REVIEW ARTICLE

SCOPING REVIEW OF HEART FAILURE EPIDEMIOLOGY, ECONOMIC BURDEN, AND REGIONAL DISPARITIES IN ASEAN COUNTRIES

Ahmed Alaa Al-Temimi[1,2], Raja Ezman Raja Sharif[3,5], Mohd Shahezwan Abd Wahab[4,5] and Hanis Hanum Zulkifly[4,5*]

[1]Faculty of Pharmacy, Universiti Teknologi MARA (UiTM), Selangor Branch, Puncak Alam Campus, 42300, Selangor, Malaysia.
[2]Clinical Pharmacy Department, College of Pharmacy, Al-Bayan University, Baghdad, Iraq.
[3]Department of Medicine, Universiti Teknologi MARA (UiTM), Faculty of Medicine Sungai Buloh, Sungai Buloh, Malaysia.
[4]Department of Pharmacy Practice and Clinical Pharmacy, Faculty of Pharmacy, Universiti Teknologi MARA (UiTM), Selangor Branch, Puncak Alam Campus, 42300, Selangor, Malaysia.
[5]Cardiology Therapeutics Research Group, Universiti Teknologi MARA, Selangor Branch, Bandar Puncak Alam, Malaysia.

***Corresponding Author: Hanis Hanum Zulkifly,**
Email: hanish2984@uitm.edu.my

ABSTRACT

Heart failure (HF) is a complex clinical syndrome and a major global public health challenge and growing health challenge, associated with substantial morbidity, mortality, and healthcare expenditure. Its burden continues to rise worldwide, driven by population ageing and improved survival from cardiovascular diseases. significant regional disparities remain, with Southeast Asia experiencing earlier age at HF, higher hospitalisation rates, and a substantial burden of comorbidities. This scoping review aimed to summarise the global epidemiology of heart failure, focusing on incidence, prevalence, and hospitalisation patterns, and regional disparities in ASEAN countries. Peer-reviewed epidemiological studies, national registries, and systematic reviews reporting on HF incidence, prevalence, hospitalisations, and outcomes worldwide. A scoping review was conducted using the ScienceDirect and PubMed databases, employing keywords both individually and in combination, including "heart failure", "incidence", "prevalence", "worldwide", "epidemiology", "HF hospitalizations", "Asian", "race", "ethnicity", "cardiac guidelines", and "Southeast Asia". Reference lists of relevant articles were also reviewed to identify additional studies. PRISMA-ScR guided, the study selection process comprised the identification, screening, eligibility assessment, and inclusion of articles. The findings demonstrate a rising burden of HF globally, with Southeast Asia showing higher rates of premature HF, frequent hospitalisations, and substantial comorbidity burden. Malaysia exhibits high HF prevalence and hospitalisation rates. These results underscore the urgent need for region-specific prevention strategies, guideline-directed medical therapy (GDMT) implementation, and multidisciplinary care to address the escalating burden and economic impact of heart failure in ASEAN countries.

Keywords: *Heart Failure, Global Epidemiology, Incidence, Prevalence, Hospitalization, Economic Burden, Multidisciplinary Care of Heart Failure, Southeast Asia, Malaysia*

INTRODUCTION

Heart Failure (HF) is a clinical syndrome due to any structural or physiological abnormality of the heart resulting in its inability to meet the metabolic demands of the body or its ability to do so only at higher-than-normal filling pressures[1]. The global prevalence of heart failure was recorded at 56.19 million cases, with an age-standardized rate of 711.90 per 100,000 people. This rate represents a decrease of 7.06% compared to the rate seen in 1990, which stood at 765.99 per 100,000 population[2]. The number of Americans over the age of 20 afflicted is estimated to be at 6.7 million, and it is projected to increase to 8.5 million by 2030. Disparities worsen the burden, as there is a higher occurrence of heart failure among Black and Hispanic populations. Mortality rates have been increasing since 2012[3].

Southeast Asia, a region including a population exceeding 600 million people, is currently seeing a worrisome escalation in premature mortality resulting from non-communicable diseases, specifically cardiovascular disease, it demonstrates a greater frequency of symptomatic heart failure in comparison to global averages[4].

Malaysia recorded a prevalence rate of 721 cases per 100,000 patients for HF in 2017, making it one of the highest rates in Southeast Asia[5], This increase is principally attributed to higher levels of natriuretic peptides (NT-proBNP) and/or signs of pulmonary edema or congestive heart failure[6]. This may be accompanied by indications and manifestations of reduced blood flow throughout the body and/or excessive fluid volume, such as breathlessness, ankle swelling, and exhaustion, as well as signs (for example, increased pressure in the jugular veins, swelling in the ankles, abnormal lung sounds, and a

shifted heartbeat), certain patients may appear without any symptoms or signs of volume overload . Elderly individuals frequently exhibit non-typical symptoms including delirium, diminished appetite, limited mobility, incontinence, and falls[8].

In general, HF is caused by impaired functioning of the heart muscle called myocardial dysfunction, which can be either systolic, diastolic, or a combination of both. Though, heart failure can also be caused by abnormalities in the valves, pericardium, endocardium, as well as irregularities in heart rhythm and conduction[9]. At times, non-cardiac conditions such as anaemia, pulmonary, renal, thyroid, or hepatic disease might exhibit symptoms and signs similar to those of heart failure. However, if there are no issues in the heart, these conditions do not fulfil the criteria for heart failure. However, these variations might simultaneously occur with heart failure and trigger the disease[10].

