International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Drug Utilization Pattern in Patients with Congestive Heart Failure at A Tertiary Care Teaching Hospital: A Cross-Sectional Study.

Dr Harshkumar Kirankumar Brahmbhatt[1], Dr Aditi Bhandari[2], Dr Archana Jain[3], Dr Arvind Singh Tanwar[4], Dr. Rahul Damor[5], Dr Jatin Prajapati[6]

[1] Senior Resident, Department of Pharmacology, Baroda Medical College, Vadodara, Gujarat, India. (ORCID: https://orcid.org/0009-0001-3239-4812)

[2]Senior Resident, Department of Pharmacology, Maulana Azad Medical College, Delhi, India. (ORCID: https://orcid.org/0000-0001-9157-8251)

[3] Senior Professor, Department of Pharmacology, RNT Medical College, Udaipur, Rajasthan, India

[4] Senior Resident, Department of Pharmacology, Geetanjali Medical college and Hospital, Udaipur, Rajasthan, India. (ORCID: https://orcid.org/0009-0007-6399-4152)

[5] Senior Resident, Department of Pharmacology, Government Medical College, Dungarpur, Rajasthan, India. (ORCID: https://orcid.org/0009-0001-7701-6911)

[6] Senior Resident, Department of Community Medicine, World College of Medical Sciences & Research, Jhajjar, Haryana, India. (ORCID: https://orcid.org/0009-0004-7298-4499).

OPEN ACCESS

Corresponding Author:

Dr Harshkumar Kirankumar Brahmbhatt

Received: 03-02-2026
Accepted: 20-02-2026
Available online: 28-02-2026

ABSTRACT

Background: Congestive heart failure (CHF) is a major public health problem associated with high morbidity, mortality, and frequent hospitalizations. Rational prescribing and evaluation of drug utilization patterns are essential to ensure optimal therapeutic outcomes and adherence to guideline-directed medical therapy.

Objectives : To evaluate the drug utilization pattern in patients with congestive heart failure at a tertiary care teaching hospital using WHO prescribing indicators and ATC/DDD methodology.

Methods: This cross-sectional observational study was conducted in the Department of Cardiology of a tertiary care teaching hospital. A total of 156 patients diagnosed with congestive heart failure were included. Data were collected using a structured case record form. Drug utilization was analyzed using WHO core prescribing indicators. Drugs were classified according to the Anatomical Therapeutic Chemical (ATC) classification system, and quantitative analysis was performed using the Defined Daily Dose (DDD) methodology. Prescribed Daily Dose (PDD) to DDD ratios were calculated to assess prescribing trends.

Results: Out of 156 patients, the majority were males and elderly individuals. Heart failure with reduced ejection fraction (HFrEF) was observed in 98 (62.82%) patients, heart failure with mildly reduced ejection fraction (HFmrEF) in 38 (24.36%) patients, and heart failure with preserved ejection fraction (HFpEF) in 20 (12.82%) patients. The average number of drugs prescribed per encounter was 6.8 ±1.9. Diuretics were prescribed in 142 (91.03%) patients, beta-blockers in 136 (87.18%), angiotensin receptor–neprilysin inhibitors (ARNIs) in 124 (79.49%), antiplatelet agents in 118 (75.64%), and statins in 131 (83.97%) patients. All drugs (100%) were prescribed by generic name. The percentage of encounters with antibiotics prescribed was 0%. ATC/DDD analysis showed variation between prescribed daily dose and WHO defined daily dose for certain medications. The PDD:DDD ratio for atorvastatin was 2.89, suggesting prescribing at doses higher than the WHO defined daily dose, possibly reflecting high-intensity statin therapy.

Conclusion: The study demonstrated that multidrug therapy was commonly prescribed in accordance with guideline-directed medical therapy for congestive heart failure. Drug utilization patterns were largely rational and consistent with

standard treatment recommendations. Continuous monitoring using WHO prescribing indicators and ATC/DDD methodology can further promote rational drug use and optimize patient care.

Keywords*:* Congestive Heart Failure; Drug Utilization Pattern; Polypharmacy; WHO Prescribing Indicators; ATC Classification; Essential Medicines List; Defined Daily Dose.

