Original Article

Confidence in self-care after heart failure hospitalization

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ABSTRACT

Background: Understanding patient perspectives of self-care is critical for improving multidisciplinary education programs and adherence to such programs. However, perspectives of self-care for patients with heart failure (HF) as well as the association between patient perspectives and patient-physician communication remain unclear.
Methods: Confidence levels regarding self-care behaviors (eight lifestyle behaviors and four consulting behaviors) and self-monitoring were assessed using a self-administered questionnaire survey, which was directly distributed by dedicated physicians and nurses to consecutive patients hospitalized with HF in a tertiary-level hospital. Patient-physician communication was evaluated according to the quality of physician-provided information regarding "treatment and treatment choices" and "prognosis" using the Prognosis and Treatment Perception Questionnaire. Out of 202 patients, 187 (92.6 %) agreed to participate, and 176 completed the survey [valid response rate, 87.1 %; male, 67.0 %; median age, 73 (63–81) years]. Multivariate logistic regression analyses were conducted to predict low confidence in self-care (score in the lowest quartile).
Results: High confidence (confident or completely confident >75 % of patients) was observed for all self-care behavior categories except low-salt diet (63.1 %), regular exercise (63.1 %), and flu vaccination (65.9 %). Lower confidence in self-care behavior was associated with low quality of patient-physician communication. With regard to self-monitoring, 62.5 % of patients were not confident in distinguishing worsening symptoms of HF from other diseases; non-confidence was also associated with low quality of patient-physician communication.
Conclusions: Hospitalized patients with HF had low confidence regarding regular exercise, salt restriction, and flu vaccination. The results also suggest patient-physician communication affects patient confidence.

Introduction

Heart failure (HF) is a major global health concern due to its association with repeated hospitalizations and high mortality [1]. To improve the poor outcomes of HF, patients' understanding of the disease, as well as lifestyle interventions, are essential. The implementation of self-care behavior (lifestyle and counseling behaviors) and monitoring (recognition of worsening HF) is associated with better quality of life and lower mortality and readmission rates [2–5]. In addition, self-care education is recognized as a quality measure for HF [6], and improving self-care is a major focus of multidisciplinary HF management programs worldwide

[2–4]. The current European Society of Cardiology/*European Heart Journal* guidelines recommend that physicians provide self-care advice prior to discharge, which enables patients to engage in continuous self-care management, especially in in-home settings [7].

Identifying patient perspectives on self-care behavior and monitoring is a topic of growing interest in the field of cardiovascular diseases [8,9], and is thought to be an essential step in closing the perception gap. Confidence levels regarding self-care exert a powerful and consistent influence on self-care performance across patient populations and various self-care behaviors [3,8,10]. Increased levels of self-efficiency promote greater adherence to daily weighting and dietary recommendations [11]. We previously reported substantial disparities in the confidence levels associated with lifestyle modifications and awareness of heart attack in patients with coronary artery disease [9], identifying imbalances in the composition of patient education programs for the management

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of HF. Thus, a comprehensive understanding of patient confidence in self-care can similarly highlight issues in providing a multidisciplinary HF management program, which may result in the improvement of adherence and self-care behavior. In general, patient-physician communication is one of the important factors that influences self-care behavior [12,13].

The relationship between patient-physician communication and self-care confidence in patients hospitalized with HF remains unclear. This constitutes a critical knowledge gap because self-care confidence may be associated with patient-physician communication in patients hospitalized with HF, highlighting actionable areas for interventions to improve clinical outcomes. Given the fact that the quality of physician-provided information is a key aspect of patient-physician communication [14], this study aimed to elucidate the confidence levels of patients hospitalized with HF regarding their self-care behavior and monitoring and to explore the association between patients' confidence in self-care and the quality of information (QoI) provided by physicians.

Methods

Study population

We performed a cross-sectional observational study that consecutively recruited patients hospitalized with HF who completed the study questionnaire between September 2017 and March 2020 at a single university hospital center (Keio University Hospital, Tokyo, Japan). Inclusion criteria were non-elective hospitalization for worsening HF and meeting Framingham criteria [15], resulting in medication augmentation or the administration of new intravenous HF therapies.

The study protocol was approved by the institutional review board prior to data collection, and research was conducted in accordance with the Declaration of Helsinki. All patients provided informed consent to participate.