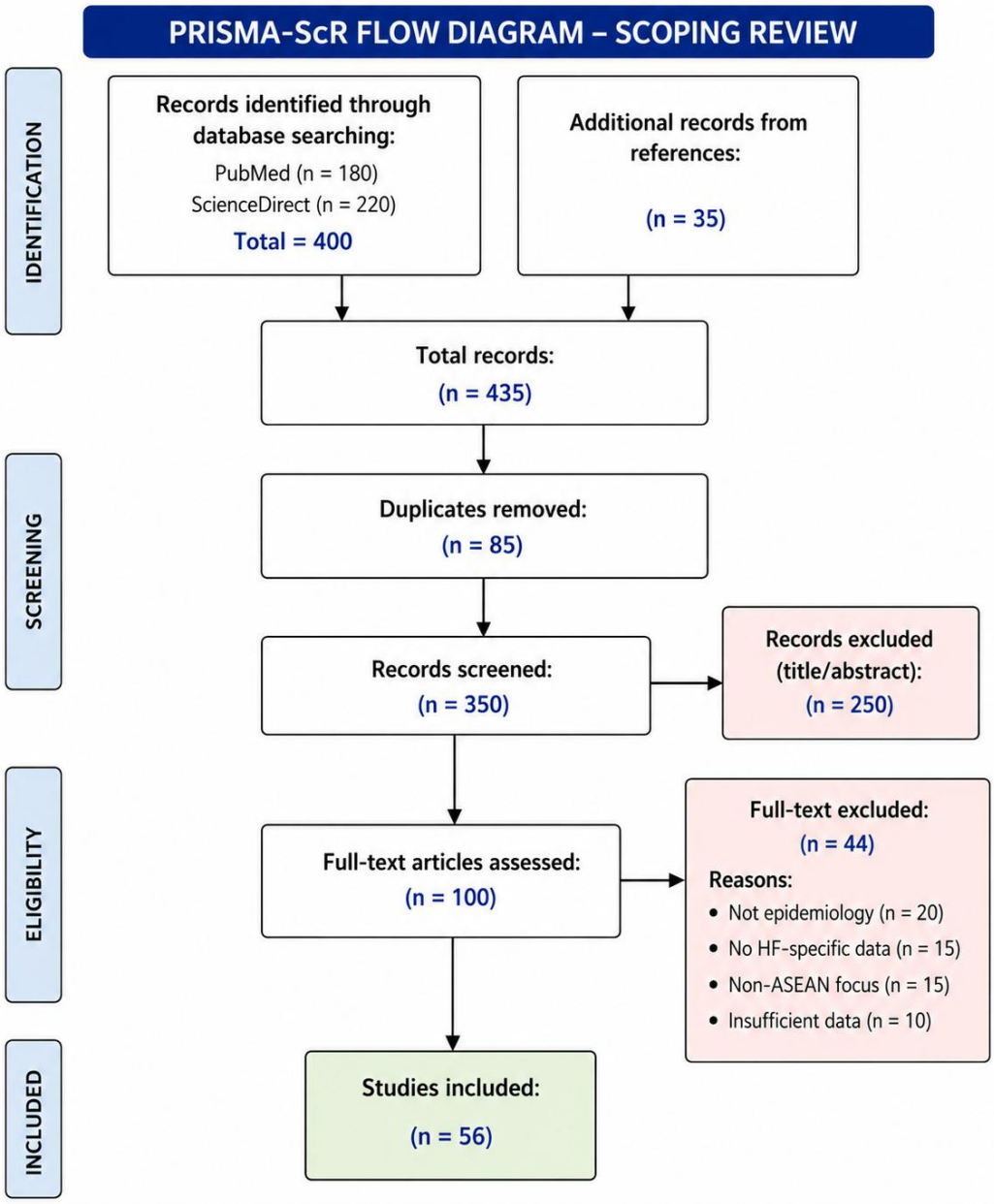

Figure 1: PRISMA-ScR Flow Diagram Illustrating Study Identification, Screening, Eligibility, and Inclusion of articles

METHODS

Study Design

This study was conducted as a scoping review to map and synthesise the available evidence on the epidemiology, economic burden, and regional disparities of heart failure (HF), with a particular focus on the Association of Southeast Asian Nations (ASEAN). The review methodology was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement to ensure a transparent and systematic study selection

process.

Search Strategy

A comprehensive literature search was conducted using the PubMed and ScienceDirect electronic databases. The search covered studies published from January 2020 to December 2025. Search terms were developed using combinations of Medical Subject Headings and free-text keywords related to heart failure, including "heart failure", "epidemiology", "incidence", "prevalence", "hospitalisation", "economic burden", "Southeast Asia", "ASEAN", "Malaysia", "Asian", "race", "ethnicity", and "guideline-directed medical therapy GDMT". Reference lists of eligible articles were also manually screened to identify additional relevant publications.

Eligibility Criteria

Inclusion criteria:

Reported epidemiological data on heart failure, including incidence, prevalence, hospitalisation, mortality, or economic burden. focused on global populations or ASEAN countries, particularly Malaysia; were original observational studies, national registries, systematic reviews, or meta-analyses; were published in peer-reviewed journals; were available in the English language.

Exclusion Criteria:

Conference abstracts, editorials, letters, commentaries, case reports, or narrative opinions; investigated animal or laboratory studies; did not report relevant epidemiological or economic outcomes related to heart failure; were duplicate publications or contained insufficient data.

Study Selection

All retrieved records were imported into (EndNote 21), and duplicate records were removed before screening. Titles and abstracts were initially screened for relevance, followed by full-text assessment of potentially eligible studies against the predefined inclusion and exclusion criteria. The study selection process followed the four PRISMA stages of identification, screening, eligibility assessment, and inclusion. The complete selection process is presented in the PRISMA flow diagram (Figure 1).

Heart Failure Epidemiology

Heart failure is a medical condition characterised by a clinical state that typically occurs as the final stage of many cardiac disorders. Worldwide, around 60 million people are affected by this condition, with an estimated frequency in Asia ranging from 1.3% to 6.7%. More than 37.7 million people worldwide[11]. Overall, the occurrence of HF has reached a stable level, but the number of people affected by it is rising due to the ageing population and the increasing number of patients who survive MI[12].

Asian patients diagnosed with heart failure tend to be quite young, with an average age of 60 years as illustrate in (Figure 2). Additionally, almost two-thirds of these patients are below the age of 65. The age of patients in this group is 10 to 15 years lower compared to patients in Europe (71-79 years) and the US (with an average age of 72 years). Among the Asian patients, the majority were males and almost 64% of them had two or more co-morbidity, such as HPT 51.9%, CAD 50.2%, or D.M 40.4%[13]. As shown in **(Table 1)**

