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Original Article

Rationale, Design, and Interim Observations of the Steady Movement With Innovating Leadership for Heart Failure (SMILE HF) Registry: A Multicenter Prospective Cohort Registry for Patients With Acute Heart Failure

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ABSTRACT

Background and Objectives: Heart failure (HF) is a leading cause of hospitalization and death worldwide. The Steady Movement with Innovating Leadership for Heart Failure (SMILE HF) aims to evaluate the clinical characteristics, management, hospital course, and long-term outcomes of patients hospitalized for acute HF in South Korea.
Methods: This prospective, observational multicenter cohort study was conducted on consecutive patients hospitalized for acute HF in nine university hospitals since September 2019. Enrolment of 2000 patients should be completed in 2024, and follow-up is planned through 2025.
Results: Interim analysis of 1,052 consecutive patients was performed to understand the baseline characteristics. The mean age was 69±15 years; 57.6% were male. The mean left ventricular ejection fraction was 39±15%. The prevalences of HF with reduced ejection fraction, HF with mildly reduced ejection fraction, and HF with preserved ejection fraction were 50.9%, 15.3%, and 29.2%. Ischemic cardiomyopathy (CMP) was the most common etiology (32%), followed by tachycardia-induced CMP (12.8%) and idiopathic dilated CMP (9.5%). The prescription rate of angiotensin-converting enzyme inhibitor/angiotensin receptor blockers/angiotensin receptor/neprilysin inhibitor, beta-blockers, spironolactone, and sodium-glucose cotransporter-2 inhibitors at discharge were 76.8%, 66.5%, 50.0%, and 17.5%, respectively. The post-discharge 90-day

mortality and readmission rates due to HF aggravation were 2.0% and 6.4%, respectively. Our analysis reveals the current state of acute HF in South Korea.

Conclusions: Our interim analysis provides valuable insights into the clinical characteristics, management, and early outcomes of acute HF patients in South Korea, highlighting the current state and treatment patterns in this population.

Keywords: Heart failure; Acute heart failure; Registry; Frailty; Korea

INTRODUCTION

Heart failure (HF) affects millions of people worldwide, and is a leading cause of hospitalization and death.[1,2] As developing societies worldwide continue to age, the prevalence of HF is increasing, leading to a subsequent rise in socioeconomic burden.[3] Alongside this escalating prevalence, the last 5–10 years have witnessed the development of several new medications for HF, including angiotensin receptor neprilysin inhibitor (ARNI), sodium-glucose cotransporter-2 (SGLT2) inhibitors, and soluble guanylate cyclase stimulator. Various clinical trials, including randomized controlled trials (RCTs), have demonstrated the efficacy of these treatments in improving symptoms and prognosis.[4-6] Consequently, the field of HF is experiencing rapid development and updates. Furthermore, research into the diverse etiologies of HF, which can show significant heterogeneity, contributes the growing need for specialization in this field.

An HF registry is a database that collects information about patients with HF, including their clinical characteristics, treatments, outcomes, and quality of life. Curation and analysis of these registries can facilitate our understanding of the epidemiology, natural history, and clinical course of patients with HF. Furthermore, it can also help to reveal the current state of HF management, monitor the quality of care, and identify gaps in care. Analysis of these databases can suggest clues to identify specific subgroups of patients with different clinical characteristics, treatment patterns, and outcomes, which can help to guide personalized and evidence-based care. For these reasons, we have devised the Steady Movement with Innovating Leadership for Heart Failure (SMILE HF) registry study, a prospective multicenter registry centered around nine major university hospitals in South Korea. This initiative aims to explore the characteristics of patients admitted to hospital for acute heart failure (AHF), and to understand the real-world clinical management of patients with HF in South Korea. In this paper, we introduce the design of the registry and present interim analysis data covering 1,052 individuals enrolled in the period from 2019 to 2022.