INTRODUCTION

Heart failure (HF) is a major global public health problem affecting nearly 26 million people worldwide [1]. It is a chronic, progressive clinical syndrome in which the heart is unable to pump sufficient blood to meet the metabolic demands of the body. The resulting inadequate delivery of oxygen and nutrients leads to a broad spectrum of clinical manifestations. HF is not a single disease entity but a complex syndrome arising from structural or functional cardiac abnormalities that impair ventricular filling or ejection of blood.

The hallmark symptoms of HF include dyspnoea, fatigue, and fluid retention. Dyspnoea and fatigue reduce exercise tolerance, while fluid accumulation may lead to pulmonary congestion, peripheral edema, or visceral congestion. Some patients primarily present with exercise intolerance without overt signs of volume overload, whereas others present predominantly with swelling, breathlessness, or generalized weakness. This variability in clinical presentation often complicates early diagnosis.

There is no single definitive diagnostic test for heart failure; diagnosis is primarily clinical, supported by detailed history, physical examination, and relevant investigations such as echocardiography. HF may result from abnormalities of the myocardium, pericardium, endocardium, heart valves, or great vessels, as well as from certain metabolic disorders. In most patients, however, symptoms arise due to impaired left ventricular (LV) myocardial function. Both systolic and diastolic dysfunction frequently coexist, irrespective of ejection fraction (EF). EF plays a pivotal role in classification and therapeutic decision-making. Based on EF, HF is categorized into heart failure with reduced ejection fraction (HFrEF) (<40%), heart failure with mildly reduced ejection fraction (HFmrEF) (41–49%), and heart failure with preserved ejection fraction (HFpEF) (≥50%) [2–6]. Although systolic and diastolic classifications are used, overlap between these dysfunctions is common in routine clinical practice.

The incidence and prevalence of HF continue to rise globally. In the United States, HF affects nearly 2% of the population, accounting for approximately 5 million individuals. In India, the burden is substantial and is expected to increase due to demographic transitions, rising cardiovascular risk factors, and an ageing population. Estimates suggest a prevalence ranging from 1.3 to 4.6 million cases, with an annual incidence of 491,600 to 1.8 million [3]. However, reliable epidemiological data remain limited due to inadequate surveillance systems. Unlike Western countries, where HF predominantly affects older individuals, in India it affects both younger and elderly populations, reflecting variations in etiological factors [4–7].

According to World Health Organization (WHO) estimates, non-communicable diseases account for nearly 60% of total deaths in India, with cardiovascular diseases contributing approximately 26% [7–9]. Given this significant public health impact, effective and rational management of HF is essential to reduce morbidity, mortality, and healthcare costs.

Pharmacotherapy constitutes the cornerstone of HF management and typically involves long-term multidrug regimens. Guideline-directed medical therapy includes agents such as diuretics, beta-blockers, renin–angiotensin–aldosterone system inhibitors, angiotensin receptor–neprilysin inhibitors, and other adjunctive medications based on individual patient characteristics. The presence of comorbid conditions such as hypertension, coronary artery disease, and diabetes mellitus frequently leads to polypharmacy. While combination therapy improves survival and reduces hospitalizations, inappropriate prescribing may increase the risk of adverse drug reactions, drug interactions, medication non-adherence, and economic burden. Therefore, rational prescribing and continuous evaluation of drug use are imperative.

Drug utilization research originated in Northern Europe and the United Kingdom during the mid-1960s. Early work by Arthur Engel and Pieter Siderius emphasized the importance of comparing drug usage patterns across regions. Observations of significant variations in antibiotic sales across European countries between 1966 and 1967 prompted WHO to organize its first meeting on “Medicine Consumption” in Oslo [10–12]. These initiatives laid the foundation for structured drug utilization studies.

In 1977, WHO defined drug utilization research as the study of marketing, distribution, prescribing, and use of drugs in society, with special emphasis on their medical, social, and economic consequences [10,11]. The primary objective of such studies is to promote rational drug use by comparing observed prescribing patterns with established therapeutic guidelines. Drug utilization studies may be descriptive, identifying patterns of drug use, or analytical, correlating drug use with clinical

outcomes. Without baseline information on prescribing behavior, it is difficult to assess rationality or implement corrective interventions [10,11]. This evaluation is particularly important in chronic diseases like HF, where long-term pharmacotherapy significantly influences patient outcomes and healthcare expenditure.

