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Review Article

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Global Innovations in the Care of Patients With Heart Failure

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ABSTRACT

The prevalence of heart failure (HF) is increasing in many regions of the world, particularly within the context of aging populations in many countries. The Heart Failure Society of America (HFSA) sought to explore areas of global HF innovation with the goal of exchanging ideas and best practices internationally. The HFSA Annual Scientific Meeting included roundtable discussions focused on the challenges faced by each of the participating regions and sharing innovative solutions. Themes identified include the lack of high-quality region-specific HF registry data that is required to accurately define patient needs and to facilitate outcome metrics; the tension between providing care that is accessible to the patient vs. concentrating highly-specialized care within tertiary centers; the need to accredit and coordinate HF care across a spectrum of healthcare delivery centers within regions; opportunities to improve the prevention and timely diagnosis of HF to enhance population outcomes, especially in communities facing healthcare disparities; and the evolution of multidisciplinary team-based care, particularly in optimizing access to guideline-directed medical therapies. This article summarizes the major themes that emerged during the roundtable sessions.

Keywords: Hospitalization; Heart failure; Comorbidity; Pharmacotherapy; Registries; Quality of health care

INTRODUCTION

The prevalence of heart failure (HF) is increasing in many regions of the world, particularly within the context of aging populations and improvements in cardiovascular therapies for acute coronary syndromes. An estimated 6.2 million Americans currently live with HF.[1] Several global estimates of HF prevalence are available, with the most recent and comprehensive being from the Global Burden of Disease (GBD) 2021 Study, showing 55.5 million people living with HF in 2021.[2-5] This corresponds to an age-standardized rate of 676.7 cases per 100,000 people, and years lived with disability (YLDs) due to HF of approximately 5.3 million globally. Population-based prevalence estimates are mostly within the 1% to 3% range, with one report describing a range of prevalence estimates from 0.3% in India and 0.8% in Japan, to 3.6% in Canada and 4.0% in Germany.[6] Amongst the countries and regions participating in these global discussions including (**Supplementary Table 1**), the highest age-standardized rate (per 100,000 population) of HF prevalence and YLDs due to HF reported was in Canada, followed by the United States of America (USA), with the lowest prevalence being recorded in the United Kingdom (**Table 1**).[5,7] Overall, ischemic and hypertensive heart disease accounted for the greatest proportions of HF globally.[8]

Within each region, there often is marked variation in HF prevalence based upon sex, race, geography, socioeconomic status and prevalent comorbidities.[1,9] Black populations worldwide have a higher prevalence of hypertension, a major risk factor for HF.[10] Chagas disease due to *Trypanosoma cruzi* infection is an important cause of heart failure with reduced ejection fraction (HFrEF) in endemic regions of Central America and Mexico, with 20% of affected individuals progressing to cardiomyopathy.[11] Diabetes is more prevalent in Southeast Asian populations and more strongly associated with poor HF outcomes.[12,13] In the Middle East, patients presenting with HF are at least 10 years younger than their counterparts in the Western world.[14,15] Furthermore, the socio-demographic index assessed in the GBD 2021 Study ranged among participating countries and regions, from 0.58 (India) to 0.89 (Republic of Korea) and correlated strongly with health outcomes (**Table 1**).[7]

In addition to regional variations related to patient characteristics, HF care resources are differentially distributed worldwide. HF is a costly disease to treat; in the United States, in 2014, there were 978,135 hospitalizations with a primary diagnosis of HF, costing an estimated US$ 11 billion.[16] A 2012 analysis of 197 countries estimated that the overall global cost of treating HF was US$ 108

Table 1. Global Burden of Disease 2021 study estimates on HF prevalence and YLDs due to HF in countries/regions represented by participating HF societies in the roundtable discussions