METHODS

Objectives of the trial

The SMILE HF registry is a prospective multicenter cohort study that is currently ongoing. This registry enrolls consecutive patients admitted to hospital for AHF and followed-up accordingly. The registry aims to accumulate data on individual patients, rather than individual hospitalizations. There are 2 major objectives for the SMILE HF: i) to describe patient characteristics, current treatments, and short- and long-term patient outcomes, and ii) to identify the influence of various prognostic factors, including frailty, on clinical outcomes.

Study design and population

Patients hospitalized for AHF in 9 university hospitals across South Korea have been consecutively enrolled since September 2019. The scheduled enrolment of 2,000 patients is expected to be complete in 2024, with a planned follow-up through 2025.

The inclusion criteria for this study include patients who meet either one of 3 symptoms (fatigue, dyspnea, ankle swelling) or 1 of 3 signs (jugular vein pressure elevation, pulmonary crackle, pitting edema) of HF or have lung congestion or edema on chest X-ray, and have an objective finding of structural or functional cardiac abnormality such as abnormal brain natriuretic peptides (BNP) or N-terminal pro B-type natriuretic peptides (NT-proBNP) levels (>100 or >300 pg/mL, respectively) or abnormal echocardiography results with left ventricular hypertrophy (LVH; left ventricular mass index ≥115 g/m^2 for males or ≥95 g/m^2 for females) and/or left atrial enlargement (LAE; left atrial volume index ≥34 mL/m^2) or E/e' >13 with septal and lateral e' <9 m/s. All of the patients signed the written informed consent, while those who refused to provide consent or were not deemed suitable for enrollment by the investigator were excluded from the study. (**Supplementary Table 1**) The study was approved by the Institutional Review Board (IRB No. 2018GR0220) and was conducted according to the Declaration of Helsinki principles.

Data collection

Written informed consent was obtained from each patient, and in cases where patients were unable to provide consent due to disease severity, informed consent was obtained from a relative or legal representative. The attending physician completed a web-based case report form with the assistance of a clinical research coordinator, including detailed variables and values collected at baseline admission. The detailed etiologies of HF patient were determined by the attending physician according to the definition described in **Supplementary Table 2**. Following discharge, events such as all-cause mortality, the mode of mortality (cardiovascular or non-cardiovascular), and rehospitalization for HF are recorded. The latest information on each patient's clinical manifestation, biochemistry, and medication is collected at the first revisit at 30 days, as well as at 3, 6, 12 months, and annually thereafter for up to 5 years. The attending physician collected the follow-up data from the patients. The outcome data for patients who had not been followed up were ascertained by a telephone interview.

Frailty test

In addition to conventional laboratory and imaging studies, patients enrolled in the SMILE HF registry underwent frailty assessments. Physical frailty was evaluated using a 6-minute walk test (6MWT), while cognitive and emotional frailty were assessed using the Korean Mini-Mental State Examination (K-MMSE) and Patient Health Questionnaire-9 (PHQ-9), respectively. Furthermore, the body composition of patients with HF was assessed using the bioelectrical impedance analysis. To identify the sarcopenia and determine the volume state of patients, bioelectrical impedance analysis was performed using a body composition analyzer (InBody S10 or InBody 770; InBody®, Seoul, Korea). The edema index was calculated as the ratio of extracellular water to total body water. Bioelectrical impedance analysis was performed as needed by the attending physician during hospitalization, generally within 24 hours before discharge when decongestion was achieved. Other frailty tests were performed after the patient's condition was stabilized and optimal medical therapy was established.

Statistical analysis

Continuous variables are expressed as the mean ± standard deviation or median [interquartile range], and categorical variables are expressed as frequencies (percentages). The 2 groups will be compared using either Student's t-test or Wilcoxon's test for continuous variables and the χ^2 test or Fisher's exact test for categorical variables. Event-free survival will be estimated using the Kaplan–Meier method, and compared using the log-rank test. Time zero will be defined as the date of the initial admission. Hazard ratios (HRs) will be calculated using the Cox proportional hazards model and presented as 95% confidence intervals (CIs) and p value. Two-tailed p values <0.05 will be considered statistically significant. Statistical analyses are performed using SPSS software (version 22.0; IBM Corp., Armonk, NY, USA).