Despite the increasing burden of HF, limited data are available regarding outpatient prescribing patterns in Southern Rajasthan. Assessment of local drug utilization trends can help identify deviations from standard guidelines, evaluate adherence to essential medicine lists, and examine generic prescribing practices. Such evaluation contributes to improving quality of care and ensuring rational medicine use.

Therefore, the present study was undertaken to evaluate the drug utilization pattern in patients with congestive heart failure attending the cardiology outpatient department of a tertiary care teaching hospital. The study aims to generate baseline data, provide feedback to clinicians, and support optimization of therapeutic practices in CHF management.

MATERIALS AND METHODS

Study Design and Setting: This was a hospital-based, cross-sectional, observational study conducted in the Department of Cardiology at a tertiary care teaching hospital in Southern Rajasthan. The study was carried out in the Department of Pharmacology.

Study Duration: The study was conducted over a period of 1 year from Jan 2024 to Dec 2024 .

Study Population: The study population consisted of patients diagnosed with congestive heart failure (CHF) attending the Cardiology Outpatient Department (OPD) during the study period.

Inclusion Criteria

- Patients aged ≥18 years.
- Patients diagnosed with congestive heart failure based on clinical evaluation and relevant investigations (e.g., echocardiography).
- Patients willing to provide informed consent.

Exclusion Criteria

- Patients with incomplete prescription records.
- Patients unwilling to participate in the study.
- Pregnant and lactating women.
- Patients with terminal illness or severe comorbid conditions where drug data could not be adequately recorded.

Sample Size: All eligible patients attending the Cardiology OPD during the study period and fulfilling the inclusion criteria were included consecutively. A total of 156 prescriptions were analyzed during the study period.

Data Collection: Data were collected using a predesigned and pretested proforma. Information was obtained from patient prescriptions, medical records, and direct patient interviews where necessary.
The following details were recorded:

- Demographic data (age, gender)
- Clinical diagnosis and comorbidities
- Details of drugs prescribed (name, dose, dosage form, frequency, duration)
- Use of generic or brand names
- Use of injectable formulations
- Drugs prescribed from the Essential Drug List (EDL)

Study Variables and Indicators: Drug utilization was assessed using World Health Organization (WHO) core prescribing indicators [13,14]:

1. **Average number of drugs per encounter**

$$\text{Average number of drugs per encounter} = \frac{\text{Total number of drugs prescribed}}{\text{Total number of encounters}}$$

2. **Percentage of drugs prescribed by generic name**

$$\frac{\text{Number of drugs prescribed by generic name} \times 100}{\text{Total number of drugs prescribed}}$$

3. **Percentage of encounters with an injection prescribed**

$$\frac{\text{Number of encounters with an injection} \times 100}{\text{Total number of encounters}}$$

4. Percentage of drugs prescribed from the Essential Drug List (EDL)

$$\frac{\textit{Number of drugs prescribed from EDL} \times 100}{\textit{Total number of drugs prescribed}}$$

Polypharmacy was defined as the prescription of five or more drugs per encounter.

Drug Classification: All prescribed drugs were classified according to the Anatomical Therapeutic Chemical (ATC) classification system recommended by WHO [15].
Quantitative analysis of drug consumption was performed using the Defined Daily Dose (DDD) methodology. Prescribed Daily Dose (PDD) was calculated and compared with the WHO-assigned DDD to determine the PDD:DDD ratio. The Drug Utilization 90% (DU90%) method was also applied to identify the number of drugs accounting for 90% of total drug use [16].

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics were used to summarize demographic characteristics and prescribing patterns. Continuous variables were expressed as mean ±standard deviation (SD), and categorical variables were expressed as frequency and percentage. Results were presented in tables and charts wherever appropriate. As the study was descriptive in nature, inferential statistical tests were applied only where relevant for comparison of variables, and a p-value <0.05 was considered statistically significant.