Geographical location	Socio-demographic index*	Number of prevalent HF cases	Age standardized rate of prevalent HF cases per 100,000 population	Number of YLDs†	Age-standardized rate of YLDs per 100,000 population
Global	0.67	55,496,832.8 (48,996,497.6–63,842,413.2)	676.7 (598.7–776.8)	5,311,083.9 (3,626,093.7–7,360,662.8)	64.7 (44.2–89.5)
United States of America	0.86	4,616,874.5 (4,290,101.9–4,976,906.5)	877.3 (820.7–943)	429,829.8 (296,095.5–594,496.5)	81.8 (55.9–113.2)
Canada	0.87	593,733.33 (485,413.3–721,562.1)	922.1 (779–1,093.2)	55,866.1 (35,936.6–78,749.3)	86.8 (57.2–120.3)
Latin America and Caribbean	0.65	4,176,721.1 (3,676,219.8–4,816,945)	706.6 (622.4–814.1)	388,419 (262,691.6–534,450.7)	65.7 (44.5–90.3)
European region					
Central & Eastern	0.80	10,858,358.3 (9,446,662.2–12,753,245.4)	706.5 (623.4–813.6)	1,022,048.4 (682,899.9–1,424,581.8)	66.6 (45.2–91.7)
Western	0.85				
United Kingdom	0.86	500,716.5 (435,454.9–583,119.33)	436.5 (389.4–493.6)	46,882.1 (31,820.9–66,296.4)	41 (27.9–57)
India	0.58	6,722,228 (5,937,217.4–7,631,762.2)	595.2 (526.7–677.8)	624,997.3 (425,464.2–854,741.4)	55 (37.4–75.8)
Japan	0.87	1,404,840.9 (1,246,525.5–1,601,283.4)	459.8 (422.3–503.2)	135,401.9 (92,600.6–188,306.8)	44.2 (30.1–60.9)
Republic of Korea	0.89	433,737.7 (372,554.9–505,417.4)	576.4 (507–657.2)	42,961 (29,227–58,567.2)	56.6 (38.2–77.3)
North Africa and Middle East	0.66	3,572,394.9 (3,083,687.7–4,131,798.9)	776.8 (663.6–917.4)	336,856.6 (226,793.3–460,801.3)	72.9 (48.6–99.6)

Estimations were represented as: value, 95% uncertainty interval (low limit–high limit).
HF = heart failure; YLDs = years lived with disability.
*Socio-demographic index is the geometric mean of 0 to 1 indices of total fertility rate under the age of 25, mean education for those ages 15 and older, and lag distributed income per capita.[7]
†Years lived with any short-term or long-term health loss weighted for severity by the disability weights.[5]

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billion per annum.[17] The burden of HF worldwide draws not only on inpatient resources but also on a wide range of outpatient services spanning primary care settings to complex ambulatory systems of care and specialty clinics, pharmacies, home care services, and elderly care facilities. In many regions, multidisciplinary teams (MDTs) incorporating the expertise of nurses, dietitians, physical therapists, pharmacists, primary care/internal medicine physicians, and cardiology physicians are assembled to deliver high-level HF care. Difficult decisions are often required by regional payers and policymakers regarding the allocation of funds across the spectrum of patients with stage A (pre) through to stage D (advanced) HF.

Considering the expanding global burden of HF and the financial and logistical challenges of delivering high-quality HF care, the Heart Failure Society of America (HFSA) has recently convened Global Roundtables within the Annual Scientific Meeting to enhance knowledge-sharing and international cooperation on patient care challenges faced by HF clinicians globally. The discussions included 12 international representatives from 8 countries or regions beyond the United States, who presented innovative programs and strategies for addressing gaps in HF care (**Supplementary Table 1**). The hope was that such success stories could be duplicated by others in the international community. The discussions also highlighted areas of unmet need for populations with HF as well as potential barriers in delivering medical and device therapies on a global basis. This review summarizes the major themes that emerged during the roundtable discussions.

DEFINING NEEDS AND LOCATIONS OF HF CARE

Information regarding the demographics, diagnoses, and locations of patients in need of HF care come from several major North American and European epidemiological cohorts.[2,18] Much less is known about HF epidemiology and resource requirements outside these regions, with data particularly scarce for Central and South America and Africa (**Table 1**).[2] High-quality data on the numbers and demographics of patients with ambulatory and decompensated HF is an essential first step toward allocating adequate resources and establishing systems of care within regions.

With this goal in mind, the Inter-American Council on Heart Failure and Pulmonary Hypertension of the Interamerican Society of Cardiology started a multicenter, prospective, observational registry (NCT05295641) to characterize the risk factors, adherence to treatment guidelines, and outcomes for patients with HF in North, Central, and South America and the Caribbean to elevate standards of care across the Americas. The main objective is to characterize patients with chronic or acute decompensated HF in the American continent. The inclusion criteria are as follows: 1. Patients over 18 years old and one of the following: A. Hospitalized with admission diagnosis of acute decompensated HF; or B. Outpatient with confirmed diagnosis (main or complementary) of HF. The exclusion criteria are 1. Hospitalized with a principal diagnosis of another cardiovascular/non-cardiovascular pathology and developing an acute decompensation of HF during hospitalization; 2. Waiting list for heart transplantation; 3. Implanted (or pending implant of) a durable ventricular assist device; 4. Palliative management previously defined for his/her cardiac condition (i.e., HF) or for another associated medical condition (cancer, chronic obstructive pulmonary disease, etc.); 5. Discharged or referred to another institution within 48 hours of hospital stay; 6. Inability to adhere to programmed follow-ups (telephone or in person) due to social, personal or other conditions considered by the principal investigator; 7. Life expectancy less than 6 months by a condition other than HF (cancer, chronic obstructive pulmonary disease, etc.).