Sociodemographic and clinical variables

Clinical data of patients were obtained from their electronic medical records and defined according to the West Tokyo Heart Failure (WET-HF) registry, an ongoing prospective multicenter cohort registry of patients hospitalized with HF in Japan [16,17]. We collected data on patients' background, etiology of HF, previous hospital admission for HF, ejection fraction on echocardiography, use of implantable cardioverter or cardiac resynchronization therapy, medication use at discharge, and laboratory results from close to discharge or at the time of discharge. The 13 comorbid conditions included in this analysis were chronic obstructive pulmonary disease, asthma, chronic kidney disease (estimated glomerular filtration rate < 60 mL/min per 1.73 m^2) [18], diabetes mellitus, anemia (hemoglobin concentration < 12.0 g/dL in women and < 13.0 g/dL in men) [19], arthritis, hypertension, hyperlipidemia, obesity (body mass index >25 kg/m^2), cancer, coronary artery disease, atrial fibrillation, and stroke.

Procedure

The procedure of the employment of the self-administered questionnaire has been described in detail previously [20]. Briefly, after the stabilization of HF symptoms, our multidisciplinary HF team conducted a patient education program using written materials for guidance on HF, which was followed by face-to-face counseling by a nurse. After the education program and provision of discharge instructions, the investigators (O.S., H. K., T. K., and N.N.) distributed the survey questionnaire to patients. If required, patients were provided with assistance when completing the questionnaire.

Survey questionnaire

The 92-question survey comprised eight domains: (i) patient characteristics (socio-demographic factors, education history, living status, social isolation, and self-care behavior); (ii) health status (quality of life and depression); (iii) awareness of HF trajectory; (iv) perspectives on treatment goals; (v) decision-making style; (vi) prognostic understanding and preferences for information disclosure; (vii) emergency treatment preferences; and (viii) advance care planning and end-of-life care preferences. The present study analyzed domains (i), (ii), (iii), and (vi). For the health status domain, generic health-related quality of life and depression were evaluated using the 3-Level EuroQoL 5-Dimensions (EQ-5D-3L) [21] and Patient Health Questionnaire-2 (PHQ-2), respectively [22,23].

Patients' perspectives toward information disclosure from physicians were adopted from three items of the Prognosis and Treatment Perception Questionnaire (PTPQ): 1) the QoI about treatment and treatment choices, 2) the QoI about prognosis provided by physicians, and 3) the frequency of conversations with the physician about prognosis [24]. Further details have been described previously [20]. Briefly, the PTPQ is a well-established self-administered questionnaire focusing on patients' perspectives that has been employed in cancer research [24]. With regard to patients' perspectives toward the quality of information provided by their physician, patients answered using a five-point Likert scale (1: excellent, 2: good, 3: satisfactory, 4: fair, 5: poor). They were also instructed to rate the frequency of conversation on a five-point Likert scale (1: never, 2: rarely, 3: sometimes, 4: often, 5: very often). An answer of "poor" or "fair" was defined as low QoI, whereas an answer of "never" or "rarely" was defined as a low frequency of conversation.

With regard to knowledge about HF trajectory, patients were instructed to choose the most typical trajectory of HF from four figures that represented trajectories of various illnesses (gradual, intermittent, rapid, or temporal decline), which were derived from previous studies, including ours [20,25]. Patients were also questioned about the impact of HF on their life expectancy and were required to indicate their views on HF as follows: (i) will be cured completely, (ii) last for the rest of their lives without shortening life expectancy, (iii) shorten their life expectancy, and (iv) unclear how HF would impact their lives. Understanding regarding the typical HF trajectory and impact of HF on patients' life expectancy was defined as the choice of "intermittent decline" and "shorten their life expectancy", respectively, based on the Japanese Cardiology Society/Japanese Heart Failure Society Guideline on Diagnosis and Treatment of Acute and Chronic Heart Failure [26].

Questionnaire regarding self-care behavior

Questions regarding patients' confidence in self-care behavior and recognition of HF symptoms are presented in Table 1. The questionnaire items regarding confidence in self-care behavior were derived from items of the Japanese-validated translation of the European HF Self-care Behavior Scale (EHFScBS) [27,28]. The EHFScBS is a validated and reliable scale used to measure the self-management performance of patients with HF [27]. This scale consists of 12 items that are broadly divided into two components (eight items regarding lifestyle behavior and four items regarding consulting behavior) (Table 1). Patients were instructed to rate their confidence level for each lifestyle behavior item on a four-point Likert scale (1: completely confident, 2: confident, 3: less confident, 4: not confident). Further, patients were instructed to rate the agreement level for each consulting behavior item on a four-point Likert scale (1: absolutely agree, 2: agree, 3: disagree, 4: absolutely disagree). With regard to the recognition of HF symptoms, patients were instructed to rate their confidence levels in the perception of worsening HF symptoms and the distinction between worsening HF and other disease symptoms on a four-point Likert scale (1: completely confident, 2: confident, 3: less confident, 4: not confident). These questions were originally created based on our previous papers [9] and further developed via in-depth discussions among the investigators, including board-certified cardiologists (H.K. and T.K.), a nurse certified in chronic HF care (N.N.), and a behavioral scientist and board-certified psychologist (D.F.).