RESULTS

Demographic characteristics and clinical profiles

As of May 2022, a total of 1,052 patients from nine hospitals in South Korea had been enrolled. The baseline characteristics of the patients are shown in **Table 1**. The mean age was 69.2±15.4 years and 57.6% were male. Hypertension was the most common co-morbidity (65.8%) in patients prior to the current admission, followed by diabetes (40.3%), ischemic heart disease (24.1%), chronic kidney disease (15.1%), and cerebrovascular disease (10.8%). The majority of patients were admitted via the emergency department (58.3%), followed by outpatient clinics (35.1%), and transferred from other departments (6.0%). The most common etiology of AHF was ischemia (31.9%), followed by tachyarrhythmia (12.6%), idiopathic dilated cardiomyopathy (DCMP) (10.1%), valvular heart disease (9.2%), and hypertension (7.9%). A definitive cause of HF etiology was not found in 12.5% of patients (**Table 1**, **Figure 1**).

The mean systolic and diastolic blood pressures of the study population were 135.5±25.3 and 82.5±17.9 mmHg, respectively, and the mean pulse rate at admission was 91.3±22.5 b.p.m. The left ventricular ejection fraction (LVEF), as assessed by echocardiography, was available for 1003 patients (95.3%). According to the current international guideline for HF,[7,8] the percentage of patients with HFrEF (LVEF ≤40%) was 50.9% and HFpEF (LVEF ≥50%) and HFmrEF (between 41% to 49%) was 29.2% and 15.3%, respectively. The baseline laboratory findings showed that average hemoglobin was 12.6 mg/dL and NT-proBNP 7,142.0 pg/mL, and average eGFR was 64.6 mL/min/1.73 cm^2. On chest X-ray, 73.1% of patients had cardiomegaly and half of the patients showed congestion or pleural effusion at admission. Regarding the frailty test, 6MWT was done in 16.1% of all patients, K-MMSE 22.5% and PHQ-9 test in 24.0% (**Table 1**). The bioelectrical impedance analysis was performed at the time of discharge in 34.4% of patients, and the edema index was 0.399±0.015. Baseline characteristics according to LVEF are described in **Supplementary Table 3**.

Management during hospitalization

Detailed data regarding patient management during hospitalization and medication at discharge are demonstrated in **Table 2**. During the hospitalization, 60% of the enrolled patients were treated with loop diuretics administered via the parenteral route. Inotropes were used in 14.1% of patients, and intravenous albumin infusion and transfusion were used in 3.5% and 6.7% of patients.

Table 1. Clinical characteristics of patients hospitalized for acute heart failure in the SMILE HF registry

Characteristics	Results
Age (years)	69.2±15.4
Male	606 (57.6)
Co-morbidities	
Hypertension	692 (65.8)
Diabetes	424 (40.3)
Chronic kidney disease	159 (15.1)
Ischemic heart disease	254 (24.1)
Cerebrovascular disease	114 (10.8)
Etiology of AHF	
Ischemic heart disease	336 (31.9)
Idiopathic DCMP	106 (10.1)
Tachycardia induced CMP	133 (12.6)
Valvular heart disease	97 (9.2)
Hypertensive CMP	83 (7.9)
Other	166 (15.8)
Unknown	131 (12.5)
Mode of admission	
Emergency department	613 (58.3)
Outpatients' department	369 (35.1)
Transfer	63 (6.0)
Clinical status on admission	
Systolic BP (mmHg)	135.5±25.3
Diastolic BP (mmHg)	82.5±17.9
Heart rate (b.p.m.)	91.3±22.5
LVEF	
≥50%	307 (29.2)
Between 41% to 49%	161 (15.3)
≤40%	535 (50.9)
Baseline laboratory test	
Hb (mg/dL)	12.6±4.0
NT-proBNP (pg/dL)	7,142.0±11,506.3
BUN (mg/dL)	24.5±13.9
Creatinine (mg/dL)	1.33±1.13
eGFR (mL/min/1.73 cm^2)	64.6±29.8
Baseline chest X-ray finding	
Cardiomegaly	769 (73.1)
Pulmonary edema	475 (45.2)
Pleural effusion	572 (54.4)
Baseline ECG	
Sinus rhythm	596 (56.7)
Atrial fibrillation or flutter	336 (31.9)
Ventricular tachycardia or fibrillation	12 (1.1)
Second- or third-degree AV block	31 (2.9)
Frailty test	
6MWT	169 (16.1)
Mean ± SD (m)	322.6±125.3
K-MMSE	237 (22.5)
Mean ± SD (score)	24.1±6.1
PHQ-9 score	253 (24.0)
Mean ± SD (score)	7.4±6.1
Bioelectrical impedance analysis	362 (34.4)
Edema index at discharge	0.399±0.015