The American Registry of Ambulatory or Acute Decompensated Heart Failure (AMERICCAASS) registry aims to include at least 60 patients per participant institution and the goal is to include at least one institution in all or the majority countries of the region. The first participant was recruited to the AMERICCAASS registry on April 1, 2022 and up to December 2022, almost 2,000 patients from 76 institutions across 20 participating countries had been enrolled. The registry is expected to enroll more than 5,000 patients by the end of the recruitment phase and the last planned follow-up is anticipated before March 30, 2024. Once registry data collection is complete, the plan is to evaluate the regional and local demographics, etiologies, comorbidities, and outcomes related to HF to build a stronger picture of the epidemiology and prognosis in this region of the world. The organizers will also examine adherence to guideline-recommended therapies (oral, devices, and procedures) and outcomes related to these interventions, including rehospitalization and mortality. Findings from the first 1,000 patients enrolled in the AMERICCAASS (63.5% men, median age of 66 years), the percentage of use of guideline directed medical therapies (GDMT), were 70.7%, 77.4%, 56.8%, and 30.7% for beta-blockers, angiotensin-converting enzyme inhibitor/angiotensin II receptor blocker/angiotensin receptor-neprilysin inhibitor (ARNI), mineralocorticoid receptor antagonists (MRA), and sodium-glucose cotransporter type-2 inhibitors (SGLT2i), respectively.[19]

With a similar recognition of the value of identifying locations of specialty HF ambulatory care, the HFSA is currently developing

a HF clinic database within the USA. In this initiative, information will be gathered from HFSA members and non-members to identify all the HF clinics in the USA, as well as key data points about those clinics including their size and scope. A theme that emerged during the Global Roundtable is the balance required between enhancing accessibility to HF care vs. concentrating specialty services within centers of excellence. Many societies recognize the importance of promoting access to HF care locally, for example by building upon primary care or internal medicine infrastructure, especially in rural or remote locations. However, the clinician expertise, specialized equipment and other resources required for higher-complexity HF care can often be delivered only within regional referral centers. This has long been the case for cardiac transplantation and durable mechanical circulatory support, where resources are best concentrated in referral centers staffed by MDTs that provide complex care to patients with the highest acuity.

Another example provided by the Heart Failure Association of India was their initiative to create a national tertiary care program for balloon pulmonary angioplasty (BPA) to address chronic thromboembolic pulmonary hypertension (CTEPH). CTEPH is a clinical condition in which there is organized thromboembolic material in the pulmonary arteries coupled with vascular remodeling that is mainly caused by a combination of endothelial dysfunction, impaired fibrinolysis and defective angiogenesis, which can cause dyspnea and progressive right HF.[20] Though surgical pulmonary endarterectomy (PEA) has been the treatment of choice for CTEPH per European guidelines, a surgical PEA is not possible in almost 37% of affected patients due to comorbidities.[21] Therefore, BPA has emerged as a viable treatment option for patients with inoperable CTEPH and predominantly distal or subsegmental lesions.[22] This minimally invasive procedure can improve exercise tolerance and right heart function with a long-term prognosis that almost equals that of surgical PEA.[23]

At the Narayana Institute of Cardiac Sciences, located in Bangalore, India, 26 patients have undergone BPA over the past 2 years. Centralizing these high-complexity procedures at a tertiary transplantation center has allowed for concentration of expertise and process improvement that optimizes outcomes. The BPA procedure is staged to minimize potentially life-threatening complications including reperfusion pulmonary edema, vessel perforation and dissection.[24] Among the 26 patients, 3 had minor hemoptysis that subsided after positive pressure ventilation, and none required emergent surgery for complications. The average reduction in the mean pulmonary artery pressure was 21.3 mmHg at 6 weeks post-BPA, translating to a 20% reduction from baseline pressures. Improvements were also observed in the 6-minute walk test and quality of life. Two patients underwent a hybrid procedure of BPA after a surgical PEA due to inadequate surgical clot removal. Introducing a highly specialized procedure in a national center of excellence has enabled the team to conclude that PEA remains the treatment of choice in patients with central lesions, but that BPA is a safe and effective option for inaccessible or distal emboli and those with recurrent CTEPH after surgery.