Table 1

Questionnaire on self-care for patients hospitalized with HF.

Questions
1. Confidence levels regarding self-care behavior
Lifestyle behavior
(Likert scale: 1 = completely confident to 4 = not confident)
I feel confident that I weigh myself every day.
I feel confident that I take it easy if I get short of breath.
I feel confident that I limit the amount of fluids I drink (not >1–1.5 L/day).
I feel confident that I take a rest during the day.
I feel confident that I eat a low salt diet.
I feel confident that I take my medication as prescribed.
I feel confident that I get a flu shot every year.
I feel confident that I exercise regularly.
Consulting behavior
(Likert scale: 1 = absolutely agree to 4 = absolutely disagree)
If my shortness of breath increases, I contact a hospital or my doctor or nurse.
If my feet/legs become more swollen than usual, I contact a hospital or my doctor or nurse.
If I gain 2 kg in 1 week, I contact a hospital or my doctor or nurse.
If I experience increased fatigue, I contact a hospital or my doctor or nurse.
2. Confidence levels regarding self-monitoring
(Likert scale: 1 = completely confident to 4 = not confident)
I can recognize worsening symptoms of HF.
I can distinguish worsening symptoms of HF from other diseases.

HF, heart failure.

Patient recruitment

Among the 342 patients with HF admitted to our university hospital, we excluded patients who could not answer the questionnaire due to unconsciousness ($n = 9$, 2.6 %), severe cognitive impairment ($n = 79$, 23.1 %), other factors such as mental disorder and language barrier ($n = 18$, 5.3 %), other end-stage life-threatening diseases (n = 7, 2.0 %), or in-hospital death ($n = 15$, 4.4 %). For patients who had repeated admission to our hospital, subsequent surveys were eliminated ($n = 12$, 3.5 %). Consequently, 202 patients were included in our questionnaire survey. Of these, 15 declined to complete the questionnaire. In addition, 9 patients who were unable to complete the questionnaire due to early discharge, and two patients who did not respond to the questions of self-care behavior were excluded. Consequently, 176 patients were analyzed in the study.

Statistical analysis

Continuous variables were expressed as means ± standard deviations or medians with interquartile ranges (IQRs) depending on distribution characteristics. Categorical variables were expressed as numbers (percentages). Overall, missing data were ≤ 5 %, except for the percentage of lymphocytes (10.2 %). Data with missing responses to the major questionnaire were excluded from the analysis. To estimate the 1-year survival rate, the Seattle Heart Failure Model (SHFM) scores were calculated in accordance with previous reports in Japanese patients hospitalized with HF [17,29].

For questionnaire items regarding confidence levels, patients were divided into high confidence (1: completely confident or absolutely agree, 2: confident or agree) and low confidence (3: less confident or disagree, 4: not confident or absolutely disagree) groups. The total confidence score for self-care behavior was calculated from the sum of the 12 confidence/agreement levels in self-care behavior with a global score ranging from 12 to 48; higher scores represented lower confidence in self-care behavior. Patients scoring higher than the second tertile for total confidence (≥25 points) were defined as the low confidence levels regarding self-care behavior. Low confidence in distinguishing worsening symptoms of HF from other diseases was defined by an answer of "not confident" or "less confident". Univariate and multivariate logistic regression analyses were conducted to elucidate the determinants of

low confidence in self-care behavior and distinguishing between worsening HF and other disease symptoms. Covariates included in the multivariate models were age, sex, education status, SHFM-estimated 1-year survival rate, and QoI from physicians about treatment and treatment choices [Model 1] or QoI about prognosis instead of about treatment and treatment choices [Model 2]. We also compared the prevalence of each comorbidity depending on the confidence levels in self-care behavior as well as self-monitoring. Statistical significance was defined as $p < 0.05$ for all statistical analyses. Data were analyzed using SPSS version 26 (IBM Corp., Armonk, NY, USA).

