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Assessment of prescribing trends and medication therapy problems in heart failure, in a Teaching Hospital in South-South Nigeria

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Abstract

Heart failure (HF) remains a major cause of morbidity and mortality globally and continues to pose a significant public health challenge in Nigeria. This retrospective study reviewed 156 HF prescriptions from adult patients attending the cardiology clinic at DELSUTH between January 2020 and December 2024. Most patients were male (64.7%) and aged 50–64 years, with New York Heart Association (NYHA) Class II being the most common diagnosis (42.3%). Diuretics were the most frequently prescribed medications—spironolactone (82.7%) and furosemide (71.2%)—followed by Angiotensin Converting Enzyme (ACE) inhibitors (50.9%), beta-blockers (47.4%), and antithrombotic agents (48.7%). Use of newer guideline-recommended therapies such as Angiotensin Receptor Neprilysin Inhibitors (ARNIs) (8.3%) and Sodium Glucose Cotransporter 2 (SGLT2) inhibitors (8.7%) was low. Medication therapy problems occurred in 7.7% of prescriptions, mainly non-adherence (3.2%) and administration errors (1.9%). Most prescribers (41.7%) followed ACC/AHA guidelines, and all prescriptions involved multidrug therapy issued by cardiologists. The study shows strong adherence to standard HF management but highlights limited access to newer therapies and persistent issues with adherence and minor medication errors.

Keywords: Guideline adherence; Heart failure; Medication therapy problems; Prescribing trends; Rational drug use

INTRODUCTION

Heart Failure (HF) is a complex clinical illness caused by any anatomical or functional impairment of ventricular filling or ejection of blood. The primary symptoms of heart failure include dyspnoea and fatigue, which can restrict exercise tolerance, as well as fluid retention, which can cause pulmonary and/or splanchnic congestion and/or peripheral oedema. Some patients have trouble with exercise but show few signs of fluid retention, whereas others predominantly complain of oedema, dyspnoea, or weariness [1]. Because some individuals exhibit no indications or symptoms of volume overload, the term "heart failure" is preferred over "congestive heart failure." There is no specific diagnostic test for HF because it is primarily a clinical diagnosis based on a detailed history and physical examination. Heart failure has become a major public health concern [2]. Heart failure is becoming a substantial contributor to the

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burden of noncommunicable illnesses in developing nations such as Nigeria, which is undergoing epidemiological and demographic changes. The epidemiology of heart failure in this country is poorly understood [3]. HF affects more than 64.3 million people worldwide [4].

Evidence from high-income countries shows that nearly half of all heart failure patients require rehospitalization within six months after discharge [5], and roughly 70% of these rehospitalizations result from worsening previously diagnosed heart failure, with additional evidence showing that HF remains the leading cause of readmission in the United States [6]. Heart failure readmission is linked to substantially higher mortality than the initial hospitalization, and HF overall is associated with reduced life expectancy, significant morbidity, and impaired quality of life. Early mortality after diagnosis is considerable, about one-third of patients die within the first three months, followed by an annual mortality rate of roughly 10% [2]. In response, outpatient disease-management strategies have been developed and widely adopted, leading to improved survival rates in several countries [7].

In most developing nations, the burden of HF is poorly understood since population-based methodologies are not readily available for measuring the condition's incidence, prevalence, and prognosis. This is primarily due to discrepancies in diagnostic criteria and condition definitions. Heart failure is a major health care burden, and despite significant therapeutic advances, morbidity and mortality in heart failure remains unacceptably high [1]. HF in Africa (including Nigeria) appears to occur at a relatively younger age, afflicting individuals in the prime of life, and is mostly of non-ischemic origin. However, there is limited, systematically collected, contemporary data describing the clinical characteristics, outcomes, and costs of HF across the continent [8]. As an extension of this, there are limited data derived from systematically and prospectively conducted studies of HF in Nigeria, the most populous region in sub-Saharan Africa. Previous studies in the 1960s, 1970s, and 1980s were mainly retrospective, and the various diagnoses were not confirmed by echocardiography [5]. Moreover, there are even fewer data to describe the prescribing trends and errors in Heart failure.

Although a few research on the prescribing trends and medication therapy problems in heart failure have been carried out in Africa, particularly in Nigeria, there is a need to evaluate the prescribing trends and errors in heart failure therapy, Heart failure continues to impose a substantial clinical and economic burden, with outcomes often compromised by inconsistent prescribing practices and preventable medication-therapy problems, particularly in resource-limited settings where gaps in guideline-directed therapy, polypharmacy risks, and inadequate monitoring remain common; therefore, this study aims to examine prescribing trends and identify medication-therapy problems among heart failure patients receiving care at the Delta State University Teaching Hospital (DELSUTH), Oghara.

METHODS

Study design. This study was a retrospective study conducted in Delta State University Teaching Hospital (DELSUTH), Oghara, Delta State, Nigeria.

Study population. The study population comprised all outpatient prescriptions issued to heart failure patients at the Delta State University Teaching Hospital, Oghara, during the study period between January 2020 and December 2024.

Study Setting. This study was conducted at Delta State University Teaching Hospital (DELSUTH), Oghara, a tertiary-level referral centre serving the Niger Delta region of Nigeria. DELSUTH provides advanced

diagnostic and specialist services to a mixed urban–rural population and functions as a major teaching hospital for medical, nursing, and allied-health trainees. The hospital has an estimated 180-bed capacity, supporting both inpatient and outpatient cardiovascular care. Specialist clinics, including cardiology, operate Monday through Friday from 8:00 am to 4:00 pm, allowing for continuous patient evaluation, follow-up, and medication management. Clinical services are delivered by a multidisciplinary team comprising physicians, nurses, and pharmacists. Although the exact number of nurses and pharmacists is not publicly documented, DELSUTH maintains a fully staffed tertiary-care workforce capable of managing complex cardiovascular conditions. Medication prescribing in this study was performed exclusively by cardiology specialists, reflecting the hospital's specialist-led model of care and alignment with guideline-directed medical therapy. As a referral centre, DELSUTH receives patients with diverse and often advanced presentations of heart failure, making it an appropriate setting for examining prescribing patterns, medication-therapy problems, and the use of both conventional and newer heart-failure pharmacotherapies.