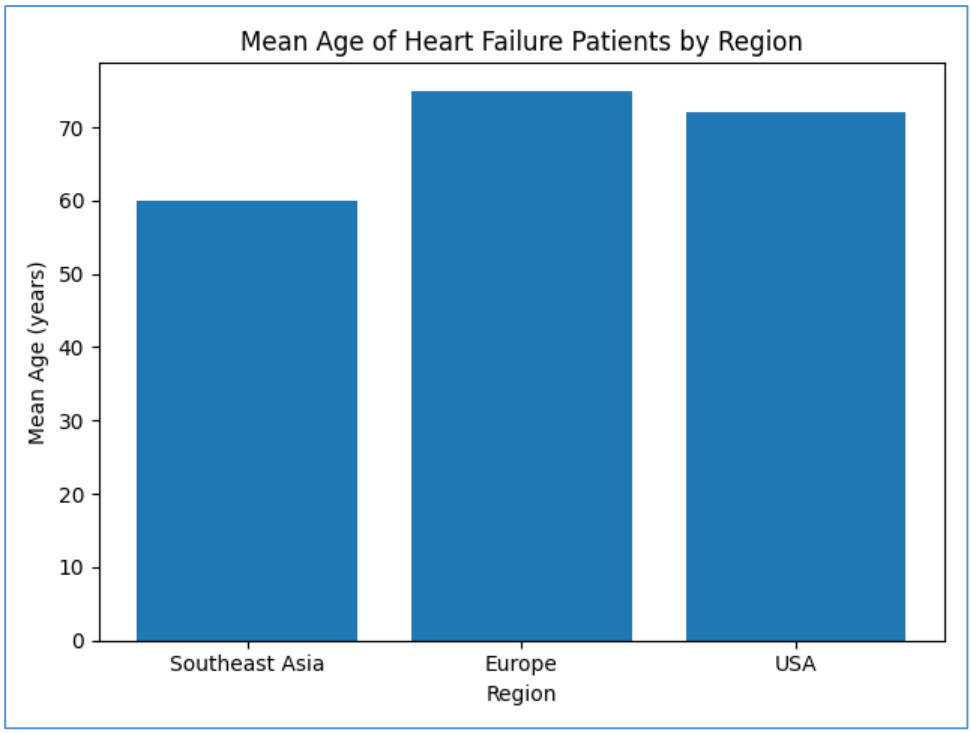

Figure 2: Mean age of heart failure patients across regions

Southeast Asians area including the countries like Malaysia, Singapore, Indonesia, Philippines and Thailand exhibited the highest impact of co-morbidities, including CAD, HPT, D.M, obesity, and CKD, all that with differences in places and population[13]. Higher prevalence and impact of these conditions in the region, possibly due to unique genetic, lifestyle, and environmental factors[14].

The quantity of hospitalisations caused by heart failure, as well as the presence of co-morbidities, has significantly increased, impacting up to 60% of patients. The increase in hospital admissions has emerged as a significant challenge for the countries[15]..

In Malaysia, cardiovascular diseases (CVDs) were responsible for 50.1% of all 30-day hospitalisation, with heart failure accounting for 27.8%. Older patients and those with chronic kidney disease (CKD) had greater chances of hospitalisation[16]. The studies are from Southeast Asia, particularly Malaysia, with six studies focusing on HF epidemiology and cover various healthcare settings including national databases and single-centre hospitals. The studies span populations aged 18 and above, with mean ages ranging from 59 to 64.1 years. The sample sizes vary widely, with incidents of HF hospitalizations recorded from smaller groups (117 patients) to extensive datasets (105,399 cases in a national discharge database). Two studies are prospective, while the rest are retrospective, focusing on hospitalized HF patients and their outcomes. Prevalence of HFrEF across the studies was a central focus, with rates ranging from 40.8% to 64.6% among hospitalized HF patients. This reveals the predominance of HFrEF in the Malaysian HF patients. Mortality was a key outcome, with 1-year mortality rates documented in some studies. The highest recorded 1-year mortality was 49.7% (in a single-centre study from Malaysia). The studies consistently documented high rates of HF re-hospitalizations. One study from a national discharge database reported 105,399 HF hospitalizations over ten years. Overall, these outcomes reveal a high burden of HF hospitalizations, significant HFrEF prevalence, and concerning mortality rates, emphasizing the need for targeted HF management in Malaysia as illustrate in (Figure 3 and Figure 4). **Table 1** shows the epidemiology of HF in some Asian countries and in Malaysia particularly.

