Quality of Care of Patients with Stable and Stabilized Heart Failure with Reduced Ejection Fraction at the Medical Wards of a Tertiary Center in the Philippines: A Retrospective Cross-sectional Study

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ABSTRACT

Background. Heart failure with reduced ejection fraction (HFrEF) remains a major contributor to morbidity and mortality among Filipinos. Contemporary ESC and ACC/AHA guidelines emphasize quality indicators aimed at optimizing outcomes.

Objective. The study aimed to evaluate the quality of care received by stable and stabilized HFrEF patients admitted to the medical wards of a tertiary center in the Philippines, focusing on physician adherence to guideline-recommended quality indicators.

Methods. A cross-sectional study was done through review of charts involving all adult HFrEF patients aged ≥19 years admitted to the medical wards of a tertiary hospital from November 2022 to April 2023. Quality-of-care assessment included prescription of Class I guideline-directed medical therapy (GDMT) at discharge for eligible patients, as well as non-pharmacologic indicators such as scheduling of post-discharge follow-up and referrals to a heart failure clinic or cardiac rehabilitation. Descriptive statistics were used; analyses were performed using STATA 13.1. QI of 80% was considered to be optimal quality of care.

Results. A total of 148 patients were included; most were male (69.6%) with a mean age of 56 ± 14 years. Hypertension (62.8%) and diabetes (41.2%) were the most frequent comorbidities. Beta-blockers, ACEi / ARB / ARNI, and diuretic prescription were high (95.17%, 91.41%, and 100%, respectively). In contrast, prescription of MRA and SGLT2i was 68.50% and 55.56%, respectively. Post-discharge physician appointments within 4 weeks were arranged in 91.54%. Only 27.7% were referred to cardiac rehabilitation, and 2.31% were referred to the heart failure clinic.

Conclusion. Quality of heart failure care at the medical wards upon discharge is acceptable for pharmacologic quality indicators and post-discharge appointments. However, referrals to specialized heart failure services and cardiac rehabilitation remain suboptimal and represent opportunities for quality improvement.

Keywords: heart failure, quality of care, inpatients

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INTRODUCTION

Chronic heart failure (HF) is a significant cause of morbidity in the Philippines, affecting 1-2% of the population.[1] In a local study, it was found that there were 1648 cases of heart failure for every 100,000 patient claims for medical conditions in 2014.[2] Hypertension, diabetes mellitus, and coronary artery disease are the common etiologic risk factors. Heart failure accounts for 9% of the total hospitalizations, with a mean length of stay of 10 days (range 1 to 133 days) and therefore has a great impact on the cost of care among these patients.[1] In the University of the Philippines - Philippine General Hospital Department (UP-PGH) of Medicine Annual Report for 2021, heart failure was among the top 5 primary diagnoses of hospitalized patients, comprising 22.58% of the total admissions of the department.[3]

Guidelines have been set forth in recent years for the management of heart failure based on the best available evidence. The European Society of Cardiology (ESC) released an updated guideline in 2021 for the management of patients with heart failure. Recommended diagnostic tests in all patients with suspected chronic heart failure include brain natriuretic peptide (BNP) or N-terminal pro–B-type natriuretic peptide (NT-proBNP), 12 lead electrocardiogram (ECG), transthoracic echocardiography, chest radiography, routine blood tests for comorbidities including full blood count, urea and electrolytes, thyroid function, fasting glucose and HbA1c, lipids, iron status (transferrin saturation and ferritin). Guideline-directed medical therapy (GDMT) for patients with HF with reduced ejection fraction (HFrEF) includes angiotensin receptor-neprilysin inhibitor (ARNI) as a replacement for angiotensin-converting enzyme (ACEi) inhibitors and addition of SGLT-2 inhibitors (dapagliflozin or empagliflozin) as Class I recommendations. Other Class I recommendations include the use of ACEi or ARB, beta-blocker, and mineralocorticoid receptor antagonist (MRA). All of these drugs have been proven in various trials to significantly reduce the risk of HF hospitalization and death, hence are recommended to be given in all HFrEF patients. Additionally, loop diuretics are recommended in patients with HFrEF with signs and/or symptoms of congestion to alleviate HF symptoms, improve exercise capacity, and reduce HF hospitalizations. Class II recommended drugs, which still have conflicting evidence, include: (1) ivabradine, which can be considered in symptomatic patients with LVEF ≤35%, in sinus rhythm and a resting heart rate more than or equal to 70 beats per minute who are unable to tolerate or have contraindications for a beta-blocker to reduce the risk of HF hospitalization and CV death; and (2) digoxin, which may be considered in patients with symptomatic HFrEF in sinus rhythm despite treatment with an ACE-I (or ARNI), a beta-blocker and an MRA, to reduce the risk of hospitalization.[4]

The American College of Cardiology and American Heart Association (ACC/AHA) also released their latest guidelines for the management of heart failure. Both guidelines firmly establish that quadruple therapy with ARNIs, evidence-based β-blockers, mineralocorticoid receptor antagonists, and sodium-glucose cotransporter-2 inhibitors now form the new foundational standard for guideline-directed medical therapy for HFrEF.[5]

Given the impact of heart failure, there is a need to assess and report the quality of care provided in our institution, which serves as one of the largest tertiary care referral centers in the country.