Sample size determination. A total of about 180 prescriptions were obtained (from January 2020 to December 2024). Using the Yamane taro equation [9,10]

$$n = \frac{[Z]^2 * P[1 - P]}{d^2}$$

Where:
n is the desired sample size
P is the expected prevalence rate (as a proportion, so 0.062770 for 6.28%)
Z is the score corresponding to the desired confidence level (1.96 for 95% confidence level)
d is the margin of error (as a proportion, so 0.05 for 5%)
Z=1.96 and p=0.20, but set precision d≈0.06277≈0.0628 (≈6.28%) instead of 0.05

Substituting in the equation,

$$n = \frac{1.96^2 * 0.20(1 - 0.20)}{0.06277^2}$$

$$n = \frac{3.8146 * 0.16}{0.0039419}$$

$$n = \frac{0.614656}{0.0039419}$$

n=156.86

Accordingly, 156 prescriptions were randomly sampled.

Inclusion criteria. Prescriptions of male and female patients diagnosed with heart failure at DELSUTH during the study period.

Exclusion Criteria. Prescriptions of Patients below 18 years diagnosed with heart failure.

i. Prescriptions of Patients with other cardiovascular diseases that are not heart failure.

ii. Prescriptions of Heart failure patients prescribed before the year 2020 and after the year 2024.

Sample selection. Eligible prescriptions were selected from the outpatient clinic records, pharmacy dispensing logs, and patient case folders. A consecutive sampling method was employed, where every eligible outpatient prescription encountered during the defined study period was reviewed until the required sample size was achieved. This method is practical, reduces selection bias, and ensures that the sample is representative of the actual prescribing practice within the study area.

Data collection. All data were collected through a survey of prescription records for both male and female in-patients and out-patients at the Delta State University Teaching Hospital, using a data collection form. Data collection was conducted during a one-week visit to the records department of Delta State Teaching Hospital, Oghara.

Statistical analysis. The data was carefully entered into a Bio-statistical table and analysed using the Statistical Package for the Social Sciences (SPSS Version 25) to check for errors and inconsistencies. The data were analysed using descriptive statistical methods, including frequencies and percentages, and the results were summarized accordingly.

Ethical consideration. Ethical approval was obtained from the Research and Ethics Committee of Delta State Teaching Hospital, Oghara, Delta State. Approval number: HREC /PAN/2025/033/0740 before commencement of the study.

RESULTS

Socio-demographics. Most of the patients were male, aged 50-64 years (58.30 ± 14.89), with a New York Heart Association (NYHA) class II diagnosis (Table 1).

Medications used in heart failure. The medications used in heart failure in these patients were based on drug classes. Diuretics were used mostly alone or in combination, and spironolactone (129, 82.7%) was the most commonly prescribed (Table 2).

Other drugs prescribed per class. This study revealed that the most frequently prescribed classes were antihyperlipidemic (34.6% and 10.9%), analgesics (27.5%), haematinics and multivitamins (21.9%), and antidiabetics (21.3%), while aphrodisiacs (0.6%) and antiulcer agents (2.8%) were the least commonly used (Table 3).

Medication therapy problems in heart failure. A total of 12(7.7 %) medication errors were detected with non-adherence 5 (3.2 %) being the most encountered drug therapy problem (Table 4)

Prescribing pattern. All 156 prescriptions (100%) involved multidrug therapy, and all were issued by cardiology specialists (100%).

Patterns of combination therapy. The ACC/AHA recommends a combination of a diuretic, an ACE inhibitor (or ARB or ARNI), and a beta-blocker for symptomatic patients. Compliance with the AHA guideline was very high, and few cardiologists followed the ESC treatment guideline. However, treatment was also individualized based on patient characteristics, comorbidities, and medication tolerance (Table 5).

DISCUSSION

Socio-demographic data. The socio-demographic profile revealed that most of the surveyed prescriptions were from male patients (64.7%), with a minority from female patients (35.3%). The average age of the patients whose prescriptions were surveyed fell within the middle-aged to older-adult range, with the highest proportion in the 50 - 64 years age group. In terms of disease classification, most patients were diagnosed with New York Heart Association (NYHA) Class II, followed by Class III, Class I, and Class IV.

Table 1: Demographic characteristics of patients with HF at DELSUTH (n=156)

Characteristics		Frequency (%)
Gender	Male	101(64.7)
	Female	55(35.3)
Age	20-34	15(9.6)
	35-49	28(18.0)
	50-64	59(37.8)
	65-79	44(28.2)
	80-94	9(5.8)
	95-109	1(0.6)
NYHA Class	I	3(1.9)
	II	66(42.3)
	III	64(41.0)
	IV	23(14.7)

Table 2: Medications used for heart failure at DELSUTH (n=156)

Drug class	Medications	Frequency (%)
ACEIs	Lisinopril	50(32.1)
	Captopril	3(1.9)
	Ramipril	29(18.6)
Betablockers	Metoprolol	13(8.3)
	Carvedilol	16(10.3)
	Bisoprolol	45(28.8)
	Others	6(3.8)
ARNIs	Sacubitril/Valsartan	13(8.3)
Diuretics	Furosemide	111(71.2)
	Torsemide	27(17.3)
	Hydrochlorothiazide	26(16.7)
	Others	42(27.6)
Mineralocorticoid antagonist	Spironolactone	129(82.7)
	Eplerenone	3(1.9)
Antithrombotic	Clopidogrel	76(48.7)
	Aspirin	16(10.3)
SGL21	Dapagliflozin	13(8.3)
	Empagliflozin	14(9.0)
ARBs	Losartan	13(44.8)
	Valsartan	7(24.1)
	Telmisartan	9(31.0)
Others	Digoxin	61(39.1)