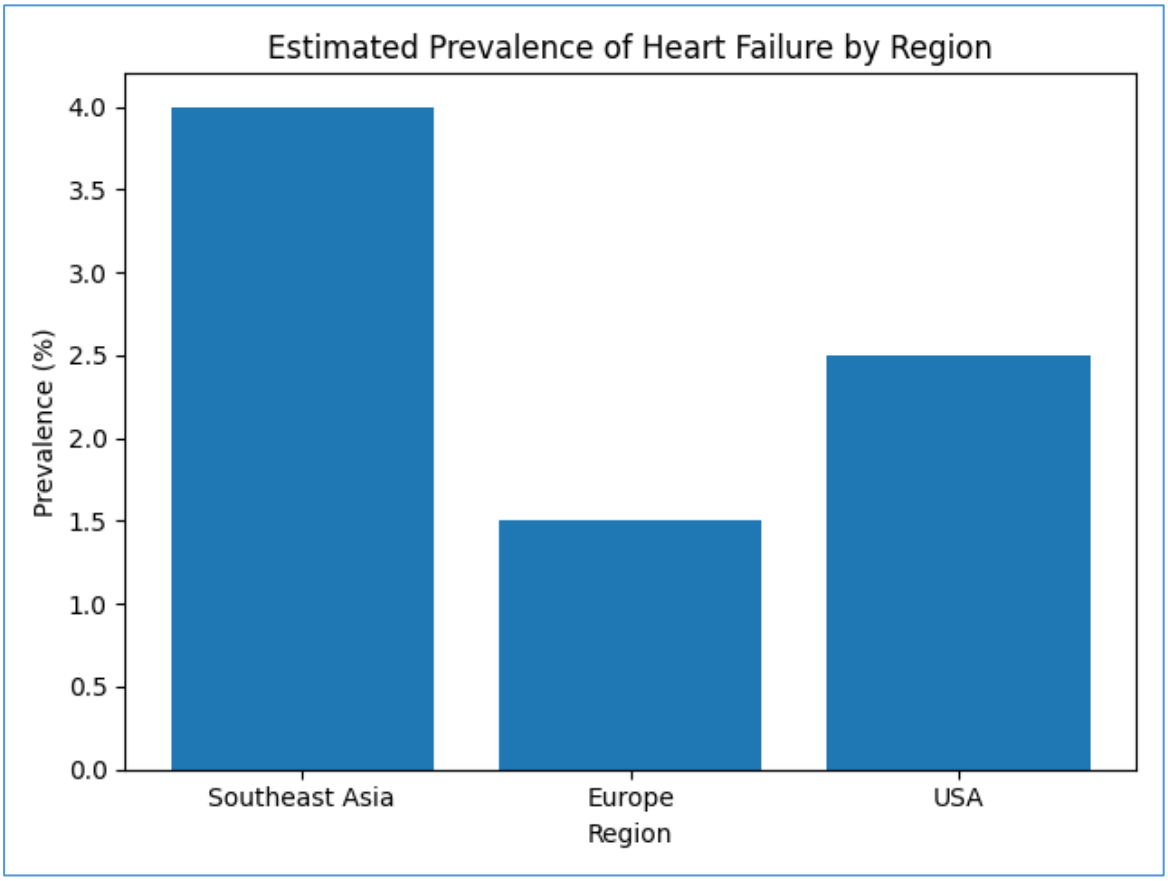

Figure 3: Comparative prevalence of heart failure by region

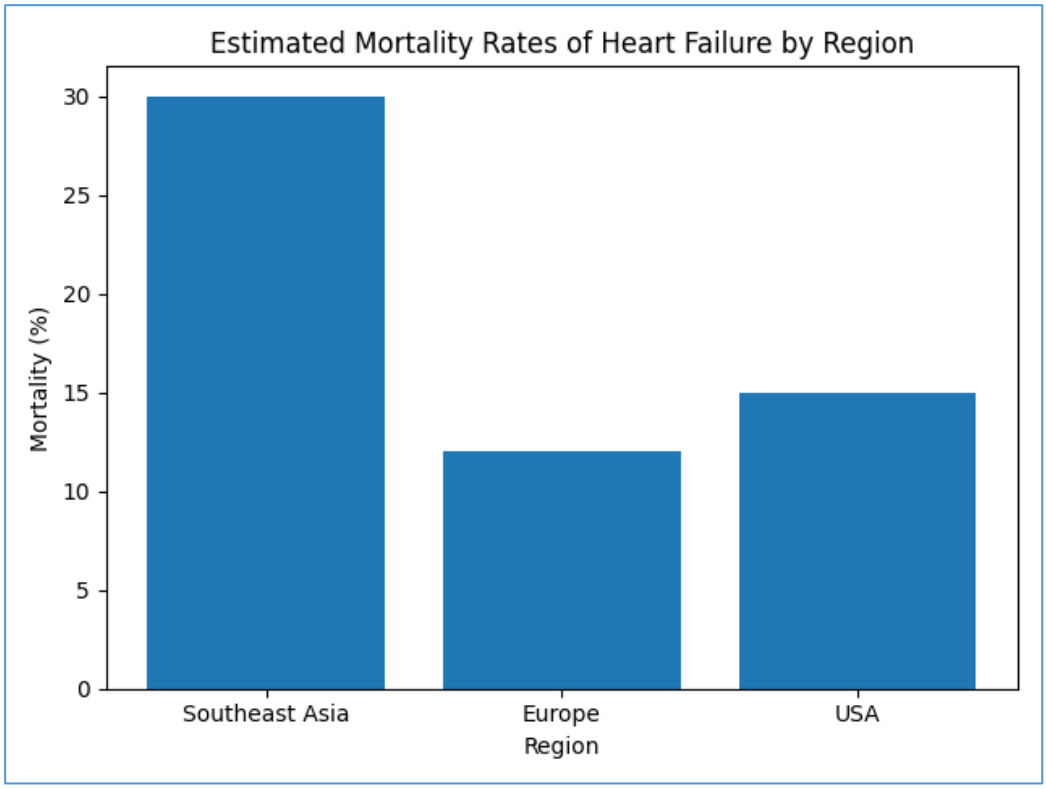

Figure 4: Mortality rates of heart failure across regions

Economic and social implications of Heart Failure

The economic and social impact of heart failure is substantial. Countries with high income allocate 1-2% of their overall healthcare budget to HF[15]. As one of the accounted direct medical expenses in the US, 68% spending of total cost only for heart failure, from the total estimated amount $30.7 billion in 2012[24]. A more recent study found that the average annual cost of care for a person with HF in the European countries was twenty-five thousand euros per year. Most of the expenses were associated with inpatient care and re-hospitalizations[11].

The worldwide economic burden of HF varies significantly across different countries[15]. On average, the expenses associated with treating and managing a HF patient are more compared to other conditions such as asthma, coronary artery disease, COPD, D.M, HPT, and hyperlipidaemia[25].

Healthcare spending in Asia shows significant variances. All through a non-interventional, retrospective study in 2014, The average hospitalisation cost for heart failure assorted from USD 4,513 in Taiwan to USD 1,443 in government hospitals in Malaysia (adjusted to 2100 USD). Considering worldwide inflation, by 2023, the annual costs per patient increased to USD 5,123-USD 3,262.[26]. The significant disparity in costs can be partially attributed to the substantial government subsidies for healthcare in Malaysia and the common utilisation of generic medications[27,28].

In Malaysia, the total healthcare expenditure accounted for 3.6% of the Gross Domestic Product (GDP) in 2014, with just 1.8% allocated specifically for healthcare facilities (HF)[29]. Due to the ageing and rapid growth of the population, it is expected that the cost burden of heart failure in Malaysia will rise[30]. The estimated cost burden is projected to reach USD 481.9 million per year, with a range of USD 31.7 million to 1,213.2 million. This represents 1.05% of the total health expenditure in 2021, with a range of 0.07% to 2.66%. The primary cause of the financial burden associated with heart failure In Malaysia Is mostly due to the expenses involved in managing patients of HfrEF, which constitutes 61.1% of the total costs. The annual financial burden jumped from USD 2.8 million for those aged 20 to 29 to USD 142.1 million for individuals aged 60 to 69. The management of HF in patients between the ages of 50 and 79 accounted for 74.1% of the total financial cost of HF in Malaysia[5].

A costing study on heart failure (HF) was undertaken at Hospital Queen Elizabeth II in Kota Kinabalu. The survey revealed that the mean yearly expense of HF per patient amounted was USD 5,428 (MYR 22,649), while the median annual cost was USD 591 (MYR 2,466) in 2017. The value seen is significantly greater than the last report in the previous study due to the inclusion of interventional procedures. 90.6% of the total expenses were attributed to the cost of inpatient care, primarily resulting from percutaneous coronary intervention (PCI) therapies and hospitalisation[31].

Table 1: Epidemiology of HF in Southeast Asia, Northeast Asia, and South Asia countries

Country	Study	Year / Study design	Data source	Age	Mean Age	Prevalence/ Sampl size	1-year mortality
(Southeast Asians) The countries included on the list are Thailand Malaysia, Philippines, Indonesia, Singapore.	Asian HF registry[13]	A prospective longitudinal study of HF outpatients from 1st Oct 2012 to 31st Oct 2016	3 Asian regions 11 centres	>18 years	61.6 years	81% (6480) with HFrEF	13.6%
(Northeast Asians) The countries included on the list are China, South Korea, Japan, Taiwan, and Hong Kong. (South Asians)	Janwanishstaporn S, al 2022. [17] Lan T, et al. 2021[18]	Retrospective observational study of hospitalized with HF from 2008 to 2013 / Systematic search and Meta-Analysis	Three major public health systems / 27 studies	Patients aged ≥ 18	65.3 years	(434,933) HF hospitalizations / (515,238) HF patients	8.9%
The countries included on the list are India Indonesia Japan ESC US							8.3% 21.4% 4.4% 4.9% 3%-7.5%
Malaysia	Lim YMF et al[19]	10 years of retrospective data from 1st Jan 2007 to 31st Dec 2016	National discharge database	>20 years	64.1 years	(105,399) incidents of HF hospitalization in an MOH hospital	33.1%
Malaysia	National Malaysia Heart Failure (MYHF Registry[20]	Prospective observational study on hospitalized patients from Aug 2019 to Dec 2020	Single centre	>18 years	60.17 years	64.6% (2673) with HfrEF	Not Available
Malaysia	Sharif RER et al[21]	Retrospective from Jan 2012 to Dec 2016	Single centre	>18 years	63.4 years	40.8% (1307) with HfrEF	49.7%
Malaysia	Ling HS et al[22]	Prospective observational study on hospitalized patients Sept 2017 to Oct 2018	Single centre	>18 years	59 years	48.8% (117) with HfrEF	Not Available
East Malaysia	Azmee et al[23]	Retrospective on hospitalized pts from 1st Jan 2009 to 31st Dec 2028	Single centre	>18 years	62 years	62.9% (3923) with HfrEF	Not Available