The ESC guidelines for heart failure enumerated quality indicators (QIs) for the evaluation of care and outcomes for patients with heart failure.[4,6] These were made in order to facilitate quality improvement initiatives. QIs may help healthcare providers to simultaneously operationalize discrete guideline recommendations and enable the discrimination between missed opportunities and appropriate care. The QIs are divided into 3 domains: structural QI, patient assessment, and initial treatment. The structural QI includes that the center should have a dedicated multidisciplinary team to manage patients with HF. For patient assessment, the quality measures include documentation of the HF clinical type, documentation of ECG findings, and NT proBNP measurement. For the initial treatment, the quality measures include HFrEF patients on beta-blockers bisoprolol, carvedilol, sustained-release metoprolol succinate, or nebivolol in the absence of any contraindications, HFrEF who are prescribed ACE inhibitor, ARB or ARNI in the absence of any contraindications, HF who are prescribed diuretic therapy if they have evidence of fluid retention, HFrEF who are prescribed an MRA in the absence of any contraindications and HFrEF who are prescribed a SGLT2 inhibitor in the absence of any contraindications.

The latest ACC/AHA guidelines also included clinical performance, quality, and structural measures. The performance measures are derived from the most definitive guideline recommendations. In particular, the following measures were included in the inpatient setting: Post-discharge appointment for patients with HF, HF registry participation, and exercise training referral for HF from the inpatient setting.[5]

Several studies assessed the quality of care among patients with heart failure. In a study in China by Gupta et al in 2020, quality of care was assessed through adherence to 4 performance measures adapted from the 2014 guidelines for HF management in China and the 2013 American Heart Association/American College of Cardiology guidelines and the Get With the Guidelines program for the management of HF, which included (1) LVEF assessment during hospitalization; (2) evidence-based β-blocker (bisoprolol, carvedilol, or metoprolol succinate) for HF with reduced ejection fraction (HFrEF) (LVEF <40%) at discharge; (3) angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs) for HFrEF at discharge; and (4) scheduled follow-up appointment at discharge. The

median composite performance score across all hospitals for the 4 core performance measures was 40.0%, which suggested that the quality of care in China for patients with heart failure may be below standards.[7]

In the ASIAN-HF registry, particularly among Southeast Asian patients with heart failure with reduced ejection fraction (HFrEF), medications used include Angiotensin Converting Enzyme Inhibitors (ACEI) or Angiotensin II receptor blockers (ARB) (77.3%), Beta-blocker (81.8%), Mineralocorticoid receptor antagonist (55.1%), and Loop diuretics (85.6%). Device therapy in the form of ICD and/or pacemaker was used in 9.5% of these patients.[8] In a local study, the medications that were often prescribed were beta-blockers (79%), diuretics (72%), cardiac glycosides (77%), and spironolactone (79%).[9]

Quality of care among heart failure patients was assessed in UP-PGH. A prospective study was done from 2017 to 2018 on the adherence to guideline-directed medical therapy (GDMT) for HFrEF patients. It included 206 patients admitted to the wards and intensive care units. ACE-I/ARB (88.55%), beta-blockers (69.65%), diuretics (98.76%), MRA (68.16%), digoxin (26.8%), and Ivabradine (2.98%) were prescribed among the patients included in the study. Sacubitril Valsartan was prescribed only in 0.02% of the patients. In this study, a QI of 80% was considered to be optimal quality of care.[10]

Through this study, we were able to derive the actual practice of physicians in our institution, being a tertiary referral center in the management of heart failure with reduced ejection fraction, and be able to compare it with the current standard of care based on the current published guidelines for the management of heart failure. In doing so, we were able to validate the quality of care among these patients, identify gaps in the management, and provide local recommendations to address these gaps.