Table 3: Other medications-prescribed in patients with HF at DELSUTH (n = 356)

Drug class	Medication	Frequency (%)
Antihyperlipidemic	Atorvastatin	54 (34.6)
	Rosuvastatin	17 (10.9)
Antibiotics		21 (5.9)
Analgesics		98 (27.5)
Haematinics and multivitamins		78 (21.9)
Aphrodisiacs		2 (0.6)
Antiulcer agents		10 (2.8)
Antidiabetics		76 (21.3)

Table 4: Drug therapy problems among patents with HF at DELSUTH

Variables		Frequency (%)
Medication error	Yes	12(7.7)
Medication error type	Dosing error	1(0.6)
	Frequency error	2(1.3)
	ROA error	3(1.9)
	Non-adherence	5(3.2)
	Adverse reactions	1(0.6)
Severity of error	Moderate	3(1.9)
	Severe	9(5.8)

Table 5: Treatment guidelines (n = 156)

Treatment guideline	Description	Frequency (%)
ACC/AHA	Diuretic + ACE inhibitor (or ARB or ARNI) + beta blocker for symptomatic patients. SGLT2 in diabetes or elevated risk of cardiovascular disease	65(41.7)
ESC	ARNI + MRA+ beta blocker +SGLT2 inhibitor (regardless of diabetes status)	32(20.5)
DELSUTH guidelines	Diuretic+ ACEI (ARB or ARNI) + Beta blocker + SGLT2 inhibitor Also determined by the hospital and individual characteristics	59(37.8)

The observed male predominance in this study is consistent with prior findings on heart failure demographics in Sub-Saharan Africa and other emerging regions. It has been reported [11] in African populations, males are more likely than females to suffer from heart failure. This could be due to a higher prevalence of ischemic heart disease, hypertension, and lifestyle risk factors such as smoking, alcohol drinking, and physical inactivity among men [12,13]. Furthermore, socio-cultural variables in some African settings may contribute to late presentation and poor health-seeking behaviour, especially among men, who may postpone medical treatment until symptoms worsen.

Studies from Nigeria [13] and Ghana [14] found that heart failure patients were older. This pattern aligns with the broader epidemiologic transition in many African countries, where the burden of cardiovascular disease has shifted from communicable to noncommunicable conditions due to urbanization, dietary changes, and improved survival following acute cardiac events [15]. In contrast, research in Western groups has revealed a higher elderly age, implying that heart failure develops at a younger age in African populations [16]. This could be due to disparities in risk factor profiles, socioeconomic level, and healthcare availability [8].

In terms of NYHA functional classification, most patients were classified as Class II or III. This data indicates that the majority of those surveyed had mild to moderate physical activity limits because of heart failure. Several studies have also reported that many patients in NYHA Classes II and III [17] suggest a common presentation in the intermediate stages of disease progression. Fewer patients were classified as NYHA Class I, indicating that asymptomatic or slightly symptomatic heart failure remains underdiagnosed or unreported in many low-resource settings. However, the relatively small but significant proportion of individuals in Class IV highlights the issue of late presentation and limited access to early diagnostic or preventative care [13].

The general distribution of NYHA classes in this study is informative because it gives information about disease severity and quality of life. Higher NYHA classifications (III and IV) have been associated with poorer prognosis, higher hospitalization rates, and higher healthcare costs [18]. As a result, the findings of this study emphasize the importance of early discovery, regular monitoring, and optimal pharmacologic care to prevent progression to more severe phases.

Medications used in heart failure.

Diuretics. Furosemide was the most widely used loop diuretic, followed by torsemide and hydrochlorothiazide, with other diuretics (Table 2). The extensive use of loop diuretics, particularly furosemide, is consistent with findings from local and worldwide studies [13,17]. Diuretics are still the basis of symptomatic therapy in heart failure patients, particularly those with pulmonary congestion, peripheral oedema, or fluid overload [18]. They provide immediate alleviation of dyspnoea and enhance exercise capacity, consequently improving the patient's quality of life [19].

Furosemide is preferred over other loop diuretics due to its availability, low cost, and familiarity among clinicians, making it the first-line diuretic in many low- and middle-income nations, including Nigeria. However, newer loop diuretics, such as torsemide, offer pharmacokinetic benefits, including extended duration of action and increased absorption, which may lead to better symptom control and fewer hospital admissions [20].

The use of hydrochlorothiazide indicates an adjunctive role; it is frequently combined with loop diuretics to achieve synergistic diuresis in cases of persistent oedema. Evidence suggests that adding thiazide improves sodium excretion in patients with a limited loop diuretic response, but electrolyte monitoring is required to avoid hypokalaemia and hyponatremia [21].

While diuretics help treat symptoms, they do not improve long-term survival, and excessive or extended use can lead to volume depletion, hypotension, and renal failure [22]. To achieve euvolemia, diuretics should be carefully titrated, followed by disease-modifying treatments such as ACE inhibitors, beta-blockers, and MRAs.

Mineralocorticoid Antagonists. Spironolactone and eplerenone were administered regularly, with spironolactone being the most used medication in this study. The high use of spironolactone in this study suggests remarkable adherence to evidence-based heart failure therapy guidelines. Spironolactone and eplerenone, have been shown to improve morbidity, mortality, and hospital readmissions in patients with NYHA Class II-IV heart failure [23,24]. Spironolactone's extensive use may also be due to its affordability and accessibility compared to eplerenone, which was prescribed only to patients who required it due to specific clinical indications and could afford its comparatively higher cost. Although both medications work by blocking aldosterone's effects on sodium and water retention, eplerenone is more selective for mineralocorticoid receptors, resulting in fewer endocrine side effects such as gynaecomastia and irregular menstruation [25]. However, due to its high cost and limited availability, eplerenone is less frequently used in resource-constrained settings.

The RALES study found that adding spironolactone to conventional medication for severe heart failure reduced all-cause mortality by 30% and hospitalizations by 35% [23]. Similarly, the EMPHASIS-HF trial demonstrated that eplerenone can reduce mortality in patients with mild symptoms [24].