A cost analysis was undertaken in three government hospitals located in Sabah, Kelantan, and Pulau Penang, respectively, to ensure its relevance. The study concentrated on patients suffering from chronic heart failure (HF) during the years 2016 and 2018. The mean annual total cost per patient with HF was USD 1,971 (MYR 8,224) with a standard deviation of USD 1,255 (MYR 5,236). Inpatient treatment accounted for 74.7% of the total expenditure. The majority of expenses for both outpatient and inpatient care were allocated to drug costs (42.0%) and procedure costs (40.8%). Patients diagnosed with heart failure with preserved left ventricular ejection fraction (LVEF) had the highest average total cost per person per year, at USD 2,410 (MYR 10,056) ± USD 1,226 (MYR 5,115)[30].

From 2005 to 2015, there were no newly approved prescription treatments for HF in the United States. The standard treatment for most patients during this time consisted of affordable generic medications[32]. Recently, novel therapies have been approved for the treatment of heart failure, such as ivabradine, sodium-glucose transport protein-2 (SGLT-2) inhibitors, sacubitril-valsartan, and vericiguat, for heart failure with reduced ejection fraction (HfrEF), and tafamidis for transthyretin cardiac amyloidosis. However, these new treatments have increased the cost regarding the use of medication to treat heart failure, with an estimated direct cost of over $4,000 per year for each heart failure patient[33,34].

In addition, the anticipated cost for HF care, both direct and indirect, exceeds 40 billion dollars each year in the United States. Out of this amount, more than 10 billion dollars can be attributed to patients admitted to the hospital following visits to an emergency department[35]. Therefore, a crucial objective in heart failure care is to avoid hospitalisations, thus decreasing direct and indirect expenses.

Humanistic Perspective Impact of Heart Failure

A significant humanistic impact is also associated with a diagnosis of HF[15,29]. This regards the impact of a disease on the patient's health-related quality of life (HRQoL), daily activities, the health and quality of life of their caregiver, the level of satisfaction the patient has with their therapy, and their adherence to the prescribed treatment regimen[15,36].

In general, most patients prioritise enhanced health-related quality of life to length the duration of survival as illustrate in (Figure 5). The goals of heart failure management contain the following:

A. Avoid exacerbation and hospitalisations, which will reduce the economic and social and humanistic perspective impact of heart failure.

B- Improving the humanistic perspective impact of heart failure by reducing symptoms, strengthening physical ability, and improving quality of life.

C- Enhancing patient survival.

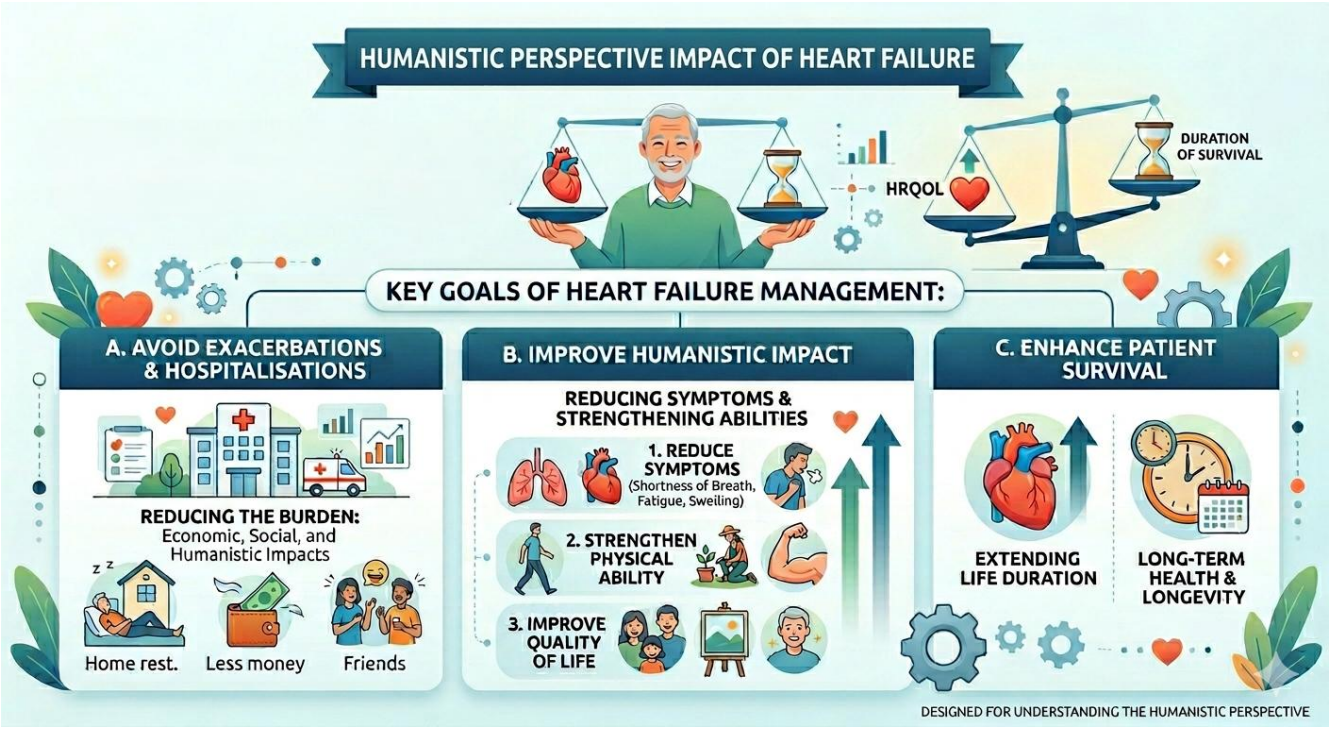

Figure 5: Key goals of heart failure management

In terms to support healthcare providers in taking care of their patients with heart failure, all guidelines have the purpose of providing evidence-based recommendations[37]. It is imperative that clinical management be customized according to the patient's specific health objectives, values, perspectives, and preferences. The utilization of sound clinical judgement is necessary for the development of a management protocol for HF38.