Related to medical locations and their expertise of care, the Heart Failure Association of the European Society of Cardiology (HFA/ESC) accredits Community, Specialized and Advanced HF Centers to advance and unify HF care throughout Europe.[25] The aims of the accreditation benchmarks for Quality of Care Centers (QCCs) are to improve standards of care, adherence to GDMT and to promote education and research across the continent. The QCC program is based upon a commitment to the MDT as a key component of successful HF care accessible throughout the patient's healthcare journey and responsive to the patient's evolving needs. The QCC network also facilitates a bilateral relationship and scientific exchange between the ESC/HFA and the HF clinician community.[26] It is anticipated that centers achieving QCC status will also form a network of research sites for European Union grants and clinical trials, which will promote regional and international networking, and enhance the national and international visibility of the participating centers.

The QCC accreditation process has been described previously.[25] Three types of QCC have been established: Community QCCs, which include primary care and rehabilitation facilities that provide non-invasive assessment and optimal medical HF therapies; Specialized QCCs, which are district hospitals with intensive care and other specialized cardiac units and which provide standard cardiovascular procedural services; and Advanced QCCs, which are tertiary centers that provide advanced HF care including transplantation and mechanical circulatory support—in the USA, the latter are described as advanced HF centers.[27] Specific accreditation requirements for QCCs include provision of data to validate the center's level of HF care, their service portfolio, availability of facilities and equipment, and their staffing structure. Data will also be requested on protocols and process measures, quality indicators, and outcomes. It is anticipated that accreditation and interval audits will involve interviews with the QCC coordinator at each site by the HFA-ESC QCC Task Force and that recertification will occur at 4 to 6-year intervals.

In many regions of the world, the location in which patients physically receive HF care is changing as patient and family expectations evolve, presenting opportunities for additional innovations in the care environment. The ability to care for patients within their

own homes is particularly popular with many HF stakeholders, especially for patients who are elderly or those with multiple comorbidities. Increasingly, telehealth platforms and hospital-at-home programs are able to support remote HF outpatient and inpatient care, respectively.[28,29] Proponents of the hospital-at-home model of care utilize wearable cardiac monitoring devices, and potentially also ambulatory pulmonary artery monitoring, to facilitate high levels of care for acutely decompensated HF without an admission within a physical hospital location.[30,31] Whether expansion of home care to include acutely decompensated patients is feasible internationally will depend largely on resources and reimbursement models. The Japanese Heart Failure Society presented a model of home care led by internal medicine physicians that has proven effective in optimizing the management of patients with HF and low mobility. Japan introduced a universal health insurance system in 1961, when the country was on the cusp of a period of rapid economic growth. Subsequently, the average life expectancy of the Japanese population increased by more than 30 years. This demographic shift has led to significant aging of the population, with the proportion of older people (≥65 years) rising from 9.1% in 1980 to 23.9% in 2022, whereas the national population has decreased steadily since 2008.[32] This demographic imbalance and slowing of economic growth have created a mismatch between the availability and demand for healthcare resources, especially with respect to older people in Japan. To counteract this, the Japanese government adopted the "Community-based Integrated Care System" in 2006 and "Regional Healthcare Vision" in 2014 to provide seamless support for older adults. In these health policy acts, home visit-based medical care is encouraged not only to allow for efficient use of hospital beds, but also to allow patients to receive end of life care at home rather than in a hospital.

Home visits are a particularly promising option for reforming HF care delivery in Japan because the number of older patients with HF is increasing in Japan's aging society.[33,34] Older patients with HF are frequently affected by multiple comorbidities including frailty and sarcopenia.[35] Many patients with HF residing at home live alone or care for their elderly spouse, whereas others reside within healthcare facilities or welfare institutions. Such environments can be obstacles for hospital visits, and a mobile medical care system may improve accessibility to necessary healthcare. A previous survey conducted by the Cabinet Office of Japan in 2017 demonstrated that 29.3% and 70.6% of Japanese wanted to receive medical care and end their lives at home, respectively, if they had severe heart disease and anticipated less than 1-year life expectancy.[36] Considering only 15.7% of all deaths observed in Japan are at home,[37] incorporating home-visits into HF care may be a means to provide more care aligned with the values of many older patients. However, much work remains to be done before more widely implementing home-visit care for patients with HF. Safety protocols for patients with severe HF, patient selection, ideal visiting frequency, cost-effectiveness, quality-of-care metrics, and the role of virtual visits and remote monitoring all need to be established, ideally on an evidence base. Nevertheless, a home-visit care approach with a MDT holds great promise to not only reduce urgent hospital visits and rehospitalizations, but also make HF care more personalized and patient-centered.