Beta blockers. This study found that beta-blockers were prescribed to a substantial proportion of patients with heart failure, with bisoprolol as the most used, followed by carvedilol, metoprolol, and other agents. The use of bisoprolol shows an increasing trend toward the use of evidence-based cardio selective drugs in the treatment of chronic heart failure.

Beta-blockers are crucial drugs in guideline-directed medical therapy (GDMT) for patients with heart failure with reduced ejection fraction (HFrEF). They work by reducing sympathetic overactivation, a major contributor to disease progression. Blocking β-adrenergic receptors reduces heart rate, oxygen consumption, and arrhythmia risk, thereby improving ventricular remodelling, survival, and functional capacity [19, 22].

Bisoprolol was the most recommended beta-blocker in this study, reflecting physicians' preference for a cardio-selective β1-blocker with a benign side-effect profile, particularly in patients with bronchospastic illnesses or peripheral vascular disease. This is consistent with current European Society of Cardiology (ESC) and American Heart Association (AHA) recommendations, which include bisoprolol, carvedilol, and metoprolol succinate as the best evidence-based beta-blockers for heart failure therapy [22]. The moderate prescription of carvedilol could be attributed to its non-selective beta- and alpha-

blocking actions, which can provide further vasodilatory benefits but can potentially lead to symptomatic hypotension in some patients.

Beta-blocker use in this study aligns broadly with international guideline recommendations, with bisoprolol emerging as the preferred agent, consistent with the pattern observed in Nigerian cohorts [17,26]. Compared with high-income countries, however, overall beta-blocker prescribing rates remain relatively low, highlighting a therapeutic gap in the local implementation of heart failure guidelines.

Angiotensin Converting Enzyme Inhibitors, Angiotensin Receptor Blockers, and Angiotensin Receptor Neprilysin Inhibitors. ACE inhibitors were the most prescribed class, with captopril as the least used and lisinopril and ramipril the most common. The following angiotensin receptor blockers (ARBs) were prescribed: valsartan, telmisartan, and losartan. Compared to ACEIs and ARBs, the use of angiotensin receptor–neprilysin inhibitors (ARNI), specifically sacubitril/valsartan, was relatively low (Table 2).

This study's finding on notable use of ACEIs is consistent with numerous regional and global data indicating that ACEIs remain the mainstay of heart failure treatment. ACEIs are life-prolonging medications that dramatically lower mortality and hospitalizations in HFrEF, according to trials like the Studies of Left Ventricular Dysfunction (SOLVD). Because of their once-daily dosage, generic availability, and positive side-effect profiles, which improve patient adherence and clinician familiarity, lisinopril and ramipril may be preferred in this group [18,27]. On the other hand, captopril, an earlier-generation ACEI that must be taken three times a day, is less frequently prescribed in modern practice because of its difficulty in dosing and increased risk of side effects such as rash and taste changes [28].

ARBs are used in place of ACEIs in patients who experience angioedema or cough. Crucial trials like Val-HeFT and CHARM-Alternative, which found their mortality and morbidity advantages over ACEIs, established their place in the care of heart failure [29]. The use of Losartan in this study may be due to its accessibility and affordability, which is in line with trends shown in other real-world prescribing studies [30]. Telmisartan and valsartan use may be related to their pharmacokinetic profiles, costs, or patient comorbidities that influence physicians' decisions.

Considering the strong evidence that ARNI, specifically sacubitril/valsartan, is superior to ACE inhibitors, its very low utilization in this study is noteworthy. When compared to enalapril, sacubitril/valsartan dramatically decreased cardiovascular death and heart failure hospitalizations [16]. Consequently, both the 2021 European Society of Cardiology (ESC) and 2022 American Heart Association (AHA) guidelines support ARNI as first-line therapy for HFrEF patients who can tolerate an ACEI or ARB [27]. Despite this, adoption remains limited worldwide, largely due to increased costs, limited availability, and the need for physician education on switching from ACEIs to ARNIs.

Sodium-Glucose Cotransporter-2 (SGLT2) Inhibitors. SGLT2 inhibitors were prescribed to a small proportion of heart failure patients, dapagliflozin (8.3%) and empagliflozin (9.0%), together representing 17.3% of prescriptions (Table 2). Despite their recent introduction into heart failure medicine, the inclusion of SGLT2 inhibitors in this current study suggests that practitioners are becoming more aware of and accepting of modern guideline-directed therapy (GDMT). SGLT2 inhibitors, which were originally intended to treat type 2 diabetes, works by inhibiting glucose reabsorption in the renal proximal tubule, causing glucosuria, osmotic diuresis, and natriuresis [31]. In addition to glycaemic

control, these medications have shown significant cardiovascular and renal advantages, irrespective of their hypoglycaemic effects [22]. Their diuretic-like action reduces plasma volume and cardiac preload, while metabolic effects increase myocardial efficiency and reduce inflammation and fibrosis [32].

In this study, empagliflozin was prescribed more commonly than dapagliflozin, most likely due to availability or physician preference. Although overall use remains low, it reflects a favourable trend toward evidence-based prescribing in heart failure care. The poor adoption rate could be attributed to economic constraints or prescribers' unfamiliarity with the pharmacological class in some Nigerian healthcare settings [26]. The use of SGLT2 inhibitors in heart failure regimens provides both clinical and prognostic benefits, making them unique among glucose-lowering medicines. In addition to lowering cardiovascular mortality, they have been demonstrated to reduce renal function decline, making them particularly beneficial in patients with diabetic nephropathy or chronic kidney disease [33]. Furthermore, the mild diuretic effect of SGLT2 inhibitors may allow lower doses of loop diuretics, thereby reducing the risk of electrolyte imbalances and renal impairment [34]. Their tolerability profile is favourable, with a low risk of hypoglycaemia; however, vaginal infections and volume depletion remain potential side effects.