There are two types of costs associated with healthcare for HF are direct costs, which comprise 60% of the total costs, and indirect costs, which comprise 40%[39]. This includes the expenses associated with the absence of a career, disability, medical leave (temporary absence from work due to illness), and 'presenteeism' (the decrease in productivity resulting from employees not performing at their full capacity due to illness, injury, or other factors). Furthermore, it covers early mortality. Generally, in many developing economies such as Malaysia, the indirect expenses associated with heart failure, including premature motality, morbidity, reduced income potential, and unpaid caregiving costs, balance the direct expenses[26,29].

A significant proportion of individuals diagnosed with HF, over 90%, exhibit hypertension, frequently along with type-2 diabetes, obesity, atrial fibrillation, and coronary disease[40,41]. The primary objective of treating HF is to decrease death rates and minimise the need for hospitalisation[42]. Medications largely focus on reducing blood pressure levels[43]. Irrespective of the ejection fraction (EF), HF patients typically undergo a treatment regimen that involves a combination of medications such as angiotensin-converting enzyme inhibitors ACEIs, beta-blockers, mineralocorticoid receptor antagonists, sodium-glucose cotransporter 2 inhibitors (SGLT2i), and diuretics. Selection of these medications is based on the patient's symptoms, signs, severity, and coexisting conditions, rather than being solely determined by the ejection fraction[44].

Multidisciplinary Care of Heart Failure to reduce hospitalisation

A multidisciplinary team approach is recommended by the American College of Cardiology, American Heart Association, and Heart Failure Society of American 2022 guidelines for patients with heart failure[45]. The use of a multidisciplinary plan of action, involving a team of experts from several fields, has been shown to reduce hospitalization rates and healthcare expenditures for patients with heart failure[46]. Pharmacists are an integral part of a multidisciplinary health care team that cares for people with heart failure (HF). Research has shown that pharmacists who engage in medication reconciliation, transitions of care, educate patients about their medications, and collaborate on medication management, have a positive impact on heart failure patient outcomes. But these outcomes will not minimise hospitalisations[47]. The clinical pharmacist's role in the patient-centred care has been shown favourable in a large number of studies, also in relation to reduction of risk factors related to HF, furthermore the pharmacist-led follow-up program for patients to evaluate the management of coronary heart disease in Norway showed highly appreciated among the participants[48].

Structured multidisciplinary treatment programmes have long been known to improve outcomes in patients with heart failure; however, little is known about the additional advanced knowledge, abilities, and experience required for clinical pharmacists to practice safely and effectively[49]. Pharmacists may enhance their decision-making abilities by collaborating with a variety of critical care team, allowing them to have a thorough comprehension of each situation[50]. Although there have been a few research investigations on the involvement of pharmacists in the treatment of hospitalised patients with heart failure (HF), the tasks that are applicable to intensive care unit (ICU) patients can also be implemented in less complicated cases to ensure the highest level of care[51].

Pharmacists play a crucial role in the long-term management of patients with heart failure (HF) and reduced ejection fraction by providing important expertise in medication administration, which is a fundamental aspect of HF therapy. Pharmacists' responsibilities have increased, and there is mounting evidence indicating a transformation in their involvement in the treatment of patients with heart failure[52]. Moreover, this approach has been discovered to improve patient compliance with self-care behaviours and the utilisation of guideline-directed medical therapy. The heart failure-specific multidisciplinary team consists of various medical professionals such as cardiologists, primary care physicians, and surgeons. It also includes advanced practice providers like nurse practitioners or physician assistants. Other members of the team include clinical pharmacists, speciality nurses (such as HF speciality nurses, and nurse transplant coordinators), dieticians, physical therapists, psychologists, and immunologist[45].

Table 2: Roles of HF multidisciplinary team

Multidisciplinary Team Member	HF Services
Advanced HF cardiologist	-The leader responsible for making final decisions on HF patient cares' with establishing a roadmap for the patient's treatment plan.
Surgeon of cardiac	-Controlling for the patients during coronary artery bypass grafting, valve replacements, and implantation of epicardial left ventricular lead for cardiac resynchronisation therapy (CRT) in the perioperative period.
Nurse practitioners and physician assistants	-Diagnoses heart failure and offers post-discharge clinic visits and regular follow-ups to optimise medications and apply GDMT properly. -Telemonitoring and remote device monitoring data into patient care. -Provides education on heart failure and collaborates with physicians to enhance the overall quality and continuity of patient care.
Nurses with specialised expertise in HF	-Coordinating care and providing full patient education. -Follow-up phone calls after discharge, checking right heart failure education, diuretic management based on specific protocols.
Clinical pharmacists specialise in clinical practice of HF	-Assesses and aids in the appropriate selection of drugs, and dosage according to Guideline Directed Medical Therapy. -Facilitates the reduction or cessation of inappropriate prescription, OTC. - Facilitates the transitions of care and aids in the completion of medication reconciliations during admission and discharge processes.
Physiotherapists	-Implement and manages exercise regimens for patients receiving outpatient cardiac rehabilitation. -Conducts exercise assessment and provides exercise regimen for patients during hospitalisation or in clinics.
Dieticians	-Offers nutritional instruction on sodium consumption and food contain high potassium. -Offers non-pharmacological interventions for co-morbidities such as HPT, D.M, and dyslipidaemia. -Provides patients with information and guidance on how to control their weight and managing obesity (BMI). -Enteral and parenteral nutrition admission management during hospitalization -Provides education on the appropriate intake of vitamin K for patients who are also taking vitamin K antagonists.
Medical professionals specialising in palliative care	-Offers counsel and empathetic assistance to patients, families, and healthcare professionals during the process of decision-making and advanced care planning.
Psychologists	Identifies, and advises psychological or behavioural health obstacles that affect adherence and/or the ability to effectively cope with the burden of chronic disease.
Inpatient transition of care nurses	-Offers extensive teaching about heart failure, including information on symptoms, monitoring vital signs, adhering to recommended diet, and how taking medications.

(53-56)

CONCLUSION

Heart failure remains a major global clinical syndrome with a disproportionate burden in Southeast Asia. This scoping review demonstrates earlier age at presentation, a predominance of heart failure with reduced ejection fraction, high rates of hospitalisation, and substantial mortality, particularly in Malaysia. The burden is closely associated with a high prevalence of cardiovascular and metabolic comorbidities, including hypertension, diabetes mellitus, coronary artery disease, and chronic kidney disease. Heart failure–related hospitalisations remain a principal driver of healthcare utilisation and costs. Despite the availability of guideline-directed medical therapy as recommended by 2023 Focused Update to the comprehensive 2021 ESC Guidelines and ACC/AHA/HFSA 2022 guidelines, gaps in implementation and access to multidisciplinary

heart failure care persist. Strengthening early detection, optimising GDMT, and integrating structured multidisciplinary management pathways are essential to reducing hospitalisations, improving survival, and mitigating the clinical and economic impact of heart failure in Southeast Asia.