Continuous variables are expressed as the mean ± standard deviation, and categorical variables are expressed as frequencies (percentages).
SMILE HF = Steady Movement with Innovating Leadership for Heart Failure; AHF = acute heart failure; DCMP = dilated cardiomyopathy; CMP = cardiomyopathy; BP = blood pressure; LVEF = left ventricular ejection fraction; Hb = hemoglobin; NT-proBNP = N-terminal pro B-type natriuretic peptides; BUN = blood urea nitrogen; eGFR = estimated glomerular filtration rate; ECG = electrocardiogram; AV = atrioventricular; 6MWT = 6-minute walk test; K-MMSE = Korean version of the Mini-Mental State Examination; SD = standard deviation; PHQ-9 = Patient health questionnaire-9.

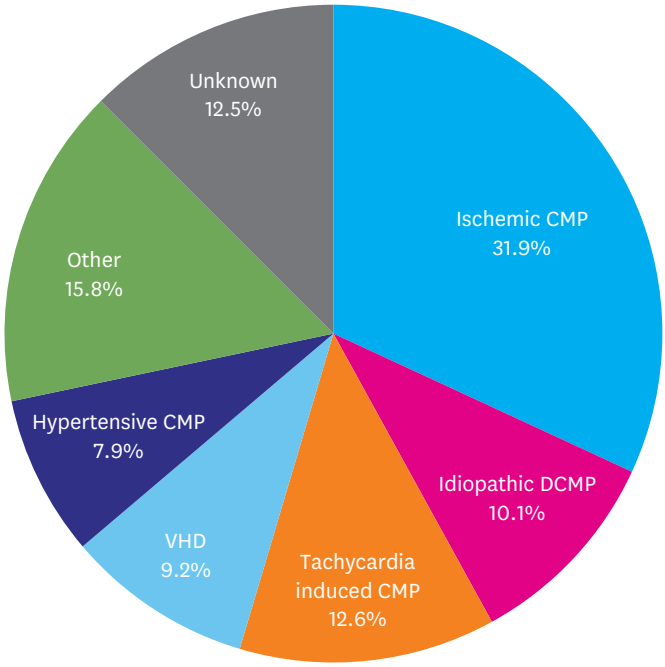

Figure 1. The etiologies of acute heart failure at enrollment.
CMP = cardiomyopathy; DCMP = dilated cardiomyopathy; VHD = valvular heart disease.

Mechanical ventilation was performed in 4.6% of patients. Percutaneous coronary intervention and coronary artery bypass graft surgery were performed in 22.1% and 1.1% of patients, respectively, while percutaneous valve intervention and open-heart valve surgery were performed in 1.0% of patients, respectively.

At discharge, the prescription rate for angiotensin-converting enzyme inhibitor (ACEI)/angiotensin receptor blocker (ARB)/ARNI was 76.8%. In detail, the prescription rate for ACEIs, ARBs, and ARNI was 14.2%, 50.7%, and 12.0%, respectively. Furthermore, 66.5% and 50.0% of patients were on beta-blockers and mineralocorticoid receptor antagonist (MRA), respectively, while only 17.5% of patients were on SGLT2 inhibitors. In HFrEF patients, the prescription rate of for ACEI/ARB/ARNI, beta blockers, MRA and SGLT2 inhibitors were 86.5%, 75.3%, 64.3%, and 23.0% (**Table 3**).