INNOVATIONS TO ENHANCE DIAGNOSIS AND TREATMENT

The past decade has seen substantial advances in the diagnosis and medical treatment of HF, with the introduction of the Universal Definition and Classification of HF,[38] the advent of ARNI and SGLT2i as foundational components of GDMT, and effective treatment strategies for heart failure with preserved ejection fraction.[39,40] However, despite this progress, 5-year outcomes remain poor and disparities of care still exist in many regions.[41] In response, the British Society for Heart Failure (BSH) launched a new initiative that aims to transform HF care over the next 25 years. More than 1 million of the 67 million British population have HF,[42] and it is estimated that a further 385,000 people with HF are currently undetected and undiagnosed, and therefore not receiving life-prolonging therapies.[43] HF prevalence is expected to rise further over the next 25 years driven primarily by the ageing of the "baby boomer" generation.[44] By 2040, Britain anticipates having 80% more people over 80-year-olds and 100% more over 90-year-olds.[45] The aging of the population will increase the prevalence of many long-term conditions, including cardiovascular diseases and specifically HF.[46] Currently, 80% of HF diagnoses in Britain are made in hospital during an acute admission, despite 40% of these patients having presented with symptoms in primary care.[47] One in 10 patients do not survive an acute admission and half of patients are either readmitted to hospital or subsequently die within a year after discharge,[48] with huge consequent human and economic costs.[49] Although there is a strong history of specialist nurses and multidisciplinary community teams managing patients with HF in Britain, broadening of stakeholders and greater political traction were identified as necessary steps to improve HF recognition and outcomes.

Therefore, in 2021 the BSH launched an initiative called "Freedom from Failure – The F Word," campaigning to increase early diagnosis of HF.[50] Aimed jointly at the public and policymakers, the first year of the Freedom from Failure campaign focused on encouraging self-recognition of common symptoms of HF such as "fatigue,

fighting for breath and filling with fluid." Strategies included campaign posters, short films and a social media presence to raise awareness of the HF syndrome within the general population and propel HF towards being a national public health priority. The current phase of the initiative focuses the attention of policymakers on the public health implications of HF and prioritizes strategies for funding prevention, timely diagnosis, and management of HF. In 2022, the BSH is embracing greater ambition to improve HF care and survival and is uniting organizations to work together and commit to the goal of reducing HF deaths by 25% in the next 25 years. This program is modelled on the Fast-Track Cities approach, which was previously successful in addressing the human immunodeficiency virus epidemic, as well as tuberculosis, and hepatitis B and C. The BSH will use a progressive, continuous improvement model to strive towards the following metrics:

- 90% of patients with a risk factor for HF are identified
- 90% of expected patients with HF are accurately diagnosed
- 90% of diagnosed patients with HF are prescribed GDMT
- 90% of patients with HF have a personalized care plan that addresses quality of life and wellbeing

These goals will be piloted in select cities and communities, initially in Britain, working with local politicians, healthcare providers, and community and faith-based organizations. Through this process, a "25in25" action plan will be created that can be adapted to new sites both within Britain and elsewhere globally to improve outcomes for people with HF, especially those who are currently unaware they have the condition. The BSH has identified this city-based initiative as the most sustainable and inclusive approach to improve the future health of those at risk of HF mortality, of all ages, genders, races, ethnicities and socioeconomic circumstances.[51] Preliminary implementation of the 25in25 initiative in pilot sites began in March 2024 with the aim of examining the feasibility, functionality, and effectiveness of the project before expanding it to encompass larger communities. The pilot phase will allow identifying and tackling any potential issues, refine processes, and evaluating the practicality and impact of the initiative.[52]

Innovations that enhance access to HF management include novel uses of patient-facing technology. Mobile technology can be harnessed to augment patient education, as demonstrated by the patient and family education tools developed by the Korean Society of Heart Failure. Such innovations may be particularly useful for expanding HF specialty care in settings where the availability of HF nurses and physicians is limited. Given that misunderstandings and knowledge gaps contribute to unsatisfactory medication adherence and self-management, the education of patients, their family members, and caregivers is critical in treating HF. The educational materials developed by the Korean Society of Heart Failure include information on the HF syndrome and medications, self-monitoring, lifestyle modifications, risk factor management and exercise recommendations. An ongoing prospective, randomized, multicenter controlled study to optimize HF care during TRANsitional period in patients with acute Heart Failure with reduced ejection fraction (TRANS-HF) is being performed to explore whether an interventional strategy that includes an education program would improve medication adherence, quality of life and clinical outcome in South Korea (NCT04900584).