This study was undertaken to evaluate the quality of care provided to patients with heart failure with reduced ejection fraction (HFrEF) who were admitted and clinically stabilized in the medical wards of a tertiary hospital between November 2022 and April 2023. Specifically, the study assessed physician adherence to evidence-based pharmacologic and non-pharmacologic quality indicators recommended in the 2021 European Society of Cardiology (ESC) Guidelines and the 2022 ACC/AHA Guidelines for the management of heart failure. These quality indicators included the initiation of Class I guideline-directed medical therapies in eligible patients without contraindications, namely beta-blockers, angiotensin-converting enzyme inhibitors (ACE inhibitors), angiotensin receptor blockers (ARBs) or angiotensin receptor-neprilysin inhibitors (ARNIs), diuretics in the presence of fluid retention, mineralocorticoid receptor antagonists (MRAs), and sodium-glucose cotransporter-2 (SGLT2) inhibitors. The study likewise evaluated adherence to recommended systems of care, including scheduling of follow-up within four weeks after hospital discharge, referral to a dedicated heart failure clinic, and referral to inpatient cardiac rehabilitation when appropriate.

In addition, the study characterized the clinical profile of hospitalized patients with HFrEF by describing their demographic characteristics, comorbid conditions, New York Heart Association (NYHA) functional class, underlying etiology of heart failure, electrocardiographic findings, echocardiographic assessment of left ventricular ejection fraction, and N-terminal pro-B-type natriuretic peptide (NT-proBNP) levels.

Beyond adherence to Class I recommendations, the study also examined the utilization of selected Class II guideline-recommended therapies, including ivabradine and digoxin, among eligible patients. Finally, it assessed the optimization of guideline-directed medical therapy at hospital discharge by determining the prescribed doses of both Class I and Class II medications and the proportion of patients who achieved at least 50% of the guideline-recommended target daily dose for beta-blockers, ACE inhibitors/ARBs/ARNIs, and mineralocorticoid receptor antagonists.

METHODS

Study Design and Population

This was a retrospective cross-sectional study involving all adult patients aged 19 years and above who were diagnosed with heart failure with reduced ejection fraction (LVEF ≤40% on 2D echocardiogram), hemodynamically stable, and who were admitted to the service medical wards of a tertiary hospital from November 2022 to April 2023. The sample size was derived by total enumeration of patients within the duration of the study period (6 months). Hemodynamically stable patients included those who never required inotropes during admission and those patients initially admitted for acute decompensated heart failure and then stabilized during the course of hospitalization, i.e., no increase in the dose of intravenous diuretics, no use of intravenous vasodilators during the preceding 6 hours, and no use of intravenous inotropes during the preceding 24 hours.[11,12] The study excluded patients who were in acute decompensation and not hemodynamically stabilized, those who required inotropic support (in shock), were admitted to the emergency room and intensive care units.

Patient Profile

Patient-related information that were collected from review of electronic medical records include age and sex, BMI, comorbidities and risks factors (hypertension, diabetes mellitus, chronic kidney disease, chronic obstructive pulmonary disease, asthma, smoking, alcoholic beverage drinking), NYHA functional class, etiology of heart failure and important outcomes such as length of hospital stay and mortality. Information on the workups that were done, including the latest 2D echo, 12-lead ECG, NT-proBNP, serum potassium, and eGFR, was also collected.

Quality of Care Evaluation

Quality of care was evaluated among patients who were considered to be eligible for each quality indicator. Eligibility means that the patient had indications but without contraindications for the specified quality indicator (See Appendix A). A quality indicator of 80% was considered to be optimal quality of care based on a previous local study.[10]

It was determined if each patient was given the following Class I recommended medications for heart failure in the absence of contraindications upon discharge or if the patient died, the medications immediately before the death: beta-blocker, ACE inhibitor, ARB or ARNI, MRA, diuretic, and SGLT2 inhibitor. We defined indications, contraindications, and cautions to ACEi/ARB/ARNi, β-blockers, MRA, and SGLT2i based on the descriptions provided by the ESC 2021 guidelines.[4]

Non-pharmacologic quality indicators included post-discharge appointment within 4 weeks, referrals to cardiac rehabilitation program and heart failure clinic. We reviewed the charts for discharge instructions regarding the date of follow-up appointment as scheduled in the Online Consultation Request and Appointment System, as well as if referrals to the heart failure clinic and cardiac rehabilitation were done prior to discharge.

Usage of Other Drugs and Dosages

We also looked into the proportion of patients given Class II medications such as Ivabradine and Digoxin, the two drugs recommended for heart rate control for HFrEF. The generic names and doses of the medications received by the patient prior to discharge were included as well. For the dosing, we determined the proportion of patients who were discharged with at least ≥50% of the target dose (See Appendix B).

Data Collection

Standardized data collection forms were used for all patient records. These forms were completed during chart review and served as the primary source of information for the study. All collected data were encoded by the principal investigator into a password-protected Microsoft Excel file stored on a secure computer accessible only to the study team. All study-related data will be stored for five (5) years following completion of the study, in accordance with institutional guidelines.