Short-term clinical outcomes

The rate of in-hospital mortality was 0.9%, and the short-term clinical outcomes of patients who were discharged alive (n=1,043) are demonstrated in **Table 4**. There were 5 (0.5%) deaths from all causes within the first month, and 20 (1.9%) deaths within 3 months. Most cases of mortality were due to cardiovascular causes, with 4 (0.4%) and 14 (1.3%) deaths occurring within the first and 3 months, respectively. In terms of readmissions, a significant number of patients were readmitted within the first 3

Table 2. Pharmacological and non-pharmacological treatments administered during hospitalization

Variables	Results
Pharmacological treatment, parenteral	
Loop diuretics	637 (60.6)
Inotropes	148 (14.1)
Dobutamine	93 (8.8)
Dopamine	33 (3.1)
Norepinephrine	30 (2.9)
Epinephrine	5 (0.5)
Others	6 (0.6)
Albumin	37 (3.5)
Transfusion	70 (6.7)
Non-pharmacological treatment	
ICU admission	264 (25.1)
Oxygen	328 (31.2)
Mechanical ventilation	48 (4.6)
Renal replacement	
Hemodialysis	18 (1.7)
CRRT	10 (1.0)
Intervention	
PCI	232 (22.1)
CABG	12 (1.1)
TAVR	10 (1.0)
Valve surgery	11 (1.0)
Pharmacological treatment at discharge	
ACEI/ARB/ARNI	808 (76.8)
ACEIs	149 (14.2)
ARBs	533 (50.7)
ARNI	126 (12.0)
MRA	526 (50.0)
β-blockers	700 (66.5)
SGLT2 inhibitors	184 (17.5)
Loop diuretics	785 (74.6)
Thiazide diuretics	21 (2.0)
Ivabradine	21 (2.0)
Nitrates	208 (19.8)
Amiodarone	106 (10.1)
Digoxin	119 (11.3)
Warfarin	65 (6.2)
DOAC	330 (31.4)
Dabigatran	6 (0.6)
Rivaroxaban	37 (3.5)
Apixaban	203 (19.3)
Edoxaban	84 (8.0)
Aspirin	390 (37.1)
Clopidogrel	359 (34.1)
Statin	656 (62.4)
Oral antihyperglycemic therapy	334 (31.7)

Categorical variables are expressed as frequencies (percentages).
ICU = intensive care unit; CRRT = continuous renal replacement therapy; PCI = percutaneous coronary intervention; CABG = coronary artery bypass graft; TAVR = transcatheter aortic valve replacement; ACEI = angiotensin converting enzyme inhibitors; ARB = angiotensin receptor blocker; ARNI = angiotensin receptor/neprilysin inhibitor; MRA = mineralocorticoid receptor antagonist; SGLT2 = sodium glucose cotransporter-2; DOAC = direct oral anticoagulants.

months, with 6.5% readmitted within the first month and 14.4% within 3 months. Of these readmissions, a significant proportion was due to cardiovascular causes, with 4.3% within the first month and 8.9% within 3 months. Additionally, readmissions due to HF accounted for 2.7% within the first month and 5.8% within

Table 3. Implementation state of GDMT at discharge based on LVEF in patients who survived initial hospitalization

Variables	HFrEF (n=535)	HFmrEF (n=161)	HFpEF (n=307)
ACEI/ARB/ARNI	463 (86.5)	120 (74.5)	188 (61.2)
ACEIs	74 (13.8)	30 (18.6)	24 (7.8)
ARBs	276 (51.6)	87 (54.0)	160 (52.1)
ARNI	113 (21.1)	3 (1.9)	4 (1.3)
MRA	344 (64.3)	56 (34.8)	113 (36.8)
β-blockers	403 (75.3)	107 (66.5)	155 (50.5)
SGLT2 inhibitors	123 (23.0)	26 (16.1)	30 (9.8)