Results

Patient characteristics

The demographic data of the study participants are presented in Table 2. Enrolled patients were predominantly male ($n = 118$, 67.0 %),

Table 2

Demographic data of the study participants.

Variables	$n = 176$
Demographics	
Age, years	73.0 (63.0–81.0)
Female, n (%)	58 (33.0 %)
High school education or less, n (%)	91 (51.7 %)
Married, n (%)	116 (65.9 %)
Living alone, n (%)	42 (23.9 %)
Comorbidities, n (%)	
Hypertension	92 (52.3 %)
Diabetes mellitus	66 (37.5 %)
Dyslipidemia	68 (38.6 %)
Chronic obstructive pulmonary disease	22 (12.5 %)
Asthma	11 (6.3 %)
Stroke	25 (14.2 %)
Cancer	44 (25.0 %)
Anemia	101(57.4 %)
Obesity	33 (18.8 %)
Coronary artery disease	48 (27.3 %)
Atrial fibrillation	112 (63.6 %)
Chronic kidney disease	145 (82.4 %)
Arthritis	18 (10.2 %)
Previous HF admission, n (%)	84 (47.7 %)
NYHA class III and IV at discharge, n (%)	54 (30.7 %)
Vital signs at discharge	
Heart rate, bpm	73.1 ± 12.9
Systolic blood pressure, mmHg	104.5 (94.0–116.0)
Echocardiographic parameters	
Left ventricular ejection fraction, %	44.2 (31.4–59.1)
Laboratory data	
Creatinine, mg/dL	1.2 (1.0–1.7)
Hemoglobin, g/dL	12.3 (10.4–13.6)
BUN, mg/dL	25.0 (19.6–35.3)
Sodium, mEq/L	139.4 (137.6–141.0)
Uric acid, mg/dL	7.1 (5.9–8.3)
Total cholesterol, mg/dL	160.0 (137.0–190.8)
White blood cells, /μL	5500 (4325–6875)
Lymphocyte, %	22.0 (17.9–27.0)
Albumin, g/dL	3.6 ± 0.5
BNP, pg/mL	401.5 (204.1–748.8)
Medication or device therapy, n (%)	
Loop diuretics	151 (85.8 %)
Beta-blockers	146 (83.0 %)
RAS inhibitors	103 (58.5 %)
Mineralocorticoid receptor antagonists	88 (50.0 %)
Statin	69 (39.2 %)
Allopurinol or febuxostat	77 (43.8 %)
ICD	15 (8.5 %)
CRT	10 (5.7 %)
SHFM-estimated 1-year survival rate, %	94.9 (92.2–96.7)

Data are shown as mean ± standard deviation, median with interquartile range, or number and percentage.

HF, heart failure; NYHA, New York Heart Association; BUN, blood urea nitrogen; BNP, brain natriuretic peptide; RAS, renin-angiotensin system; ICD, implantable cardioverter defibrillator; CRT, cardiac resynchronization therapy; SHFM, Seattle Heart Failure Model.

with a median age of 73.0 (IQR: 63.0–81.0) years and a median left ventricular ejection fraction of 44.2 % (31.4–59.1 %). Furthermore, 23.3 % ($n = 41$), 18.8 % ($n = 33$), and 23.9 % ($n = 42$) of patients had ischemic, dilated, and valvular etiologies for HF, respectively. Nearly half [47.7 % ($n = 84$)] of the study participants had previous HF admission. Online Table 1 presents the patients' understanding of the HF trajectory and perspectives toward information disclosure. Among the total number of patients, 54.1 % selected the typical HF trajectory (intermittent decline), and 39.9 % perceived that HF would limit their life expectancy. Furthermore, 72.7 % rated the QoI provided about their treatment and treatment choices as "excellent" or "good," and 54.7 % provided these responses regarding the QoI about prognosis. In addition, 26.8 % of patients answered "never" or "rarely" to questions about the frequency of prognostic discussion.

The confidence levels regarding self-care behaviors are presented in Fig. 1. Overall, patients had a high level of confidence (confident or completely confident, >75 %) in the majority of lifestyle behaviors, such as proper medication use, getting sufficient rest in case of dyspnea/shortness of breath, taking a rest during the day, daily weighing, and fluid restriction. However, patients had relatively low levels of confidence (confident or completely confident, <75 %) in getting a flu vaccination (65.9 %), eating a low-salt diet (63.1 %), and exercising regularly (63.1 %). >75 % of patients "completely agreed" or "agreed" with consulting behavior (i.e. contacting the doctor or nurse in the case of dyspnea, edema, weight gain, and fatigue).