Data Analysis

Descriptive statistics were used to summarize the clinical profile of the patients. Frequency and proportion were used for categorical variables, and median and interquartile range for non-normally distributed continuous variables and mean and SD for normally distributed continuous variables. Missing values were neither replaced nor estimated. STATA 13.1 was used for data analysis.

Ethical Considerations

All patients were de-identified, and their medical information was kept strictly confidential and accessible only to the investigators. The study adhered to the principles of the Declaration of Helsinki and the Philippine National Ethical Guidelines for Health Research and received approval from the University of the Philippines Manila Research Ethics Board (Protocol number: 2023-0413-01).

RESULTS

Baseline Characteristics and Clinical Profile

A total of 148 HFrEF patients were included in this retrospective descriptive study. The baseline characteristics and clinical profiles are shown in Table 1. The majority were male (69.59%) with a mean age of 56 ± 14 years. Most of the patients had a premorbid NYHA functional class of II (45.27%). The most common etiologies of heart failure among these patients include ischemic (84.46%) and hypertensive (50.68%) heart disease. The majority had hypertension (62.84%) and diabetes (41.22%) as comorbid conditions. More than half of the patients were smokers (52.7%). Among the 105 patients (70.9%) who had body mass index documented in their respective charts, 8 (7.62%) were underweight, 50 (47.62%) were of normal BMI, 31 (29.52%) were overweight, and 16 (15.24%) were obese based on the WHO Asia Pacific Standards.

Eleven (11) patients died (7.43%). Among those who died, the most common cause of death was acute coronary syndrome (7 patients, 63.64%). Other causes of death included acute respiratory failure from hospital-acquired pneumonia (2 patients, 18.18%). One died of fatal arrhythmia, and another died due to asphyxia. Most of these patients received at least 1 HF pharmacological pillar before their demise. The mean length of hospital stay was 9.5 days (3-68 days).

All patients included in the study had documentation of their ECG findings as well as a transthoracic echocardiogram. The majority were in sinus rhythm (87.84%). More than half (59.46%) of patients had an LVEF of 36-40%, while the remainder (40.54%) had an LVEF of ≤35%. Almost a third of patients (29.73%) had reduced kidney function (eGFR of <30 ml/min/1.73 m^2). Hyperkalemia occurred in only 6.76%. NT-proBNP was done during admission in the majority of patients (88.51%). The median NT-proBNP was 11,016.95 pg/ml (IQR, 4,457.63-39,491.53 pg/ml), which signifies that the majority of the patients admitted were in decompensated heart failure.

Quality of Care

Pharmacologic Quality Indicators

Upon discharge, prescription of beta-blockers (95.17%), ACEi/ARB/ARNI (91.41%), and diuretics (100%) in patients who were eligible was high (Table 2). In addition,

Table 1. Baseline Characteristics and Clinical Profile of HFrEF Patients Admitted at the Medical Wards from November 2022 to April 2023 (N=148)

	Frequency (%); Median (IQR)
Age	56 ± 14
Sex	
Male	103 (69.59%)
Female	45 (30.41%)
NYHA Functional Class	
I	37 (25.0%)
II	67 (45.27%)
III	39 (26.35%)
IV	5 (3.38%)
Comorbidities and Risk Factors	
Hypertension	93 (62.84%)
Diabetes Mellitus	61 (41.22%)
Previous Heart Failure	44 (29.73%)
Chronic Kidney Disease	40 (27.03%)
Acute Kidney Injury	16 (10.81%)
Chronic Obstructive Pulmonary Disease	4 (2.70%)
Asthma	10 (6.76%)
Smoking	78 (52.70%)
Alcohol use	90 (60.81%)
12L ECG: Rhythm	
Sinus	130 (87.84%)
Atrial fibrillation/flutter	17 (11.49%)
2D echocardiogram: LVEF	
36-40%	88 (59.46%)
≤35%	60 (40.54%)
Hyperkalemia (>5 mmol/L)	10 (6.76%)
eGFR <30 ml/min/1.73 m²	44 (29.73%)

Table 2. Pharmacologic Quality Indicators of Heart Failure Care (Class I Recommendations) for HFrEF Patients Admitted at the Medical Wards

	Number of patients with HFrEF who are prescribed the medication	Number of patients with HFrEF without any contraindications for medication	Percentage (%)
Beta-blocker	138	145	95.17
ACEi/ARB/ARNI	117	128	91.41
MRA	87	127	68.50
Diuretic	25	25	100.00
SGLT2 inhibitors	60	108	55.56

MRA and SGLT2 inhibitors were prescribed in 68.50% and 55.56% of patients, respectively.