Categorical variables are expressed as frequencies (percentages).
GDMT = guideline-directed medical therapy; LVEF = left ventricular ejection fraction; ACEI = angiotensin converting enzyme inhibitor; ARB = angiotensin receptor blockers; ARNI = angiotensin receptor/neprilysin inhibitor; MRA = mineralocorticoid receptor antagonists; SGLT2 = sodium glucose cotransporter-2; HFrEF = heart failure with reduced ejection fraction; HFmrEF = heart failure with mildly reduced ejection fraction; HFpEF = heart failure with preserved ejection fraction.

Table 4. One- and 3-month clinical outcomes of patients discharged alive (n=1,043)

Variables	1 month	3 months
All-cause mortality	5 (0.5)	20 (1.9)
Cardiovascular death	4 (0.4)	14 (1.3)
Non-cardiovascular death	1 (0.1)	6 (0.6)
Readmission for	68 (6.5)	150 (14.4)
Cardiovascular cause	45 (4.3)	93 (8.9)
Heart failure aggravation	28 (2.7)	61 (5.8)
Other causes*	17 (1.6)	32 (3.1)
Composite of total mortality and readmission for cardiovascular cause	52 (5.0)	109 (10.5)
Composite of total mortality and readmission for heart failure	36 (3.5)	79 (7.6)

Categorical variables are expressed as frequencies (percentages).
*Other causes include sudden cardiac death, cerebrovascular diseases such as stroke and cerebral hemorrhage, and other cardiovascular conditions.

3 months. The composite outcomes of total mortality and readmission are also presented, with 5.0% of patients having either died or been readmitted for cardiovascular causes within the first month, and 10.5% within 3 months.

DISCUSSION

The SMILE HF is an ongoing prospective multicenter registry of patients admitted to nine university hospitals for AHF in South Korea. The current interim analysis of the registry represents the most recent characterization of patients with AHF in South Korea. HF is a significant and costly public health issue that poses significant challenges to patients, healthcare systems, and society. As the population ages and risk factors change, it is important to periodically reassess the epidemiologic profile of HF.

The mean age of the patients in the SMILE HF registry was 69.2±15.4 years, which was older than in previous Korean Heart Failure (KorHF) registries. To provide additional context, in the

Korean multicenter HF study (1998–2003), the mean age was 64.1±14.3 years, followed by 66.5±15.1 in the KorHF registry (2004–2009) and 68.5±14.5 in the Korean Acute Heart Failure (KorAHF) registry (2011–2014).[9,10] Advances in medical treatment and healthcare have led to improved survival rates, allowing individuals with HF and other comorbidities to live longer. Additionally, the aging population in general contributes to a higher prevalence of HF among older adults.[11] Moreover, as modern medicine has advanced, the diagnosis and management of cardiovascular diseases (CVDs) such as atherosclerotic CVD and arrhythmias have improved, delaying the progression to HF, which can be considered the final stage of these conditions. These trends together result in a higher mean age of patients in contemporary HF registries compared to earlier ones. The results of the present study reveal a high prevalence of hypertension and an increasing incidence of diabetes mellitus among patients with HF. While the proportion of ischemic CMP shows a declining trend compared with previous KorHF registries,[9,10,12] it remained the predominant cause of HF in our study. Tachycardia-induced CMP, previously underrepresented in several research,[10,12] has emerged as the second most prevalent cause of AHF. This underscores the necessity for future research to comprehensively understand and address this condition. The rate of hypertensive CMP was 8% in our study; this metric varied widely in previous Korean and other HF registries, ranging 4.0–45.0%,[9,13-15] although our result was similar to that found in the recent European Society of Cardiology Heart Failure Long-Term Registry.[16] The prevalence of valvular heart disease and idiopathic DCMP was similar compared to previous registries.[9,12,16] HFrEF accounts for half of all patients with AHF, increasing to two-thirds when combined with HFmrEF. However, HFpEF still constitutes a substantial portion, approximately 30%.