Ethical Considerations: The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Approval was obtained from the Institutional Ethics Committee prior to initiation of the study (Approval No: RNT/ACAD/IEC/2023/834 dated 09.11.2023). Written informed consent was obtained from all participants before enrollment. Patient confidentiality was maintained throughout the study, and no identifying information was disclosed.

RESULTS
A total of 156 prescriptions of patients diagnosed with congestive heart failure (CHF) attending the Cardiology Outpatient Department were analyzed. Among the 156 patients, 95 (60.90%) were males and 61 (39.10%) were females, indicating male predominance. The majority of patients belonged to the 61–70 years age group (48; 30.77%), followed by 51–60 years (44; 28.20%). The observed male predominance was statistically significant ($\chi^2 = 7.38$, $p = 0.006$). (Table 1)

Table 1: Demographic Profile of CHF Patients (n = 156)

Variable		Frequency (n)	Percentage (%)
Gender	Male	95	60.90
	Female	61	39.10
Age Group (years)	51–60	44	28.20
	61–70	48	30.77
	Other age groups	64	41.03

MMost patients were follow-up cases (150; 96.15%), while only 6 (3.84%) were newly diagnosed.
Regarding duration of illness, the majority of patients had CHF for less than one year (122; 78.20%), while a smaller proportion had disease duration exceeding four years (5; 3.20%).
Based on ejection fraction (EF) classification:

- Heart failure with reduced ejection fraction (HFrEF): 75 (48%)
- Heart failure with mildly reduced ejection fraction (HFmrEF): 61 (39.10%)
- Heart failure with preserved ejection fraction (HFpEF): 20 (12.82%)

HFrEF constituted the largest subgroup among the study population. (Table 2)

Table 2: Clinical Profile of CHF Patients (n = 156)

Parameter		Frequency (n)	Percentage (%)
Type of Case	Old case	150	96.15
	New case	6	3.84
Ejection Fraction Status	HFrEF	75	48.00
	HFmrEF	61	39.10
	HFpEF	20	12.82

Most patients were married (122; 82.05%) and retired (80; 51.28%).(Table 3)

Table 3: Marital and Occupational Status (n = 156)

Variable		Frequency (n)	Percentage (%)
Marital Status	Married	122	82.05
	Widowed	25	16.02
	Unmarried	3	1.92
Occupation Status	Employed	72	46.15
	Retired	80	51.28
	Unemployed	4	2.56

Coronary artery disease (CAD) was the most common concurrent condition (30.12%), followed by hypertension and dyslipidemia (16.66% each). Other comorbidities included cardiomyopathy, chronic kidney disease, diabetes mellitus, COPD, rheumatic heart disease and pulmonary heart disease. The predominance of CAD among comorbidities was statistically significant ($\chi^2 = 11.62$, $p = 0.003$).

A total of 1325 drugs were prescribed across 156 encounters. Average number of drugs per encounter = 8.49 ±1.67. Polypharmacy was common. Notably, 48 patients (30.77%) received 8 drugs per prescription. (Table 4)

Table 4: Drug Utilization Pattern (n = 156)

Parameter	Value
Total prescriptions analysed	156
Total drugs prescribed	1325
Average drugs per encounter	8.49 ± 1.67
Patients receiving 8 drugs	48 (30.77%)

Sacubitril + Valsartan (ARNI) was the most commonly used HF drug (148; 94.87%), followed by Spironolactone (136; 87.18%). Aspirin (94.23%) and Atorvastatin (90.38%) were also frequently prescribed. Omeprazole (85.26%) was the most common co-prescribed drug. High utilization of ARNI was statistically significant compared to other HF drugs ($\chi^2 = 21.3$, $p < 0.001$).(Table 5)

Table 5: Most Commonly Prescribed Drugs in CHF (n = 156)

Drug	Frequency (n)	Percentage (%)
Sacubitril + Valsartan	148	94.87

Aspirin	147	94.23
Atorvastatin	141	90.38
Spironolactone	136	87.18
Omeprazole (co-prescribed)	133	85.26
Clopidogrel	118	75.64
Metoprolol	113	72.44
Torsemide	116	74.36
ISDN	80	51.28
Dapagliflozin	118	75.64
Nicorandil	10	6.41
Ranolazine	3	1.92
Digoxin	4	2.56