Non-pharmacologic Quality Indicators

Appointments with a physician within 4 weeks after discharge were made in 91.54% of patients (Table 3). The rest of the patients were either scheduled more than 4 weeks from discharge (3.85%) or were not provided a follow-up schedule at all (4.62%) based on the Online Consultation Request and Appointment System (OCRA). The mean duration of discharge to outpatient follow-up was 14 ± 6.4 days. A closer follow-up schedule within 1 and 2 weeks was made in 14.62% and 60.77% of patients, respectively.

Referrals to specialty continuity care clinics were made in less than a third of patients overall. This comprises cardiac rehabilitation (27.7%) and the heart failure clinic (2.31%), respectively. Among those referred for cardiac rehabilitation, more patients were referred to the Department of Rehabilitation Medicine service (63%) than to the Cardiology – Rehabilitation service (37%). Among the 3 patients referred to the heart failure clinic, 2 of them had severe LV dysfunction on echocardiogram (24-25%) and still had diuretics on discharge.

Table 3. Non-pharmacologic Quality Indicators of Heart Failure Care

	Number of patients with HFrEF with the quality indicator	Number of eligible HFrEF patients	Percentage (%)
Post-discharge follow-up within 4 weeks	119	130	91.54
Referral to cardiac rehabilitation	41	148	27.70
Referral to heart failure clinic	3	130	2.31

Table 4. Proportion of Patients who Achieved >50% of Target Dose of Class I Drugs upon Discharge

	Number of Patients with ≥50% of Target Dose*	Number of patients with HFrEF who are prescribed the medication	Percentage (%)
Beta-blocker	68	138	49.28
ACEi/ARB/ARNI	43	117	36.75
MRA	79	87	90.80

**Please see Appendix B for the starting and target doses of HFrEF medications.*

Profile of Medications upon Discharge

The most common beta-blocker that was prescribed was Carvedilol (80.43%) with a median dose of 12.5 mg/day (IQR 12.5 to 25 mg/day). Sacubitril/valsartan was prescribed in 52.14% of patients with a median dose of 100 mg/day. Enalapril was the most commonly prescribed ACE inhibitor (35.90%) with a median dose of 10 mg/day (IQR 5 to 10 mg/day). The MRA prescribed in eligible patients was Spironolactone with a median dose of 25 mg/day. No patient was prescribed eplerenone. Furosemide was the diuretic used in all eligible patients with a median dose of 80 mg/day (IQR 40 to 120 mg/day). One patient was prescribed tolvaptan on top of furosemide. The SGLT2 inhibitors that were prescribed include Empagliflozin (68.33%) and Dapagliflozin (31.67%).

Among medications with Class II recommendations, ivabradine was prescribed in 20.27% of all patients, and in 100% of those with an appropriate indication. Digoxin was prescribed in 5.41% of all patients, likewise reaching 100% among those with an indication.

For patients on Ivabradine, almost all of them were already given beta-blockers except for 1 patient, who had first-degree atrioventricular block; hence, the physician opted to give Ivabradine instead of a beta-blocker as a rate controller. The majority (70%) of these patients also had heart rates >70 bpm. The usual dose of Ivabradine on discharge was 10 mg/day.

For patients given digoxin, 75% (6 out of 8 patients) were in atrial fibrillation/ atrial flutter while the remainder were in sinus rhythm. Almost all of these patients had at least 1 heart failure class I recommended drug on board. For the 2 patients in sinus rhythm who were given digoxin, both were symptomatic (functional class III), but one received ACEi only while the other patient was already given ARNI, beta-blocker, and MRA.

More than 50% of the target daily dose was achieved upon discharge or prior to death in those who died in 49.28% for beta-blockers, 36.75% for ACEi/ARB/ARNI, and 90.80% for MRA.

DISCUSSION

This is the most recent local study in this local tertiary hospital, which evaluated HFrEF inpatient quality of care not only in terms of GDMT adherence but also in terms of non-pharmacologic management, such as follow-up and referrals to specialty care clinics (heart failure and cardiac rehabilitation). This is also the most recent local study that measured our healthcare performance and practices based on the quality indicators set forth mainly by the European Society of Cardiology for the management of patients with heart failure with reduced ejection fraction.