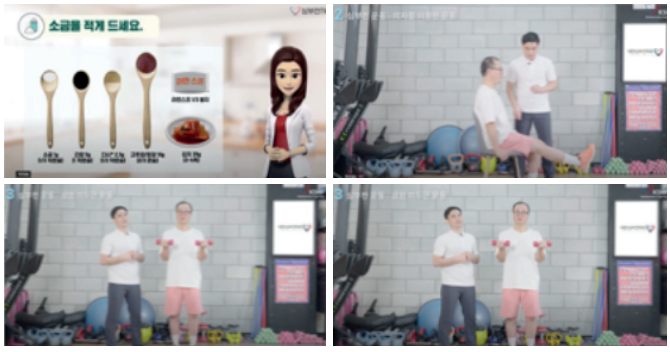

Figure 1. Examples of a video education resource on diet and exercise.

The Korean Society of Heart Failure has also developed video materials hosted on the YouTube platform (https://www.youtube.com/@TV-bi3qy/videos) that are complementary to written educational booklets. These videos contain nutritional counseling, including how to reduce salt in daily cooking, which is a particularly relevant educational initiative in this region. Sodium intake remains high in South Korea, even though daily sodium intake decreased by about 30% from 4,831 mg in 2010 to 3,274 mg in 2018.[53] The videos also demonstrate home-based exercise program of calisthenics and exercises using a chair or dumbbells to improve exercise capacity, muscle strength, and quality of life (**Figure 1**). Finally, an assistant mobile chatbot application with an online chat interface was developed to support patients in tracking their symptoms using a symptom diary, better understand their condition, and provide information on medication administration and self-care with scripts, a downloadable PDF, and direct links to the website in an interactive manner (**Figure 2**; http://khfs.or.kr/eng/heart/heart_03.php).

MULTI-DISCIPLINARY MODELS TO IMPROVE INPATIENT AND OUTPATIENT HF CARE

A theme running through many innovations in HF care is the benefit of building a multidisciplinary model of care to improve

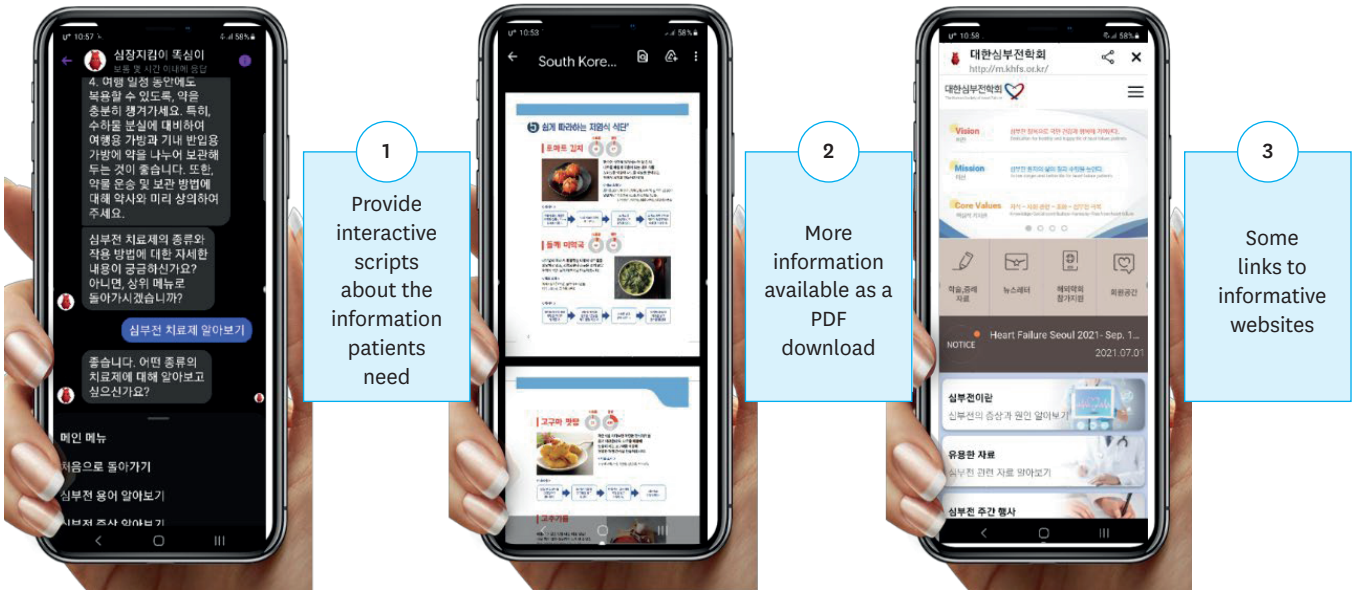

Figure 2. Basic function of heart failure conversational mobile chatbot application.