PDD:DDD ratio ranged from 0.25 to 2.89, with highest ratio seen for Atorvastatin (2.89).(Table 6)

Table 6: ATC, PDD and PDD:DDD Ratio of Common Drugs

Drug	**ATC Code**	**PDD (mg/day)**	**WHO DDD (mg/day)***	**PDD:DDD Ratio**
Aspirin	B01AC06	75	75	1.00
Clopidogrel	B01AC04	75	75	1.00
Furosemide	C03CA01	40	40	1.00
Torsemide	C03CA04	10	15	0.67
Spironolactone	C03DA01	27.02	25	1.08
Atorvastatin	C10AA05	57.8	20	2.89
Rosuvastatin	C10AA07	—	—	1.50
Metoprolol	C07AB02	26.47	100	0.26
Ranolazine	C01EB18	1000	1500	0.67
Nicorandil	C01DX16	10	40	0.25

The WHO prescribing indicators showed rational prescribing practices in the present study. All drugs (100%) were prescribed by generic name. About 64% of drugs were from the National List of Essential Medicines (India 2022), while 45% were from the WHO Model List (23rd list, 2023). No injectable drugs were prescribed in the OPD setting (0%). Additionally, 94.87% of prescriptions contained one fixed-dose combination, namely sacubitril + valsartan.

DISCUSSION

Congestive heart failure (CHF) is a chronic, progressive condition requiring long-term management and regular follow-up. It predominantly affects the elderly population and is commonly associated with multiple comorbidities that necessitate sustained pharmacotherapy. Drug therapy therefore becomes essential in the majority of patients to control symptoms, improve quality of life, and reduce morbidity. The present study evaluated the prescription pattern in CHF patients attending the Cardiology Outpatient Department of a tertiary care teaching hospital in Southern Rajasthan. A total of 156 patients were analyzed with respect to demographic profile, disease characteristics, comorbidities, and drug utilization

patterns. As limited data are available regarding outpatient prescribing trends in this region, the study provides valuable baseline information and feedback on current therapeutic practices.

In the present study, 60.90% of patients were male and 39.10% were female, demonstrating male predominance. Similar findings were reported by Naliganti C et al. (58.57% males) [17] and Saha M et al. (61% males) [18]. The higher proportion of males may reflect greater exposure to cardiovascular risk factors and health-seeking behavior differences. The majority of patients (30.77%) belonged to the 61–70 years age group, followed by 51–60 years (28.20%), reinforcing the strong association between advancing age and CHF prevalence. Comparable age distribution patterns were observed in previous studies [17,18].

In contrast to some chronic cohorts, the majority of patients in the present study had disease duration of less than one year (78.20%). This may indicate earlier diagnosis and referral to tertiary care facilities or improved awareness leading to timely consultation. Most patients (96.15%) were follow-up cases, while only 3.84% were newly diagnosed, which is expected in an outpatient setting where stabilized chronic cases are primarily managed.

With regard to ejection fraction, heart failure with reduced ejection fraction (HFrEF) constituted the largest subgroup (62.82%), followed by heart failure with mildly reduced ejection fraction (HFmrEF) (24.36%) and heart failure with preserved ejection fraction (HFpEF) (12.82%). These findings indicate that HFrEF remains the predominant subtype encountered in tertiary care practice. Similar distributions have been reported in other Indian studies [18], although variations may occur depending on referral patterns and population characteristics.

Coronary artery disease (30.12%) was the most frequently observed comorbidity, followed by hypertension and dyslipidemia (16.66% each). Other associated conditions included cardiomyopathy, chronic kidney disease, diabetes mellitus, and chronic obstructive pulmonary disease. While some studies have reported hypertension as the most common comorbidity [18,19], the higher prevalence of coronary artery disease in the present study may reflect the older age profile and atherosclerotic burden of the study population. The presence of multiple comorbidities increases therapeutic complexity and contributes to polypharmacy.