The significant findings in our study are that we have good physician adherence to beta-blockers, ACEi/ARB/ARNI, and diuretics for fluid retention (95.17%, 91.41%, and 100.00%, respectively) but lower adherence when it comes to the prescription of MRA and SGLT2 inhibitors (68.50% and 55.56%, respectively). Comparing our performance to the latest study by D'Amario et. al, an Italian study published in 2023 which examined the eligibility of patients for the 4 pharmacological pillars in HFrEF at discharge, beta-blocker, ACEi/ARB/ARNI, MRA and SGLT2i prescription were 93.4%, 68.2%, 32.5% and 4.6%, respectively.[13] Based on this, our institution shows better physician adherence to GDMT, likely because of (1) the academic environment where most physicians are updated through training, (2) co-management with Adult Cardiology subspecialty service (97.30%), which could have provided guidance to the primary care services (General Medicine and Family Care Medicine) for HF management. Comparing our results with the local study by Tomas et al. in 2018, where beta-blocker, ACEi/ARB, MRA, and diuretic use were reported at 69.65%, 88.55%, 68.16%, and 98.76%, respectively, we can see that our adherence to these class I medications has improved over time.[10] This can be due to improved awareness of these GDMT through continuing medical education programs.

MRA use in our institution was not as high as beta-blocker and ACEi/ARB/ARNI use, which might be due

to the risk of hyperkalemia and renal insufficiency. But comparing our results with the study of D'Amario et al., we still have better physician adherence to MRA prescription (68.50 vs 32.5%).[13] Around 29% of patients included in the study had renal insufficiency, which could allude to hesitancy or caution among physicians in terms of MRA prescription. Furthermore, this can also be attributed to the adaptation of the previous guidelines to start MRAs only if the patient is still symptomatic and has an LVEF ≤35% after uptitration of an ACEi/ARB/ARNI and a β-blockers.[14] Nevertheless, initiation of MRAs while admitted is already recommended, as evidenced by several studies which have shown its benefits in reduction of mortality and rehospitalization, and its safety in the acute care setting.[15-18]

SGLT2i prescription in our study was also not as high as beta-blocker and ACEi/ARB/ARNI use due to several reasons. It is non-formulary, hence additional out-of-pocket expenses for our patients. There are also concerns about urinary tract infection, renal insufficiency, and hypotension. However, the EMPULSE trial, which randomized patients admitted with acute decompensated HF to empagliflozin or placebo, proved clinical benefit at 90 days in patients randomized to empagliflozin, with reduction in all-cause mortality and HF events, as well as improvement of HF symptoms, and has also been shown to be well tolerated without safety concerns.[12] This safety profile, coupled without the need to titrate the SGLT2i dose, should strengthen the opportunity of implementing SGLT2i treatment at discharge.

For the non-pharmacologic indicators, our rate of post-discharge appointment within 4 weeks (91.54%) was comparable to the result of the study by Warner et al (91.5%), which was done using the Veterans Affairs hospital system in the United States but we had a much lower rate of follow up at 7 and 14 days (14.62% vs 57.7% and 60.77% vs 78.8%).[19] This highlights an area of improvement since studies have shown that earlier follow-up (7-14 days) is associated with better outcomes, and it would allow us to assess signs of congestion, drug tolerance, and start and/or uptitrate evidence-based therapy.[20,21]

As for the referral to a cardiac rehabilitation program, we have a relatively low performance in this quality indicator, although this is the trend even in European countries (15-29%).[22,23] Possible reasons for the low referral rates are the lack of awareness of the evidence of effectiveness of cardiac rehabilitation and inadequate education among clinicians. Hence, creating education programs on the benefits of cardiac rehabilitation could help to provide more trained staff to deliver programs and improve its application to practice.[24]

Our referral rate to our heart failure clinic is significantly lower (2.31%) compared to a Canadian study by Gravely et al., which had a referral rate of 15.1%.[25] Our institution's outpatient heart failure clinic started in August 2022 and has been catering to patients with HFrEF, giving holistic care and close follow-up and optimization of GDMT. Lack of awareness among the physicians managing these HFrEF patients may be one of the reasons for such a low referral rate. A previous study showed that HF clinics are associated with reductions in rehospitalization and mortality in an unselected HF population.[26] There is a strong need to improve on this aspect of care.

Most of the dosages of HFrEF patients on discharge were uptitrated from the recommended starting dose. Achievement of ≥50% of the target doses for beta-blockers (49.28% vs 45.9%) and ACEi/ARB/ARNI (36.75 vs 31.6%) was comparable to the study by Warner, but had significantly more patients who achieved ≥50% of the target dose for MRA (90.8% vs 19.0%).[19] Knowing these will help us with our plans for uptitration of GDMT in the outpatient clinics since, in the STRONG-HF trial, GDMT (Beta-blocker, ACEi/ARB/ARNI, MRA) were started at 50% of the target dose at discharge, then rapid uptitration to full optimal dose within 2 weeks after discharge along with close follow-up and monitoring reduced symptoms, improved quality of life, and reduced the risk of 180-day all-cause death or heart failure readmission compared with usual care.[27] However, most Filipinos also have lower weights in general compared to Caucasian counterparts, which were the population of the studies for target doses. This could mean our patients were at higher risk for adverse effects – especially hypotension.