Univariate logistic regression analysis revealed that low confidence in self-care behavior was associated with younger age [odds ratio (OR) = 0.97; 95 % confidence level (CI): 0.95–1.00], lower education status (OR = 2.49; 95 % CI: 1.29–4.81), and lower QoI from physicians about treatment and treatment choices (OR = 4.68; 95 % CI: 1.52–14.44) (Online Table 2). HF severity (i.e. New York Heart Association functional class, SHFM-estimated 1-year survival rate), comorbidities, and understanding of HF trajectory were not significantly associated with low confidence in self-care behaviors. No significant difference was observed in the prevalence of comorbidities between patients with high and low confidence levels in self-care behavior (Online Fig. 1). After adjustment, younger age (OR = 0.97; 95 % CI: 0.94–1.00), lower education status (OR = 2.74; 95 % CI: 1.31–5.73),

Table 3
Multivariate logistic regression analysis of determinants of low confidence levels regarding self-care behavior.

Variables	OR	95 % CI	p-Value
<Model 1>			
Age (per each year increase)	0.97	0.94–1.00	0.029
Female	1.02	0.47–2.20	0.955
High school education or less	2.74	1.31–5.73	0.008
SHFM-estimated 1-year survival rate (per each % increase)	0.94	0.89–1.00	0.066
Low quality of information about treatment and treatment choices	5.99	1.67–21.45	0.006
<Model 2>			
Age (per each year increase)	0.97	0.94–1.00	0.032
Female	1.01	0.48–2.14	0.978
High school education or less	2.91	1.42–5.96	0.003
SHFM-estimated 1-year survival rate (per each % increase)	0.95	0.89–1.01	0.078
Low quality of information about prognosis	1.30	0.56–3.02	0.537

OR, odds ratio; CI, confidence interval; SHFM, Seattle Heart Failure Model.

and lower QoI from physicians about treatment and treatment choices (OR = 5.99; 95 % CI: 1.67–21.45) remained as determinants of low confidence levels regarding self-care behavior (Table 3).

Data regarding patients' recognition of HF symptoms are presented in Fig. 2. Among the total number of patients, 56.8 % were confident in the perception of worsening HF (completely confident, 16.5 %; confident, 40.3 %). Moreover, 37.5 % of patients were confident in distinguishing worsening symptoms of HF from other diseases (completely confident, 9.7 %; confident, 27.8 %). Univariate regression analysis revealed that low QoI from physicians about treatment and treatment choices (OR = 9.63; 95 % CI: 1.24–75.11) and about prognosis (OR = 2.73; 95 % CI: 1.11–6.71) were both significantly associated with low confidence in distinguishing worsening symptoms of HF from other diseases (Online Table 3). Conversely, patients with diabetes mellitus (OR = 0.53; 95 % CI: 0.28–0.99) or stroke (OR = 0.34; 95 % CI: 0.14–0.81) had high confidence in distinguishing worsening symptoms. The prevalence of diabetes mellitus ($p = 0.044$) and stroke ($p = 0.012$) was significantly higher in
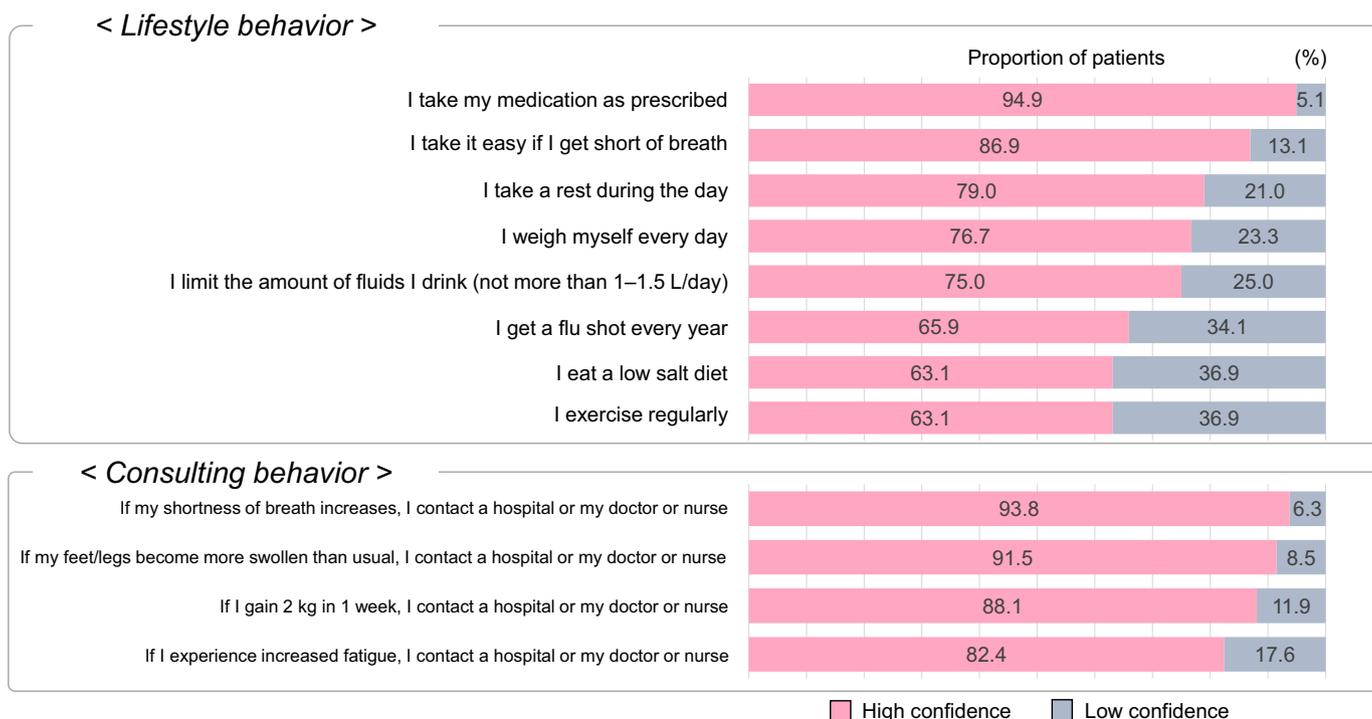