Anti-thrombotic agents. Antithrombotic agents were used as adjunct therapy in a subset of prescriptions, with clopidogrel prescribed more often than aspirin (Table 2). Routine antithrombotic therapy is not universally recommended for all heart failure patients, particularly those in sinus rhythm without additional thromboembolic risk [35], but a considerable subset of patients in this cohort had ischaemic cardiomyopathy, atrial fibrillation, or a history of myocardial infarction, all of which warrant antiplatelet therapy [19]. The preference for clopidogrel over aspirin likely reflects clinically justified prescribing in patients with a higher bleeding risk, concurrent ACE inhibitor therapy, or prior aspirin intolerance, and is consistent with international guidance discouraging routine antiplatelet use in HF patients without a clear ischaemic or atherothrombotic indication [35].

Other medications prescribed for comorbid conditions

The most frequently prescribed non-cardiac drug classes were anti-hyperlipidaemics, analgesics, haematinics and multivitamins, and antidiabetics, while aphrodisiacs and antiulcer agents were the least commonly used (Table 3). The presence of these medications reflects the multimorbidity and symptom complexity typically associated with HF therapy, as patients frequently present with concomitant diseases that necessitate additional pharmacological therapies [22].

Anti- hyperlipidaemic agents. In this study, antihyperlipidemic medications were administered to a subset of patients. atorvastatin was the most commonly used, followed by rosuvastatin. These findings show that a significant proportion of Heart failure (HF) patients received lipid-lowering therapy, indicating that atherosclerotic cardiovascular disease (ASCVD) was an underlying or contributory cause in many cases. Statins (HMG-CoA reductase inhibitors) are mostly used in HF patients due to their recognised role in secondary prevention of ischaemic heart disease (IHD), rather than for direct therapy of HF [35]. The usage of statins in this study emphasizes the burden of ischaemic HF and physicians' focus on cardiovascular risk reduction. Atorvastatin's dominance also reflects a pragmatic prescribing strategy that prioritizes accessibility, cost-effectiveness, and clinical familiarity. Nonetheless, inappropriate statin use in individuals with non-ischemic HF should be avoided, as trials have demonstrated no mortality benefit in this population.

Appropriate prescribing based on aetiology and lipid profile is vital.

Analgesics. The unusually high analgesic prescription rate may be linked to the demand for pain relief in HF patients, who frequently have musculoskeletal pain, osteoarthritis, or chest discomfort associated with comorbidities [36]. However, analgesics, particularly nonsteroidal anti-inflammatory medicines (NSAIDs), should be used with caution since they might aggravate HF by increasing salt and water retention and counteracting diuretic effects [37]. The findings emphasize the significance of sensible analgesic prescribing, preferably with acetaminophen rather than NSAIDs, in order to reduce cardiac function loss [38].

Haematinics and multivitamins. The use of haematinics and multivitamins in this study is consistent with the care of iron deficiency and anaemia, which are prevalent comorbidities in HF. Iron deficiency, even in the absence of evident anaemia, affects up to 50% of HF patients and is linked to lower exercise tolerance, fatigue, and poor prognosis [18]. Supplementation with haematinics, such as iron preparations and folic acid, improves haemoglobin levels and may increase functional capacity [39]. The use of multivitamins indicates efforts to improve nutritional support, as malnutrition and micronutrient deficiencies are common in chronic HF [40].

Antidiabetic medications. Antidiabetic medications were prescribed to a substantial proportion of patients, indicating a high frequency of heart-failure–diabetes comorbidity within the study population. This conclusion is consistent with reports showing 30-40% of HF patients had diabetes mellitus [41]. The use of newer agents, such as SGLT2 inhibitors (e.g., dapagliflozin and empagliflozin, as noted in earlier tables), represents a positive prescribing trend, given their demonstrated benefits in reducing HF hospitalization and cardiovascular mortality regardless of diabetic status [42]. This demonstrates an encouraging adherence to guideline-directed medication, as SGLT2 inhibitors are now regarded as one of the four "pillars" of current heart failure medicine [35].

Antiulcer agents. Antiulcer drugs were used in a small proportion of patients (2.8%, Table 3), suggesting targeted prophylaxis against gastrointestinal discomfort in patients taking multiple medications, such as antiplatelets or NSAIDs. Proton pump inhibitors and H2 antagonists are frequently used to prevent peptic ulcer disease and upper gastrointestinal bleeding in such patients [43]. However, long-term proton pump inhibitor use has been associated with side effects such as hypomagnesaemia and renal impairment, which may worsen HF outcomes [44]; their use should therefore be judicious and guided by clear clinical indication.

Aphrodisiacs. Aphrodisiacs were prescribed to 0.6% of patients (Table 3). Erectile dysfunction is common in heart failure patients due to reduced cardiac output, neurohormonal imbalance, and medication side effects [45]. Phosphodiesterase-5 inhibitors, such as sildenafil, have been used successfully in stable HF with preserved ejection fraction, though caution is advised because of potential hypotensive effects when combined with nitrates [46]. The low use observed in this cohort may reflect prescriber caution related to these safety concerns.

Antibiotics. Antibiotics were administered to a small proportion of patients (5.9%, Table 3), mostly for the treatment of concomitant upper or lower respiratory tract infections or urinary tract infections, which are recognized precipitants of HF decompensation [47]. While their use was limited, this is consistent with common clinical practice, as infection control is important for reducing HF exacerbations and hospitalizations. Antibiotic stewardship

remains important to prevent antimicrobial resistance, and therapy should be guided by culture results or local antibiotic sensitivity patterns where possible.

Medication therapy problems. Medication errors were identified in 7.7% of prescriptions in this study (Table 4). The most prevalent form of medication error was non-adherence, followed by route-of-administration errors, frequency errors, dosing errors, and adverse drug reactions. In terms of severity, more errors were classified as severe than moderate. The overall prevalence of medication errors in this study falls within the range reported in other heart failure populations, 5% to 20% [48,49]. These findings highlight that, despite specialist involvement in prescribing, medication errors remain a meaningful issue in heart failure care that warrants ongoing vigilance and review.