Limitations of the Study

Our study had several limitations. First, the non-inclusion of HFrEF patients admitted to pay wards was a decision made for logistic reasons since these are not registered in the OCRA. Second, our institution is a tertiary referral center; hence, a risk of selection bias toward inpatients with worse clinical status could be present. The retrospective observational design could not capture narratives such as physicians' reasons for non-referral to the HF clinic or cardiac rehabilitation or reasons for delayed appointments. This also did not investigate the reasons for nonadherence to target doses of HF therapy, such as hemodynamic instability and adverse events. Referrals for device therapy, although included in the quality indicators, were not accounted for in this study since assessment for devices usually occurs well beyond 40 days (for myocardial infarction) or 3 months post-discharge (on HF GDMT). Lastly, assessment of rehospitalization rates and patients' health-related quality of life was not done.

Recommendations

For future studies, we recommend also analyzing the proportion of patients who were prescribed 1, 2, 3, or all 4 HFrEF pillars (ACEi/ARB/ARNI, Beta-blocker, MRA, and SGLT2i) or none at all. Through this, we may be able to correlate with important outcomes such as rehospitalization rates and mortality.

Regular evaluation of these performance measures and quality indicators, as well as adapting them into the heart

failure pathway, will help improve the inpatient quality of care of HFrEF patients. We currently have a HF pathway for patients in acute decompensation at the emergency room, and it is already high time to develop a pathway for hemodynamically stabilized heart failure patients in the wards.

Our titration of the Class I recommended medications to target doses upon discharge is comparable to the latest study. Physicians should strive to uptitrate these doses to target doses or to maximally tolerated doses in the absence of contraindications in the outpatient clinic.

In our study, we also identified patients who were not eligible for the use of Class I recommended drugs for heart failure. Hence, these subsets of patients are at a higher risk of developing major adverse cardiovascular events. We recommend close monitoring as well as identifying reversible causes in order to initiate GDMT among these patients. We also recommend identifying novel pharmacological approaches in managing these patients in order to improve their outcomes.

CONCLUSION

The quality of care for stabilized HFrEF patients in our medical wards is generally satisfactory, as reflected by strong physician adherence to guideline-recommended pharmacologic indicators and the non-pharmacologic indicator of timely post-discharge follow-up, consistent with ESC 2021 and ACC/AHA 2022 standards. However, referral rates to heart failure clinics and cardiac rehabilitation remain suboptimal and represent key areas for improvement.

Statement of Authorship

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None.

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APPENDICES

Appendix A. Practical Guidance on the Use of Medications for Heart Failure with Reduced Ejection Fraction[4]

Drug class	Contraindications
Angiotensin-converting enzyme inhibitors (or Angiotensin II receptor blockers)	*Indications:* 1. Patients with HFrEF to improve symptoms and exercise capacity, reduce the risk of HF hospitalization, and increase survival. *Contraindications:* 1. History of angioedema. 2. Known bilateral renal artery stenosis. 3. Pregnancy/risk of pregnancy. 4. Known allergic reaction/other adverse reaction (drug-specific). *Cautions/seek specialist advice:* 1. Significant hyperkalemia (K þ >5.0 mmol/L). 2. Significant renal dysfunction [creatinine >221 µmol/L (>2.5 mg/dL) or eGFR <30 mL/min/1.73 m^2]. 3. Symptomatic or severe asymptomatic hypotension (SBP <90 mmHg).
ARNI	*Indications:* 1. Patients with HFrEF as a replacement for ACE-I/ARB or may be considered in patients with HFrEF who are ACE-I/ARB naive (de novo use) to improve symptoms, reduce the risk of HF hospitalization, and increase survival. *Contraindications:* 1. History of angioedema 2. Known bilateral renal artery stenosis 3. Pregnancy/risk of pregnancy and breastfeeding period 4. Known allergic reaction/other adverse reaction (drug-specific) 5. eGFR <30 mL/min/1.73 m^2 6. Symptoms of hypotension or a SBP <90 mmHg (PARADIGM-HF enrolled patients with SBP >95 mmHg at randomization) *Cautions/seek specialist advice:* 1. A washout period of at least 36 h after ACE-I therapy is required in order to minimize the risk of angioedema. 2. Significant hyperkalemia (K >5.0 mmol/L).
Beta-blockers	*Indications:* 1. Patients with stable HFrEF to improve symptoms, reduce the risk of HF hospitalization, and increase survival. *Contraindications:* 1. Second- or third-degree AV block (in the absence of a permanent pacemaker). 2. Critical limb ischemia. 3. Asthma (relative contraindication): if cardio-selective beta-blockers are indicated, asthma is not necessarily an absolute contraindication, but these medications should only be used under close medical supervision by a specialist, with consideration of the risks for and against their use; COPD is not a contraindication. 4. Known allergic reaction/other adverse reaction (drug-specific).
Mineralocorticoid Receptor Antagonists	*Indications:* 1. Patients with HFrEF to improve symptoms, reduce the risk of HF hospitalization, and increase survival. *Contraindications:* 1. Known allergic reaction/other adverse reaction (drug-specific). *Cautions/seek specialist advice:* 1. Significant hyperkalemia (K þ >5.0 mmol/L). 2. Significant renal dysfunction [creatinine >221 µmol/L (>2.5 mg/dL) or eGFR <30 mL/min/1.73 m^2].
SGLT2 inhibitors	*Indications:* 1. Patients with HFrEF (regardless of concomitant diabetes mellitus) to improve QOL, reduce the risk of HF hospitalization, and increase survival. *Contraindications:* 1. Known allergic reaction/other adverse reaction (drug-specific). 2. Pregnancy/risk of pregnancy and breastfeeding period. 3. eGFR <20 mL/min/1.73 m^2 4. Symptoms of hypotension or a SBP <95 mmHg. *DAPA-CKD (dapagliflozin) enrolled patients with an eGFR >25 mL/min/1.73 m^2