With the recent advance in HF research and updates of the HF guidelines, a growing emphasis has been placed on the implementation of HF pharmacotherapy, including the use of the four pillar drugs which should be initiated and optimized before discharge.[7,8,17] In the recent update of European and Korean HF guideline, the use of SGLT2 inhibitors is highlighted as a Class I indication, regardless of LVEF.[7,18] Additionally, ACEI/ARB/ARNI, beta-blockers, and MRA are recommended as Class I for HFrEF and Class IIb for HFmrEF in the European HF guideline.[7] On the other hand, in South Korea, ARNI and MRA receive a Class IIa recommendation, while ACEIs/ARBs and beta-blockers are classified as Class IIb recommendations in HFmrEF patients.[18] In this registry, the proportion of prescriptions following the 4-pillar approach was observed to be higher compared to that in previous registries, particularly noting a significant use in HFrEF.[9,19] However, despite SGLT2 inhibitors having a Class I recommendation, their prescription rate during the study period in South Korea was notably low. This could be attributed to the fact that the update regarding SGLT2 inhibitors occurred in August 2021 in the European guideline,[8] while the interim analysis was conducted with the data spanning from September 2019 to May 2022. Given that this study was conducted on half of the patients, it is anticipated that the prescription rate of SGLT2 inhibitors would have increased in the other half of the study. Additionally, SGLT2 inhibitors were not covered by national insurance for non-diabetic patients in the early stages of the study. However, these drugs became eligible for coverage by national health insurance in early 2024, which could lead to an increase in prescription rates.

While frailty is common in patients with HF,[20] and its significance is increasingly being recognized,[21,22] there remains a notable lack of attention to this aspect in real-world clinical settings.[23] In our study, the PHQ-9 and K-MMSE were the most commonly used frailty tests, administered in approximately 24% of cases, with the 6MWT performed in only 15%. This finding reveals the current state of frailty evaluation in HF patients in South Korea and underscores a gap in the attention given to frailty assessment in routine clinical practice. It is essential to stress the need for additional research exploring how frailty, as assessed by these tests, impacts the quality of life and clinical outcomes in upcoming patients with HF. Gaining insights into how frailty influences the lives and prognoses of individuals with HF is critical for refining patient care and customizing interventions to address this commonly overlooked facet of patient health. In addition, implementing educational initiatives, protocol standardization, resource allocation and workflow integration with continuous monitoring and feedback would be needed. Regarding the bioelectrical impedance analysis, the mean edema index at discharge was higher than the normal reference value, ranging from 0.360 to 0.390,[24-26] which raises the question of whether decongestion is adequate in patients who hospitalized with AHF.

Considering that the national HF registry is currently being conducted in South Korea, the SMILE HF registry may have a partial scope limitation due to the inclusion of only 9 university hospitals. However, it is expected to have a complementary effect by providing detailed data to study topics not covered in the national registry, including frailty tests, detailed laboratory tests, and clinical outcome data. In addition, we tried to detail the etiologies in HF patients, however, distinction of these etiologies was left to the individual researchers.

In conclusion, this interim analysis of the SMILE HF registry demonstrates that patients with AHF in South Korea are becoming older, while the etiology of HF is evolving. HFrEF still predominates among AHF patients, with an increasing prescription to the

guideline-directed medical therapy compared to previous studies. However, there is a growing number of patients with HFpEF, and our results suggest that insufficient attention is being given to frailty testing and management. We anticipate that the SMILE HF registry will serve as a valuable tool reflecting the current clinical practice of HF management in South Korea. It could improve our understanding, management, and outcomes of HF, and benefiting patients, clinicians, researchers, and health care systems.

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Author Contributions
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SUPPLEMENTARY MATERIALS

Supplementary Table 1
Inclusion and exclusion criteria of the study

Supplementary Table 2
Diagnostic criteria of etiology of HF

Supplementary Table 3
Baseline characteristics according to left ventricular ejection fraction

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