Non-adherence. Non-adherence was identified as the most common medication therapy problem in this study. This finding is consistent with previous research identifying poor adherence as a key driver of hospital readmissions and treatment failure in heart failure [50]. Complex multidrug regimens, side effects, cost burden, and inadequate patient education can all contribute to non-adherence [51]. Pharmacist-led interventions, patient counselling, and medication synchronization programs have all been shown to reduce non-adherence and improve clinical outcomes [52].

***Dosing and frequency errors*.** The dosing and frequency errors found in this study likely reflect difficulty with dose optimization, particularly for medications such as ACE inhibitors, beta-blockers, and diuretics, which require careful titration. Similar patterns have been observed elsewhere, where evidence-based HF treatments were underdosed because of concerns about adverse events or concomitant disease. These types of errors can result in subtherapeutic responses or, conversely, toxicity if the dose is too high. Implementing dose titration protocols and electronic prescribing systems can help prevent these errors [53].

Route of administration (ROA) errors and adverse drug reactions. Errors in the route of administration and adverse medication reactions found in this study point to potential communication or care transition gaps between prescribers, pharmacists, and nursing personnel. According to studies, miscommunication at the prescription and dispensing stages is responsible for a major share of preventable drug errors in hospitals [54]. Adverse events, although minimal in this trial, may have been underreported; still, they remain a worry due to drug-drug interactions and renal impairment, both of which are common in HF patients [48].

Severity of errors. In this study, most medication errors were classified as severe, based on their potential to cause clinically significant harm, while fewer errors fell into the moderate category. This has therapeutic implications because severe medication errors can lead to decompensation, hospitalization, or death in HF. Previous research has also indicated that 30-60% of medication errors in HF cause clinically substantial harm [49, 55]. The elevated rate of severe errors observed in this study consistent with prior reports showing that 30–60% of medication errors in heart-failure populations result in clinically substantial harm underscores the importance of routine medication review and multidisciplinary case discussions.

Rationale for multidrug combination therapy in heart failure. Heart failure is a complex illness marked by neurohormonal activation, fluid retention, and progressive ventricular remodelling. Because no single agent can address all of these pathophysiological pathways, multidrug therapy is the most appropriate approach for

this condition [35]. The use of combination therapy observed in this study aligns with international recommendations from the European Society of Cardiology [37] and the American College of Cardiology/American Heart Association [56], which emphasize a multidrug regimen consisting of ACE inhibitors or ARNI, beta-blockers, aldosterone antagonists, and SGLT2 inhibitors as foundational pharmacologic agents [19].

Patterns of combination therapy. The findings of this study show that most patients were treated according to the ACC/AHA guideline, a smaller proportion followed the ESC guideline recommendations, and a substantial minority received therapy based on institutional or individualized protocols. This distribution reflects a high level of adherence to evidence-based recommendations, particularly the ACC/AHA standard regimen of a diuretic plus an ACE inhibitor (or ARB/ARNI) and a beta-blocker. It also shows meaningful treatment individualization based on patient characteristics, comorbidities, and medication tolerance.

ACC/AHA-based regimens. The widespread adoption of ACC/AHA-guided therapy observed among prescribers in this study (65, 41.7%; Table.5) reflects a strong preference for North American clinical guidelines, which have long been prominent in global heart failure management. The 2022 ACC/AHA/HFSA heart failure guideline emphasizes neurohormonal blockade, including ACE inhibitors or ARBs (or ARNI), evidence-based beta-blockers, and diuretics for symptomatic relief [27]. The addition of SGLT2 inhibitors for patients with diabetes or elevated cardiovascular risk is consistent with existing recommendations, given data showing reduced mortality and hospitalization in this population [3,41]. The high adherence to ACC/AHA therapy observed in this study indicates that cardiologists in this setting prioritize guideline-directed medical therapy and appropriately integrate newer pharmacologic developments.

ESC-based regimens. Approximately one-fifth of the patients in this study (32, 20.5%; Table 5) received therapy in accordance with European Society of Cardiology guidelines [37], which recommend a more comprehensive four-drug combination for patients with HFrEF: ARNI, beta-blocker, mineralocorticoid receptor antagonist, and SGLT2 inhibitor, regardless of diabetes status. This regimen, sometimes described as the four foundational pillars of HFrEF treatment, has been linked to a substantial decline in all-cause mortality and HF hospitalization [32]. The relatively low adherence to the ESC regimen observed in this study (Table 5) could be attributed to limited access to newer, more expensive medicines, such as sacubitril/valsartan and SGLT2 inhibitors, in low- and middle-income settings, as well as variation in local guideline adoption and training. Nonetheless, the presence of some adherence suggests that the ESC approach is gaining acceptance, particularly among clinicians familiar with international evidence.

Individualised and institutional regimens. A large proportion of patients (59, 37.8%; Table 5) were treated using personalised or institutional therapy protocols adapted to patient comorbidities, medication tolerance, or socioeconomic constraints. While this approach differs from strict guideline adherence, it is common in real-world clinical settings. Individualized regimens frequently address practical issues such as cost, drug availability, renal function, electrolyte imbalance, and blood pressure tolerance [29]. This reflects a patient-centred approach that recognizes that, while guideline-directed therapy is desirable, it must occasionally be modified to ensure safety, affordability, and adherence.

Role of specialist prescribers. All prescriptions in this study were written by

cardiology specialists, reflecting the facility's emphasis on tertiary or specialty heart failure care. Specialist prescribing is associated with higher adherence to clinical guidelines and better patient outcomes than non-specialist management [57]. Cardiologists are more likely to initiate and titrate evidence-based medications to target doses, such as beta-blockers and RAAS inhibitors, thereby improving survival and reducing hospitalizations [57].