patient outcomes. This is particularly evident for programs that aim to enhance GDMT optimization, where HF specialty pharmacists can play a leading role across inpatient and outpatient domains of care.[54] Evidence from the Middle East and North Africa (MENA) region showed that a pharmacy-led outpatient HF clinic was associated with increased GDMT utilization and up-titration rates.[55] In a retrospective study of 94 patients with HFrEF referred to the first pharmacist-led HF medication optimization clinic in the MENA region, Atallah et al.[55] reported higher rates of patients achieving GDMTs target doses at their follow-up visit (mean follow-up period 51±36.1 days) compared to the initial visit for beta-blockers (31.9% vs. 40.4%, p=0.03) and renin-angiotensin-aldosterone system inhibitors (7.4% vs. 25.5%, p<0.001). In addition, the authors reported that most patients (62.8%) had at least one evidence-based titration, including any initiation or titration of GDMT, by the end of the follow-up period.

A similar MDT approach was instituted in Canada, where vast geographic distances necessarily limit reliance upon clinic visits for medication titrations. The province of Quebec has a network of 40+ HF clinics that share the same electronic medical records. They are staffed by a MDT of HF cardiologists, dietitians, nurse clinicians and practitioners and pharmacists, with the latter 2 groups having clinical autonomy in this specialized ambulatory setting with a goal of optimizing GDMT. Despite this staffing, gaps in clinical care persist. In one of these clinics, investigators evaluated the level of adherence to GDMT implementation and investigated whether physiological factors or therapeutic inertia were the basis of suboptimal treatment optimisation. They also determined whether the degree of adherence to GDMT was associated with outcomes among patients with HFrEF. The medical records of 511 patients with HFrEF who were followed for at least 6 months, a period that allowed for drug optimization, were reviewed for the prescription rates of recommended pharmacological agents and devices (implantable cardiac defibrillators, cardiac resynchronization therapy). Then, an algorithm was applied for each agent and device integrating clinical (New York Heart Association [NYHA] class, heart rate, blood pressure) and biological parameters (creatinine, serum potassium) based on the inclusion and exclusion criteria of landmark trials guiding these recommendations. The goal was to identify potential explanations for treatment gaps, defining physiological (blood pressure, heart rate) or biological (renal dysfunction, hyperkalemia) limitations for suboptimal achievement of target dosage of GDMT.[56]

Among eligible patients, prescription rates were high for β-blockers (93.0%), MRA (88.5%), vasodilators (83.6%), implantable cardiac defibrillators (75.1%) and cardiac resynchronization therapy (82.1%), but not for ivabradine (45.9%, although only 37 patients were eligible once beta-blockers were optimized). However, fewer patients achieved target or maximally tolerated medication doses (β-blockers, 70.4%; MRA, 60.1%; and vasodilators, 68.5%, despite 91% taking an ARNI) and a quarter were still being uptitrated. Suboptimal dosing of therapy was associated with older age (odds ratio [OR], 1.228; p<0.0001) and poorer functional status (NYHA III–IV, OR, 1.893; p=0.0468).[56] In addition, the level of adherence to GDMT was associated with outcomes. Indeed, compared to optimized patients, the intolerant group (hazard ratio [HR], 4.60; 95% confidence interval [CI], 2.23–9.48; p<0.0001) had the highest risk of the composite

outcome, followed by the undertreated (HR, 3.45; 95% CI, 1.78–6.67; p=0.0002) and in-titration (HR, 1.99; 95% CI, 0.97–4.06; p=0.0588) groups. Overall predictors of outcomes included use of loop diuretics (HR, 4.54; 95% CI, 2.39–8.60), undertreatment (HR, 2.38; 95% CI, 1.22–4.67), intolerance to triple therapy (HR, 3.08; 95% CI, 1.47–6.42), peripheral vascular disease (HR, 2.13; 95% CI, 1.29–3.50) and advanced NYHA class (III–IV; HR, 1.89; 95% CI, 1.25–2.85); all p<0.05.[57] The investigators concluded that gaps in adherence to guidelines exist within a specialized HF clinic and can be explained largely by limiting physiological factors rather than therapeutic inertia. Older age, severe symptoms, and markers of frailty were associated with suboptimal doses of GDMT, suggesting that an individualized—rather than a 'one-size-fits-all'—approach may be required. Secondly, this analysis showed that lesser adherence to guideline recommended care is associated with worse outcomes. Specifically, intolerant/contraindicated patients had the worst prognosis, whereas those undertreated and in titration had an intermediate risk, as compared to those optimized. Most recently, Tang et al.[58] in their study of the global impact of the optimal utilization of GDMT in patients with HFrEF, found that improvement in GDMT use could potentially prevent an estimated 1.19 million deaths (95% CI, 0.77 million–1.91 million) per year, with a large proportion of the averted deaths projected to be in the Eastern Mediterranean and African, Southeast Asian, and Western Pacific regions combined.

