill burden.^{24,25,27,28}

WHO-INRUD prescription indicators showed that 30.02% of drugs were prescribed by generic name and 51.69% were prescribed from the National List of Essential Medicines (NLEM) 2022. Prescribing of necessary medicines was moderate, although the comparatively low proportion of generic prescribing shows space for improvement. World Health Organization recommends generic prescribing to promote affordability, accessibility and sensible use of medications.^{5,12} Antibiotics and injections were prescribed in 20.03% and 29.17% of encounters respectively. The frequent use of injections reflects the admission of critically ill patients to the intensive care unit, whereas the usage of antibiotics may be due to the existence of co-infections among hospitalized patients.^{29,30}

The findings of the present study provide useful insight into the distribution of cardiovascular diseases, associated comorbidities and prescribing practices among geriatric patients in a tertiary care setting. Overall, The WHO-INRUD prescribing indicators were used to assess rational drug usage and identify areas for improvement, particularly in the use of generics and adherence to critical medicines. Regular audits of prescriptions and continuous promotion of evidence-based prescribing practices may help to improve the quality of care and patient safety for older patients with cardiovascular illnesses.^{5,12,29}

CONCLUSION

Hypertension was the most common cardiovascular disease among geriatric patients admitted to a tertiary care hospital, followed by ischemic heart disease and heart failure. The high prevalence of cardiovascular and non-cardiovascular comorbidities indicates the difficulty of

pharmacotherapeutic care in geriatric patients and the necessity for specific treatment methods. The prescribing patterns of cardiovascular drugs were generally compatible with current treatment guidelines. Calcium channel blockers were the most frequently prescribed cardiovascular drug class, followed closely by antiplatelet agents. Antiplatelet medications, statins and fixed dose combinations were also administered frequently, which shows adherence to the evidence-based care methods for cardiovascular disorders.

Use of WHO-INRUD indicators for evaluation of prescribing practices showed moderate adherence to essential medicine prescribing and comparatively low generic prescribing. Antibiotic and injectable use reflected the clinical picture of hospitalized and critically sick patients in the research. The findings indicate areas for enhancing rational prescribing procedures, notably for generic prescribing and the use of essential drugs.

Regular prescription audit, continuous monitoring using WHO-INRUD prescribing indicators and implementation of evidence-based prescribing practices may result in improved medication use, enhanced patient safety and improved therapeutic outcomes among geriatric patients with cardiovascular diseases.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Gandani JA, Misra S, Kejriwal A. Drug utilization pattern of cardiovascular medications and assessment of WHO-INRUD prescribing indicators among geriatric patients in a tertiary care hospital: a cross-sectional study. *Int J Basic Clin Pharmacol* 2026;15:967-73.