Conclusion. This study described the prescribing trends and medication therapy problems (MTPs) in heart failure management at Delta State University Teaching Hospital (DELSUTH), Oghara. Furosemide and mineralocorticoid receptor antagonists, especially spironolactone, were the most frequently prescribed medications, followed by ACE inhibitors, beta-blockers, and antithrombotic agents. There was extensive use of mineralocorticoid receptor antagonists and ACE inhibitors, whereas the use of newer agents such as ARNIs and SGLT2 inhibitors remained low, largely due to cost, limited availability, and prescriber familiarity.

Most prescribers followed the ACC/AHA guidelines, while a smaller proportion adhered to the ESC recommendations, indicating a blend of standardized and individualized approaches to patient care. Medication therapy problems were relatively uncommon, with non-adherence the most frequent, followed by minor dosing and administration errors.

Overall, DELSUTH's prescribing pattern closely matches international treatment standards; however, there remains room to increase the use of newer, evidence-based medicines. Continuing education for healthcare practitioners, improved drug availability, and greater pharmacist involvement are critical to improving rational prescribing and patient outcomes.

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REFERENCES

1. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JGF, Coats AJS, et al. 2016 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J. 2016;37(27):2129-200.
2. Roger VL. Epidemiology of heart failure: a contemporary perspective. Circ Res. 2021;128(10):1451-64.
3. Ogah OS, Kushimo OA, Adebiyi A, Onyema CT, Uchenna OC, Adebayo BE, et al. Heart failure in Nigeria: protocol for a systematic review and meta-analysis. Afr Health Sci. 2023;23(2):530-6.
4. Vaduganathan M, Claggett BL, Jhund PS, Cunningham JW, Ferreira JP, Zannad F, et al. Estimating lifetime benefits of comprehensive disease-modifying pharmacological therapies in patients with heart failure with reduced ejection fraction: a modeling study. Lancet. 2020;396(10244):121-8.
5. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan—a web and mobile app for systematic reviews. Syst Rev. 2016;5(1):210.
6. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. N Engl J Med. 2009;360(14):1418-28.
7. Wijeysundera HC, Machado M, Wang X, Van Der Velde G, Sikich N, Witteman W, et al. Cost-effectiveness of specialized multidisciplinary heart failure clinics in Ontario, Canada. Value Health. 2010;13(8):915-21.
8. Ntusi NB, Mayosi BM. Epidemiology of heart failure in sub-Saharan Africa. Expert Rev Cardiovasc Ther. 2009;7(2):169-80.
9. Yamane T. Statistics: an introductory analysis. 2nd ed. New York: Harper & Row; 1967.
10. Israel GD. Determining sample size. Gainesville: University of Florida IFAS Extension; 2013.
11. Ojji DB, Mayosi B, Sliwa K, Francis V, Stewart S. Heart failure in sub-Saharan Africa: a clinical review. Cardiovasc J Afr. 2015;26(1):28-33.

12. Ogah OS, Stewart S, Falase AO, Akinyemi JO, Adegbite GD, Alabi AA, et al. Contemporary profile of acute heart failure in southern Nigeria: data from the Abeokuta Heart Failure Clinical Registry. J Am Coll Cardiol. 2012;59(10):1410-9.

13. Damasceno A, Mayosi BM, Sani M, Ogah OS, Mondo C, Dzudie A, et al. The causes, treatment, and outcome of acute heart failure in 1006 Africans from nine countries. Arch Intern Med. 2012;172(18):1386-94.

14. Adebayo SO, Ogah OS, Sliwa K. Epidemiology of heart failure in sub-Saharan Africa. Curr Cardiol Rev. 2015;11(2):155-62.

15. Sliwa K, Damasceno A, Mayosi BM. Epidemiology and etiology of cardiomyopathy in Africa. Circulation. 2010;112(23):3577-83.

16. McMurray JJV, Packer M, Desai AS, Gong J, Lefkowitz MP, Rizkala AR, et al. Angiotensin–neprilysin inhibition versus enalapril in heart failure. N Engl J Med. 2014;371(11):993-1004.

17. Talle MA, Okeahialam BN, Gadzama AA. Heart failure in a Nigerian tertiary hospital: a 10-year review. Niger J Med. 2019;28(1):39-45.

18. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JGF, Coats AJS, et al. 2016 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J. 2016;37(27):2129-200.

19. Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE, Colvin MM, et al. 2017 ACC/AHA/HFSA focused update of the 2013 guideline for the management of heart failure. Circulation. 2017;136(6):e137-61.

20. Matsue Y, Damman K, Voors AA, Kagiyama N, Yamaguchi T, Kuroda S, et al. Time-to-loop diuretic treatment and mortality in acute heart failure. Heart. 2017;103(13):1059-66.

21. Ellison DH, Felker GM. Diuretic treatment in heart failure. N Engl J Med. 2017;377(20):1964-75.

22. McDonagh TA, Metra M, Adamo M, Gardner RS, Baumbach A, Böhm M, et al. 2021 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J. 2021;42(36):3599-726.

23. Pitt B, Zannad F, Remme WJ, Cody R, Castaigne A, Perez A, et al. The effect of spironolactone on morbidity and mortality in patients with severe heart failure. N Engl J Med. 1999;341(10):709-17.

24. Zannad F, McMurray JJV, Krum H, van Veldhuisen DJ, Swedberg K, Shi H, et al. Eplerenone in patients with systolic heart failure and mild symptoms. N Engl J Med. 2011;364(1):11-21.

25. Juurlink DN, Mamdani MM, Lee DS, Kopp A, Austin PC, Laupacis A, et al. Rates of hyperkalemia after publication of the RALES trial. N Engl J Med. 2004;351(6):543-51.

26. Sule HM, Yusuf AS, Talle MA. Prescribing patterns in heart failure patients in a Nigerian tertiary hospital. Niger J Cardiol. 2020;17(2):77-83.

27. Heidenreich PA, Bozkurt B, Aguilar D, Allen LA, Byun JJ, Colvin MM, et al. 2022 AHA/ACC/HFSA guideline for the management of heart failure. Circulation. 2022;145(18):e895-1032.