The evolution of HF MDTs in the Middle East and Canada illustrates the value of adapting HF resources to unique challenges and needs of the population within the specific region. These teams also demonstrated the importance of measuring interventions and outcomes to determine which strategies are effective within a specific healthcare environment. Owing to the complexity of HF management, major professional HF societies have strongly emphasized the value of MDT approaches. Studies from Europe and North America demonstrated the benefits of initiating specialized MDT services on hospitalized patients with HF.[59,60] In the MENA region, the first specialized HF-MDT inpatient service was established at Cleveland Clinic Abu Dhabi on January 1, 2017. This MDT included specialized HF cardiologists, cardiac surgeons, specialized cardiac intensivists, nurses, pharmacists, social workers, and dietitians. To study the impact of the implementation of this approach on admitted patients with acute HF, the investigators conducted a comparison between the pre-HF-MDT era (06/2015–12/2016, n=71) and the HF-MDT era (01/2017–06/2018, n=86) of in-hospital resource utilization and clinical outcomes.[61] The study population had a mean age of 64±16.4 years and a high burden of diabetes (67.5%), hypertension (70.1%), and left ventricular systolic dysfunction (72%), with no statistically significant differences in demographics or baseline comorbidities between the study groups. Patients admitted post-implementation of the HF-MDT approach featured a 38% shorter median hospital length of stay (8, [interquartile range 4.8–19] vs. 5 [3–9] days, p=0.02) and a 36% reduction in time-to-first clinic visit after discharge (11 [8–20] vs. 7 [5–9] days, p<0.001) compared to the pre-HF-MDT group.[61] While this study does not establish a causal relationship between the implementation of HF-MDT and improved clinical outcomes, the availability of a HF-MDT offers coordinated, multifaceted care that may improve the processes of care during and after an acute HF admission. These findings support the recommendation of adopting an MDT approach for the care of patients with HF to improve resource utilization and clinical outcomes.

INTERNATIONAL COOPERATION TO ACCELERATE INNOVATION

The "Global Innovations in the Care of Patients with Heart Failure" roundtable discussions provided a valuable opportunity to share global best practices and evolving strategies that seek to improve outcomes for patients with HF. Such international cooperation has the potential to accelerate the pace of innovation by identifying successful approaches that may be adapted to meet the needs of different countries and regions. However, strategies proven successful in one region may not be universally applicable without fully addressing regional variations in healthcare infrastructure and socioeconomic factors. Limited access to GDMT or advanced HF therapies further highlights the need to consider social determinants of health when implementing treatment plans and emphasizing the need for interventions at the patient, clinician, and system levels to reduce inequities.[62] Furthermore, additional studies are needed to identify challenges and effective models of HF care in parts of the world where data is scarce (e.g., Africa).

Despite regional disparities, the roundtable discussions highlighted several shared challenges, including a lack of data required to accurately define patient needs and to facilitate outcome metrics; the tension between providing care that is accessible to the patient vs. concentrating highly specialized care within tertiary centers; the need to accredit and coordinate HF care across a spectrum of healthcare delivery centers within regions; under-diagnosis of HF, especially in communities facing healthcare disparities; under-prescription of optimal GDMT; and evolution in our patients' needs in the setting of an aging population and a surge in the prevalence of HF.

Similarly, the innovative solutions being leveraged to address these challenges had significant parallels across the regions, with major

themes being the importance of data collection from HF centers; cooperation within MDTs to achieve best practices especially in access to GDMT; and the use of patient-facing technology to extend the accessibility of these MDTs to the patient and their caregivers. Sharing knowledge and experiences among the participants of these Roundtable discussions has the potential to elevate patient care globally, thus demonstrating that the value of an international meeting can extend beyond the dissemination of primary basic and clinical research findings, and include an exchange of innovations in systems of care.

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Conflict of Interest
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SUPPLEMENTARY MATERIAL

Supplementary Table 1

Participants and topics in the "Global Innovations in the Care of Patients with Heart Failure" roundtable at the Heart Failure Society of America Annual Scientific Meeting

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