ACKNOWLEDGMENTS

I would like to express my fruitful to Al-Bayan University, and Cardiology Therapeutics Research Group, Universiti Teknologi MARA, Malaysia for their support, which facilitated the successful completion of this research.

REFERENCES

1. Lala A, Hamo CE, Bozkurt B, Fiuzat M, Blumer V, Bukhoff D, et al. Standardized Definitions for Evaluation of Acute Decompensated Heart Failure Therapies: HF-ARC Expert Panel Paper. Heart Failure. 2024;12(1):1-15.

2. Yan T, Zhu S, Yin X, Xie C, Xue J, Zhu M, et al. Burden, trends, and inequalities of heart failure globally, 1990 to 2019: a secondary analysis based on the global burden of disease 2019 study. Journal of the American Heart Association. 2023;12(6):e027852.

3. Members wc, Bozkurt B, Ahmad T, Alexander KM, Baker WL, Bosak K, et al. Heart failure epidemiology and outcomes statistics: a report of the Heart Failure Society of America. Journal of cardiac failure. 2023;29(10):1412.

4. Feng J, Zhang Y, Zhang J. Epidemiology and burden of heart failure in Asia. JACC: Asia. 2024;4(4):249-64.

5. Ong SC, Low JZ. Financial burden of heart failure in Malaysia: A perspective from the public healthcare system. Plos one. 2023;18(7):e0288035.

6. Bozkurt B, Coats AJ, Tsutsui H, Abdelhamid M, Adamopoulos S, Albert N, et al. Universal definition and classification of heart failure: a report of the heart failure society of America, heart failure association of the European society of cardiology, Japanese heart failure society and writing committee of the universal definition of heart failure. Journal of cardiac failure. 2021;27(4):387-413.

7. Snipelisky D, Chaudhry S-P, Stewart GC. The many faces of heart failure. Cardiac electrophysiology clinics. 2019;11(1):11-20.

8. Gibbs C, Davies M, Lip G. ABC of heart failure-Clinical features and complications. BMJ. 2000;320(Suppl S3).

9. Prinzen FW, Auricchio A, Mullens W, Linde C, Huizar JF. Electrical management of heart failure: from pathophysiology to treatment. European Heart Journal. 2022;43(20):1917-27.

10. Schwinger RH. Pathophysiology of heart failure. Cardiovascular diagnosis and therapy. 2021;11(1):263.

11. Savarese G, Becher PM, Lund LH, Seferovic P, Rosano GM, Coats AJ. Global burden of heart failure: a comprehensive and updated review of epidemiology. Cardiovascular research. 2022;118(17):3272-87.

12. Groenewegen A, Rutten FH, Mosterd A, Hoes AW. Epidemiology of heart failure. European journal of heart failure. 2020;22(8):1342-56.

13. MacDonald MR, Tay WT, Teng THK, Anand I, Ling LH, Yap J, et al. Regional variation of mortality in heart failure with reduced and preserved ejection fraction across Asia: outcomes in the ASIAN-HF registry. Journal of the American Heart Association. 2020;9(1):e012199.

14. Aung T, Qin Y, Tay WT, Binte Salahudin Bamadhaj NS, Chandramouli C, Ouwerkerk W, et al. Prevalence and prognostic significance of frailty in Asian patients with heart failure: insights from ASIAN-HF. JACC: Asia. 2021;1(3):303-13.

15. Hessel FP. Overview of the socio-economic consequences of heart failure. Cardiovascular Diagnosis and Therapy. 2021;11(1):254.

16. Mohd Ghazi A, Teoh CK, Abdul Rahim AA. Patient profiles on outcomes in patients hospitalized for heart failure: a 10-year history of the Malaysian population. ESC Heart Failure. 2022;9(4):2664-75.

17. Janwanishstaporn S, Karaketklang K, Krittayaphong R. National trend in heart failure hospitalization and outcome

under public health insurance system in Thailand 2008–2013. BMC Cardiovascular Disorders. 2022;22(1):1-12.

18. Lan T, Liao Y-H, Zhang J, Yang Z-P, Xu G-S, Zhu L, et al. Mortality and readmission rates after heart failure: a systematic review and meta-analysis. Therapeutics and clinical risk management. 2021:1307-20.

19. Lim YMF, Ong SM, Koudstaal S, Hwong WY, Liew HB, Rajadurai J, et al. Trends for readmission and mortality after heart failure hospitalisation in Malaysia, 2007 to 2016. Global Heart. 2022;17(1).

20. Ahmad WW, Kader MA, Ross N, Ramli A, Ghazi A, Hassan H, et al. Demographic and characteristic of patients admitted with heart failure: Interim analysis of Malaysia Heart Failure (MYHF) Registry. International Journal of Cardiology. 2021;345:13-4.

21. Abd Malek A, Kader MA, Ong T, Ramli A, Hassan HC, Whadawan S, et al. Clinical characteristics of hospitalized heart failure patients with 30 days mortality: Insights from Malaysian Heart Failure (MYHF) registry. International Journal of Cardiology. 2022;369:21-2.

22. Raja Shariff RE, Kasim S, Borhan MK, Yusoff MR. Acute heart failure–The 'real'Malaysian experience: An observational study from a single non-cardiac centre. Proceedings of Singapore Healthcare. 2021;30(3):218-24.

23. Ling HS, Chung BK, Chua PF, Gan KX, Ho WL, Ong EYL, et al. Acute decompensated heart failure in a non cardiology tertiary referral centre, Sarawak General Hospital (SGH-HF). BMC cardiovascular disorders. 2020;20:1-11.

24. Heidenreich PA, Albert NM, Allen LA, Bluemke DA, Butler J, Fonarow GC, et al. Forecasting the impact of heart failure in the United States: a policy statement from the American Heart Association. Circulation: Heart Failure. 2013;6(3):606-19.

25. Alva M, Gray A, Mihaylova B, Leal J, Holman R. The impact of diabetes-related complications on healthcare costs: new results from the UKPDS (UKPDS 84). Diabetic medicine. 2015;32(4):459-66.

26. Yingchoncharoen T, Wu T-C, Choi D-J, Ong TK, Liew HB, Cho M-C. Economic burden of heart failure in Asian countries with different healthcare systems. Korean circulation journal. 2021;51(8):681-93.

27. Wong SL, Ibrahim S, Abdul Kadir N, Mohd Salleh S. Access and affordability of medicines in Malaysia: need for a national pricing policy. Applied health economics and health policy. 2019;17:641-54.

28. Lee KS, Kassab YW, Taha NA, Zainal ZA. Factors impacting pharmaceutical prices and affordability: narrative review. Pharmacy. 2020;9(1):1.

29. Cook C, Cole G, Asaria P, Jabbour R, Francis DP. The annual global economic burden of heart failure. International journal of cardiology. 2014;171(3):368-76.