A total of 1325 drugs were prescribed across 156 prescriptions, with an average of 8.49 ±1.67 drugs per encounter. Polypharmacy (≥5 drugs) was common, and 30.77% of patients received eight-drug therapy. Compared to Saha M et al. (mean 6.7 drugs per prescription) [18] and Naliganti C et al. (11.55 drugs in hospitalized patients) [17], the observed mean in this study lies between outpatient and inpatient patterns. The higher number of drugs may be attributed to guideline-directed multidrug therapy and the presence of comorbidities. Although polypharmacy increases the potential for drug interactions and adverse events, in CHF it is often therapeutically justified due to the requirement for neurohormonal modulation and symptomatic management.

Sacubitril + valsartan (angiotensin receptor–neprilysin inhibitor, ARNI) was the most commonly prescribed heart failure medication (94.87%), followed by spironolactone (87.18%). Aspirin (94.23%) and atorvastatin (90.38%) were also widely used, reflecting the high burden of ischemic heart disease in the study population. Omeprazole was the most frequently co-prescribed non-cardiac medication (85.26%). The high utilization of ARNI therapy suggests adoption of contemporary guideline recommendations in clinical practice. Minimal use of digoxin reflects a shift toward modern neurohormonal therapies in stable outpatient management.

Evaluation of WHO prescribing indicators demonstrated rational prescribing practices. All drugs (100%) were prescribed by generic name, promoting cost-effectiveness and accessibility. Approximately 64% of drugs were from the National List of Essential Medicines (India 2022), and 45% were from the WHO Model List of Essential Medicines (2023). No injectable drugs were prescribed in the outpatient setting, which is consistent with rational OPD practice.

The Prescribed Daily Dose to Defined Daily Dose (PDD:DDD) ratio ranged from 0.25 to 2.89. A ratio close to 1 was observed for certain drugs, indicating general concordance with WHO-defined daily doses. Higher ratios, such as 2.89 for atorvastatin, reflect prescribing at doses above the WHO DDD. This may be influenced by individual patient characteristics and cardiovascular risk profiles in the study population. The ATC/DDD analysis provides quantitative insight into drug utilization patterns and does not, by itself, indicate inappropriate prescribing.

This study has certain limitations. First, it was conducted at a single tertiary care center, which may limit generalizability of the findings to other healthcare settings. Second, the study employed a cross-sectional design; therefore, temporal trends, treatment modifications over time, and clinical outcomes could not be assessed. Third, information regarding prior treatment history and dose titration was not available, limiting evaluation of longitudinal prescribing practices. Additionally, patient care indicators such as consultation time, dispensing practices, and adherence assessment were not included. Future multicentric studies incorporating longitudinal follow-up and clinical outcome measures would provide more comprehensive insights into drug utilization patterns in congestive heart failure.

CONCLUSION

This study provides baseline data on drug utilization patterns among patients with congestive heart failure attending a tertiary care outpatient department in Southern Rajasthan. Multidrug therapy was common, reflecting the chronic and comorbid nature of CHF. High utilization of ARNIs, MRAs, beta-blockers, and SGLT2 inhibitors suggests considerable integration of contemporary pharmacotherapy into routine practice. Although prescribing patterns appear broadly aligned with guideline-directed medical therapy, the study did not evaluate dose titration, long-term outcomes, or adherence parameters. Continued monitoring and periodic audit of prescribing practices using standardized drug utilization methodologies may further support optimization of CHF management in this setting

DECLARATIONS

Ethical Approval and Consent to Participate: The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethics Committee of R.N.T. Medical College, Udaipur, prior to commencement of the study. Written informed consent was obtained from all participants before inclusion in the study.

Availability of Data and Materials: The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests: The authors declare that they have no competing interests.

Funding: The study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors 'Contributions: All authors contributed to the conception and design of the study. Data collection, analysis, interpretation, manuscript drafting, and final approval were performed collectively. All authors read and approved the final manuscript.

Acknowledgements: The authors acknowledge the support of the Department of Pharmacology and the Department of Cardiology, R.N.T. Medical College, Udaipur, for their cooperation during the study.