< Lifestyle behavior >

Proportion of patients (%)

	High confidence	Low confidence
I take my medication as prescribed	94.9	5.1
I take it easy if I get short of breath	86.9	13.1
I take a rest during the day	79.0	21.0
I weigh myself every day	76.7	23.3
I limit the amount of fluids I drink (not more than 1–1.5 L/day)	75.0	25.0
I get a flu shot every year	65.9	34.1
I eat a low salt diet	63.1	36.9
I exercise regularly	63.1	36.9

< Consulting behavior >

	High confidence	Low confidence
If my shortness of breath increases, I contact a hospital or my doctor or nurse	93.8	6.3
If my feet/legs become more swollen than usual, I contact a hospital or my doctor or nurse	91.5	8.5
If I gain 2 kg in 1 week, I contact a hospital or my doctor or nurse	88.1	11.9
If I experience increased fatigue, I contact a hospital or my doctor or nurse	82.4	17.6

■ High confidence ■ Low confidence

Fig. 1. Confidence levels regarding self-care behavior.

**Confidence level in
recognition of worsening HF symptoms**
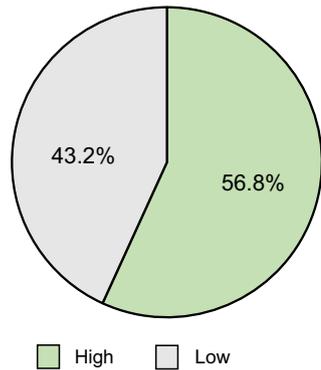
**Confidence level in
distinction of worsening symptoms of
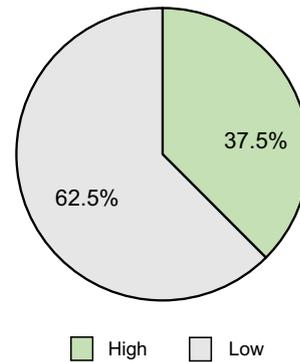HF and other diseases**

Fig. 2. Patients' perception and recognition of HF symptoms.
HF, heart failure.

patients with high confidence in distinguishing worsening symptoms of HF from other diseases than in those with low confidence levels (Fig. 3). After adjustment, lower QoI from physicians about treatment and treatment choices (OR, 9.89; 95 % CI, 1.24–79.11) or about prognosis (OR = 2.70; 95 % CI: 1.07–6.82) remained as determinants of low confidence in distinguishing worsening symptoms (Table 4).