30. Ong SC, Low JZ, Yew WY, Yen CH, Abdul Kader MAS, Liew HB, et al. Cost analysis of chronic heart failure management in Malaysia: A multi-centred retrospective study. Frontiers in Cardiovascular Medicine. 2022;9:971592.

31. Shafie AA, Tan YP, Liau SY, Yang SL, Liew HB, Chaiyakunapruk N. Registry based analysis of cost-of-illness study among stage C heart failure patients at Hospital Queen Elizabeth II, Sabah, Malaysia. Health Policy and Technology. 2019;8(1):51-60.

32. Gunn AH, Warraich HJ, Mentz RJ. Costs of care and financial hardship among patients with heart failure. American Heart Journal. 2024;269:94-107.

33. Kuan W-C, Sim R, Wong WJ, Dujaili J, Kasim S, Lee KK-C, et al. Economic evaluations of guideline-directed medical therapies for heart failure with reduced ejection fraction: a systematic review. Value in Health. 2023;26(10):1558-76.

34. Ehling J, Noblé HJ, Gysan D, Möller M, Goss F, Haerer W, et al. Are Hospital Admissions (Costs) and Mortality Rate Impacted by Guideline-driven Treatment of Heart Failure?: A

Comparison between Participants in the "CorBene" CMP and Standard-care Patients on the Basis of Propensity Score Matching. International Journal of Angiology. 2024.

35. Halatchev IG, McDonald JR, Wu W-C. A patient-centred, comprehensive model for the care for heart failure: the 360 heart failure centre. Open heart. 2020;7(2).

36. Giles L, Freeman C, Field P, Sörstadius E, Kartman B. Humanistic burden and economic impact of heart failure–a systematic review of the literature. F1000Research. 2020;8:859.

37. Hashemlu L, Esmaeili R, Bahramnezhad F, Rohani C. A systematic review on clinical guidelines of home health care in heart failure patients. BMC nursing. 2023;22(1):127.

38. Al-Temimi AA, Sharif RER, Abd Wahab MS, Zulkifly HH. Guideline-Directed Medical Therapy (Gdmt) For Heart Failure Management: Addressing Applications, Barriers And Optimizing Implementation. Georgian Medical News. 2025;366(9):76-83.

39. Bundgaard J, Mogensen UM, Christensen S, Ploug U, Rørth R, Ibsen R, et al. Direct and indirect costs of heart failure in relation to diabetes status-A nationwide study. Nutrition, Metabolism and Cardiovascular Diseases. 2022;32(8):1880-5.

40. Tsutsui H, Albert NM, Coats AJ, Anker SD, Bayes-Genis A, Butler J, et al. Natriuretic peptides: role in the diagnosis and management of heart failure: a scientific statement from the Heart Failure Association of the European Society of Cardiology, Heart Failure Society of America and Japanese Heart Failure Society. Journal of Cardiac Failure. 2023;29(5):787-804.

41. Jasinska-Piadlo A, Campbell P. Management of patients with heart failure and preserved ejection fraction. Heart. 2023;109(11):874-83.

42. Metra M, Tomasoni D, Adamo M, Bayes-Genis A, Filippatos G, Abdelhamid M, et al. Worsening of chronic heart failure: definition, epidemiology, management and prevention. A clinical consensus statement by the Heart Failure Association of the European Society of Cardiology. European Journal of Heart Failure. 2023;25(6):776-91.

43. Díez J, Butler J. Growing heart failure burden of hypertensive heart disease: a call to action. Hypertension. 2023;80(1):13-21.

44. Rist A, Sevre K, Wachtell K, Devereux RB, Aurigemma GP, Smiseth OA, et al. The current best drug treatment for hypertensive heart failure with preserved ejection fraction. European journal of internal medicine. 2023.

45. Sokos G, Kido K, Panjrath G, Benton E, Page II R, Patel J, et al. Multidisciplinary care in heart failure services. Journal of Cardiac Failure. 2023.

46. White-Williams C, Rossi LP, Bittner VA, Driscoll A, Durant RW, Granger BB, et al. Addressing social determinants of health in the care of patients with heart failure: a scientific statement from the American Heart Association. Circulation. 2020;141(22):e841-e63.

47. Cheng JW. Current perspectives on the role of the pharmacist in heart failure management. Integrated Pharmacy Research and Practice. 2018:1-11.

48. Garcia BH, Storli SL, Småbrekke L. A pharmacist-led follow-up program for patients with coronary heart disease in North Norway–a qualitative study exploring patient experiences. BMC research notes. 2014;7:1-9.

49. Jasińska-Stroschein M, Waszyk-Nowaczyk M. Multidimensional interventions on supporting disease management for hospitalized patients with heart failure: the role of clinical and community pharmacists. Journal of Clinical Medicine. 2023;12(8):3037.

50. Mohammad RA, Betthauser KD, Korona RB, Coe AB, Kolpek JH, Fritschle AC, et al. Clinical pharmacist services within intensive care unit recovery clinics: An opinion of the critical care practice and research network of the American College of Clinical Pharmacy. Journal of the American College of Clinical Pharmacy. 2020;3(7):1369-79.

51. Zavaleta-Monestel E, Arguedas-Chacón S, Quirós-Romero A, Chaverri-Fernández JM, Serrano-Arias B, Díaz-Madriz JP, et al. Optimizing Heart Failure Management: A Review of the Clinical Pharmacist Integration to the Multidisciplinary Health Care Team. International Journal of Heart Failure. 2023;6.

52. Cao VF, Cowley E, Koshman SL, MacGillivray J, Sidsworth M, Turgeon RD. Pharmacist-led optimization of heart failure medications: A systematic review. Journal of the American College of Clinical Pharmacy. 2021;4(7):862-70.

53. Vallabhajosyula S, Ogunsakin A, Jentzer JC, Sinha SS, Kochar A, Gerberi DJ, et al. Multidisciplinary Care Teams in Acute Cardiovascular Care: A Review of Composition, Logistics, Outcomes, Training, and Future Directions. Journal of Cardiac Failure. 2024;30(10):1367-83.

54. Batchelor WB, Anwaruddin S, Wang DD, Perpetua EM, Krishnaswami A, Velagapudi P, et al. The multidisciplinary heart team in cardiovascular medicine: current role and future challenges. JACC: Advances. 2023;2(1):100160.

55. Sokos G, Kido K, Panjrath G, Benton E, PAGE II R, Patel J, et al. Multidisciplinary care in heart failure services. Journal of cardiac failure. 2023;29(6):943-58.

56. Diederich T, Burdorf A, Pozehl B, Bowman S, Ferguson K, Holder K, et al. The role of a multidisciplinary heart failure clinic in optimization of guideline-directed medical therapy: HF-optimize. Heart & Lung. 2023;57:95-101.