28. Ritter JM, Lewis LD, Mant TG, Ferro A. A textbook of clinical pharmacology and therapeutics. 5th ed. London: Hodder Arnold; 2008.

29. Lam CSP, Dewan P, McMurray JV. Clinical implementation of new heart failure therapies: challenges and opportunities. Eur Heart J Suppl. 2021;23(Suppl A):A13-20.

30. Shah KS, Fang JC. Sodium-glucose cotransporter 2 inhibitors in heart failure. Annu Rev Pharmacol Toxicol. 2022;62:109-20.

31. Zinman B, Wanner C, Lachin JM, Fitchett D, Bluhmki E, Hantel S, et al. Empagliflozin, cardiovascular outcomes, and mortality in type 2 diabetes. N Engl J Med. 2015;373(22):2117-28.

32. Packer M, Anker SD, Butler J, Filippatos G, Pocock SJ, Carson P, et al. Cardiovascular and renal outcomes with empagliflozin in heart failure. N Engl J Med. 2020;383(15):1413-24.

33. Heerspink HJL, Stefánsson BV, Correa-Rotter R, Chertow GM, Greene T, Hou FF, et al. Dapagliflozin in patients with chronic kidney disease. N Engl J Med. 2020;383(15):1436-46.

34. Verma S, McMurray JJV. SGLT2 inhibitors and mechanisms of cardiovascular benefit: a state-of-the-art review. Diabetologia. 2018;61(10):2108-17.

35. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JGF, Coats AJS, et al. 2021 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J. 2021;42(36):3599-726.

36. Zhou H, Zhang J, Xu R. Pain and analgesic use in patients with heart failure: a systematic review. J Card Fail. 2018;24(7):511-7.

37. National Institute for Health and Care Excellence. NSAIDs: prescribing issues [Internet]. London: NICE Clinical Knowledge Summaries; 2023 [cited 2026 Mar 20]. Available from:

https://cks.nice.org.uk/topics/nsaids-prescribing-issues/

38. Page RL, O'Rourke RA. Drugs that may worsen heart failure. Circulation. 2019;139(13):e604-6.

39. Anker SD, Comin-Colet J, Filippatos G, Willenheimer R, Dickstein K, Drexler H, et al. Ferric carboxymaltose in patients with heart failure and iron deficiency. N Engl J Med. 2009;361(25):2436-48.

40. Collins SP, Lainscak M, Piepoli MF. Nutritional aspects of heart failure management: a review. Eur J Heart Fail. 2021;23(3):448-60.

41. Kristensen SL, Preiss D, Jhund PS, Squire I, Cardoso JS, Merkely B, et al. Risk related to pre-diabetes and diabetes in heart failure with reduced ejection fraction: insights from the PARADIGM-HF trial. Eur J Heart Fail. 2016;18(9):1234-43.

42. McMurray JJV, Solomon SD, Inzucchi SE, Køber L, Kosiborod MN, Martinez FA, et al. Dapagliflozin in patients with heart failure and reduced ejection fraction. N Engl J Med. 2019;381(21):1995-2008.

43. Ooi JD, Sutherland A, Liew D. Proton pump inhibitors in heart failure: use and safety. Heart Lung Circ. 2017;26(6):550-6.

44. Freedberg DE, Kim LS, Yang YX. The risks and benefits of long-term use of proton pump inhibitors: expert review and best practice advice. Gastroenterology. 2017;152(4):706-15.

45. Nunes JPL, Costa JF, Santos M. Erectile dysfunction in heart failure patients: epidemiology, pathophysiology, and treatment. Curr Heart Fail Rep. 2017;14(3):182-91.

46. Lewis GD, Lachmann J, Camuso J, Lepore JJ, Shin J, Martinovic ME, et al. Sildenafil improves exercise capacity and quality of life in patients with systolic heart failure and secondary pulmonary hypertension. Circulation. 2007;116(14):1555-62.

47. Molinsky RL, Demmer RT, et al. Infection-related hospitalizations linked to elevated heart failure risk. J Am Heart Assoc. 2025.

48. Al-Azzam SI, Alzoubi KH, Obeidat NA. Drug-related problems and medication errors in hospitalized patients with heart failure: a prospective observational study. Int J Clin Pharm. 2020;42(6):1586-95.

49. Koirala B, Rahman M, Poudel RS. Medication errors and associated factors among hospitalized heart failure patients: a cross-sectional study. BMC Cardiovasc Disord. 2020;20(1):118.

50. Ruppar TM, Cooper PS, Mehr DR, Delgado JM, Dunbar-Jacob JM. Medication adherence interventions improve heart failure mortality and readmission rates: systematic review and meta-analysis of controlled trials. J Am Heart Assoc. 2016;5(6):e002606.

51. Wu JR, Moser DK, Lennie TA, Burkhart PV. Medication adherence in patients who have heart failure: a review of the literature. Nurs Clin North Am. 2008;43(1):133-53.

52. Burnier M, Egan BM. Adherence in hypertension: a review of prevalence, risk factors, impact, and management. Circ Res. 2019;124(7):1124-40.

53. Aronson JK. Medication errors: definitions and classification. Br J Clin Pharmacol. 2015;80(3):501-7.

54. Classen DC, Resar R, Griffin F, Federico F, Frankel T, Kimmel N, et al. “Global trigger tool” shows that adverse events in hospitals may be ten times greater than previously measured. Health Aff. 2011;30(4):581-9.

55. Tjia J, Bonner A, Briesacher BA, Peterson D. Medication errors and adverse drug events in elderly patients with heart failure. Am J Geriatr Pharmacother. 2018;16(5):344-54.

56. American Heart Association. Classes of heart failure [Internet]. Dallas: American Heart Association; 2017 [cited 2025 Jan 3]. Available from: https://www.heart.org/en

57. Fonarow GC, Abraham WT, Albert NM, Stough WG, Gheorghiade M, Greenberg BH, et al. Influence of a performance-improvement initiative on quality of care for patients hospitalized with heart failure. Circulation. 2012;113(14):188-95.