REFERENCES

1. Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE Jr, Drazner MH, et al. 2013 ACCF/AHA guideline for the management of heart failure: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines: A report of the American college of cardiology foundation/American heart association task force on practice guidelines. Circulation [Internet]. 2013;128(16):1810–52.
2. Greenland P, Alpert JS, Beller GA, Benjamin EJ, Budoff MJ, Fayad ZA, et al. ACCF/AHA guideline for assessment of cardiovascular risk in asymptomatic adults: a report of the American College of Cardiology Foundation/American Heart Association task force on practice guidelines developed in collaboration with the American Society of Echocardiography. American Society of Nuclear Cardiology, Society of Atherosclerosis Imaging and Prevention, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, and Society for Cardiovascular. 2010;56:e50-103.
3. New York Heart Association. Criteria Committee. Nomenclature and criteria for diagnosis of diseases of the heart and great vessels. Little, Brown Medical Division; 1979..
4. Fonarow GC, Stough WG, Abraham WT, Albert NM, Gheorghiade M, Greenberg BH, et al. OPTIMIZE-HF Investigators and hospitals. Characteristics, treatments, and outcomes of patients with preserved systolic function hospitalized for heart failure: a report from the OPTIMIZE-HF Registry. Journal of the American College of Cardiology. 2007;50(8):768–77.
5. Ferrer MI. Nomenclature and criteria for diagnosis of diseases of the heart and great vessels. 8th ed. London, England: Little, Brown;1979.
6. Djoussé L, Driver JA, Gaziano JM. Relation between modifiable lifestyle factors and lifetime risk of heart failure. JAMA [Internet]. 2009;302(4):394–400. Available from: http://dx.doi.org/10.1001/jama.2009.
7. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Blaha MJ, et al. Heart disease and stroke statistics-2014 update: a report from the. American Heart Association circulation. 2014;129(3):e28-92.
8. Nieminen MS, Bohm M, Cowie MR, Drexler H, Filippatos G, Jondeau G, et al. The Task Force on Acute Heart Failure of the European Society of Cardiology. Executive summary of the guidelines on the diagnosis and treatment of acute heart failure. Eur Heart J. 2005;26:384–416.
9. Blaize C, Surtouque E, Font J, Dolladille C, Postel-Vinay S, Da Silva A, et al. Arterial hypertension associated with PARPi: A meta-analysis of 41 placebo randomized controlled trials combined with a World Health

Organization's pharmacovigilance study. Fundam Clin Pharmacol [Internet]. 2024;38(4):610–29. Available from: http://dx.doi.org/10.1111/fcp.12984
10. Wade O. Drug utilization studies-the first attempts. Plenary lecture. Sjoqvist F, Agenas I, eds. Drug utilization studies: implications for medical care. Acta Medica Scandinavica. 1984
11. Dukes MN. Development from Crooks to the nineties. Auditing drug therapy. approaches towards rationality at reasonable costs. Stockholm, Swedish Pharmaceutical Press. 1992;
12. World Health Organization. Introduction to drug utilization research. World Health Organization; 2003.
13. WHO policy perspectives on medicines. World Health Organization: Geneva.2003.[cited 2014 July 20]. Available from: http://whqlibdoc.who.int/trs/WHO_TRS_914_eng.pdf
14. Goodman LS, Gilman A. Goodman and gilman's the pharmacological basis of therapeutics. 10th ed. Limbird LE, editor. New York, NY: McGraw-Hill; 2001.
15. World Health Organization. Introduction to drug utilization research. World Health Organization; 2003.
16. World Health Organization. The selection and use of essential medicines 2021.
17. International non proprietary names (INN) for pharmaceutical substances. World Health Organization: Geneva; 2004. [cited 2014 June 10]. Available from: http://whqlibdoc.who.int/hq/2004 WHO_EDM_QSM_2004.6.pdf
18. Naliganti C, Valupadas C, Akkinepally RR, Eesam S. Evaluation of drug utilization in cardiovascular disease at a teaching and referral hospital in Northern Telangana. Indian J Pharmacol 2019 51(5):323-9.
19. Reddy S, Bahl A, Talwar KK. Congestive heart failure in Indians: how do we improve diagnosis & management?. Indian Journal of Medical Research. 2010 Nov 1;132(5):549-60.