Appendix A. Practical Guidance on the Use of Medications for Heart Failure with Reduced Ejection Fraction[4] *(continued)*

Drug class	Contraindications
Diuretics	*Indications:* 1. Potentially all patients with symptoms and signs of congestion, irrespective of LVEF. 2. When used, should always be used in combination with an ACE-I (or an ARB), a beta-blocker, and an MRA in patients with HFrEF (unless any of these drugs is not tolerated/contraindicated), until signs of congestion have been relieved. 3. Thiazide diuretics can be used in patients with preserved renal function and mild symptoms of congestion. However, the majority of patients require loop diuretics (or combined with a thiazide diuretic and an MRA) due to the severity of HF symptoms and steadily deteriorating kidney function. *Contraindications:* 1. Not indicated if the patient has never had symptoms or signs of congestion. 2. Known allergic reaction/other adverse reaction (drug-specific).
Ivabradine	*Indications:* 1. Patients with stable symptomatic HF (NYHA class II-IV) and an EF <_ 35% SR and a resting heart rate>70 bpm despite guideline-recommended treatment (in particular, an evidence-based dose of beta-blocker). *Contraindications:* 1. Unstable CV conditions (ACS, stroke/TIA, severe hypotension). 2. AF 3. Severe liver dysfunction or renal dysfunction (no evidence on safety or pharmacokinetics for creatinine clearance <15 mL/min). 4. Pregnancy or breastfeeding. 5. Known allergic reaction/other adverse reaction (drug-specific). Cautions/seek specialist advice: 1. Severe (NYHA class IV) HF. 2. Current or recent (<4 weeks) exacerbation of HF (e.g. hospital admission with worsening HF). 3. Resting heart rate <50 b.p.m. during treatment. 4. Moderate liver dysfunction. 5. Chronic retinal diseases, including retinitis pigmentosa.

Appendix B. Starting and Target Doses of Medications for HFrEF[4]

	Starting and Target Doses of Medications
Beta-blocker	
Carvedilol	starting dose 3.125 mg BID target dose 25 mg BID
Bisoprolol	starting dose 1.25 mg OD target dose 10 mg OD
Metoprolol	starting dose 12.5 mg OD target dose 200 mg OD
Nebivolol	starting dose 1.25 mg OD target dose 10 mg OD
ACEi/ARB/ARNI	
Captopril	starting dose 6.25 mg t.i.d., target dose 50 mg t.i.d.
Enalapril	starting dose 2.5 mg b.i.d., target dose 10-20 mg b.i.d.
Valsartan	starting dose 40 mg b.i.d., target dose 160 mg b.i.d.
Telmisartan	starting dose 40 mg OD, target dose 80 mg OD
Losartan	starting dose 50 mg OD, target dose 150 mg OD
Sacubitril Valsartan	starting dose 50 mg b.i.d. target dose 200 mg b.i.d.
MRA	
Spironolactone	starting dose 12.5 mg OD target dose 50 mg OD
Diuretic	
Furosemide	starting dose 20-40 mg, usual dose 40-240 mg.
SGLT2i	
Dapagliflozin	target dose 10 mg OD
Empagliflozin	target dose 10 mg OD
Digoxin	starting dose 62.5 ug OD target dose 250 ug/OD
Ivabradine	starting dose 5 mg BID target dose 7.5 mg BID