Discussion

This study examined patient perspectives on self-care after HF hospitalization. The key findings of the present study are as follows: 1) while patients' overall confidence levels for self-care behavior were satisfactory, patients had relatively low confidence regarding low-salt diet, regular exercise, and flu vaccination; 2) low confidence in self-care behavior was associated with younger age, lower education status, and low quality of patient-physician communication; and 3) approximately 60 % of patients were not confident in distinguishing between

worsening symptoms of HF and other diseases, for which the quality of patient-physician communication was a determinant.

There is a paucity of studies examining the extent to which patients have confidence in achieving each component of self-care. We comprehensively investigated patients' confidence levels in 12 self-care behaviors (eight lifestyle behavior items and four counseling behavior items) derived from the EHFScBS [27]. In accordance with previous studies [5,30–32], our analysis revealed that patients' confidence regarding regular exercising, eating a low-salt diet, and flu vaccination were insufficient. This highlights the need for patient education programs with an emphasis on these components; the optimal transition of education and care from hospital to home may reduce the rates of avoidable rehospitalization [33]. Moreover, in the outpatient setting, questioning patients about physical activity and salt restriction as part of routine clinical examinations may be warranted. Furthermore, potential barriers for each item need to be addressed proactively. For exercise promotion, a detailed exercise program (e.g. home-based telerehabilitation) could be adopted,
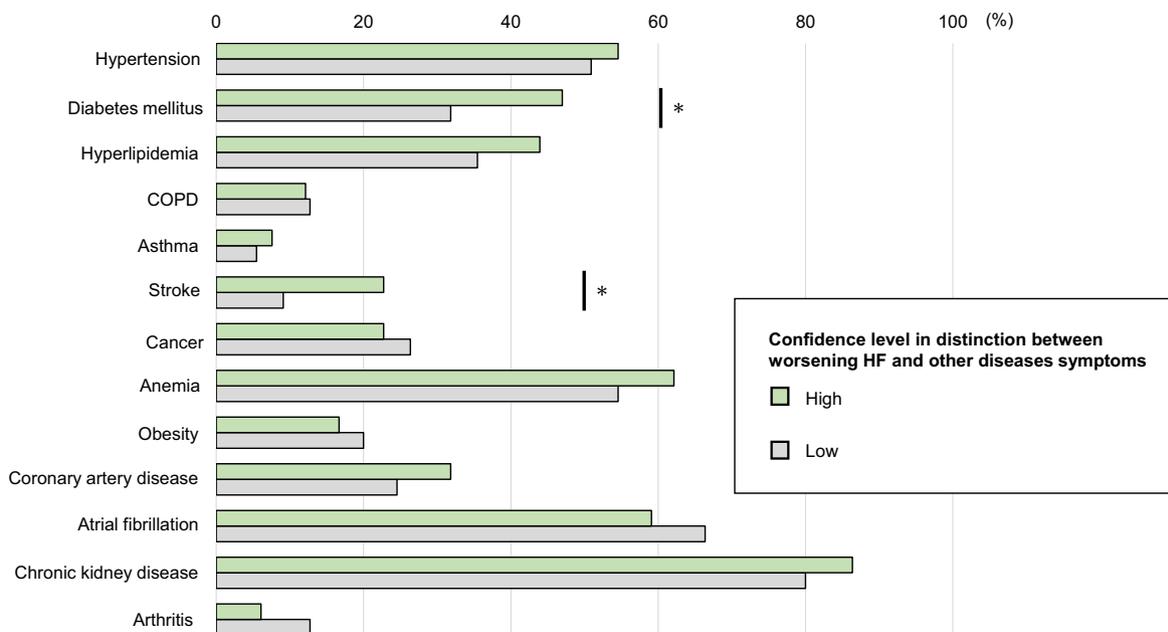

Fig. 3. Prevalence of comorbidities among patients with HF with high and low confidence levels regarding the distinction of worsening symptoms of HF from other diseases.
HF, heart failure; COPD, chronic obstructive pulmonary disease. *$p < 0.05$.

Table 4

Multivariate logistic regression analysis of determinants of low confidence levels regarding distinction of worsening symptoms of HF from other diseases.

Variables	OR	95 % CI	*p*-Value
<Model 1>			
Age (per each year increase)	1.00	0.97–1.02	0.687
Female	2.01	0.95–4.28	0.069
High school education or less	0.62	0.31–1.22	0.165
SHFM-estimated 1-year survival rate (per each % increase)	1.03	0.97–1.10	0.291
Low quality of information about treatment and treatment choices	9.89	1.24–79.11	0.031
<Model 2>			
Age (per each year increase)	0.99	0.97–1.02	0.624
Female	1.80	0.84–3.83	0.130
High school education or less	0.62	0.32–1.23	0.170
SHFM-estimated 1-year survival rate (per each % increase)	1.03	0.97–1.10	0.291
Low quality of information about prognosis	2.70	1.07–6.82	0.036

HF, heart failure; OR, odds ratio; CI, confidence interval; SHFM, Seattle Heart Failure Model.

because patients' uncertainty regarding appropriate exercise modalities, intensities, and training protocols may be a barrier to routine exercise [2,34]. With regard to vaccinations, open discussions about the importance of vaccinations and any concerns that patients and families may be essential. Because of the suboptimal adherence to salt restriction after acute exacerbation of HF, dietitian-administered counseling needs to be considered in the outpatient setting [35].

Our results indicated that a higher quality of physician-provided information was associated with greater confidence in self-care behavior and management, which is concordant with previous studies in similar settings [12,13,36]. Although patient-physician communication may be a key therapeutic target to improve self-care, our findings did not identify the details of the information that physicians need to provide. Although the risk of worsening HF may be a major impetus to promoting adequate engagement in self-care [3], patients' understanding of the HF trajectory was not associated with their confidence in self-care in our study. Patients' understanding of the importance of self-care, which was not evaluated in this study, might affect their confidence level. Previous meta-analyses of randomized trials of self-management interventions in patients with HF demonstrated that interventions using face-to-face communication were more effective at influencing readmission compared with interventions without these strategies [37]. Future studies should focus on the implementation of these interventions by cardiologists to enhance patient-physician communication in real-world settings (i.e. with limited human resources).

In our hospitalized HF cohort, low confidence in self-care behavior was associated with younger age and lower education status, which is consistent with previous studies [4,38,39]. Although depression is a common factor that impedes self-care in other settings [10,39], PHQ-2 score was not associated with patients' confidence in self-care in our cohort. These findings clarify the subpopulations that should be targeted for implementing interventions to encourage adherence to self-care. Recent technological innovations (e.g. wearable activity monitors, smartphones, and other mobile applications) provide promising approaches for improving monitoring and patient engagement [40], especially in younger patients. "Low-tech" approaches (e.g. easy to use, low-literacy educational materials) or user-friendly devices may also be required for patients with limited education. Indeed, one pilot study demonstrated that a language-free tool successfully improved self-care behavior in ethnically diverse patients with low literacy [41]. Considering that patients' background in HF is heterogeneous, individualized approaches using these technologies should be considered rather than conventional uniform approaches.

Although self-care is essential for complex patients with multiple comorbidities, monitoring symptoms and differentiating the cause of a particular symptom are the most challenging issues when more than one chronic illness is present [3,4]. Notably, in this study, low confidence in distinguishing worsening symptoms of HF from other diseases was associated with a lower prevalence of diabetes and stroke. Although the precise reason for this relationship is unclear, multidisciplinary education about both HF and other diseases may contribute to higher confidence in self-monitoring. Because of the increased prevalence of multiple comorbidities in an aging society, a deeper understanding of appropriate multidisciplinary programs for patients with HF with multiple comorbidities in conjunction with programs for other comorbidities is necessary.

There are several limitations to the present study that should be considered when interpreting the results. First, this was a small-scale study conducted in a single center; consequently, statistical power may have been insufficient to detect reliable outcomes. Second, confidence levels were based on patients' evaluations, which might be subjective rather than objective. However, recently, the need for patient-focused research to determine best practice interventions that meet patient needs for knowledge and self-care related to their condition has been emphasized [42]. We believe that our study will enable medical providers to address patient needs through the understanding of patients' perspectives. Third, the cross-sectional design of this study limits our ability to clarify the impact of patients' confidence on actual self-care behavior. Therefore, post-discharge assessment of actual self-care behavior will add value to our study. In addition to self-reported validated questionnaires (e.g. EHFScBS), further exploration with objective and precise measurements of actual self-care behavior (e.g. physical activity using wearable devices, sodium intake by urine sodium measurement) [43,44] is warranted. Furthermore, the present study was also not able to disclose the relationship between patients' self-care behavior and long-term outcomes of HF. To investigate the prognostic association between patients' confidence and actual performance of self-care behavior, further large-scale longitudinal studies are warranted. Fourth, the cause-effect relationship (e.g. the association between patients' confidence in self-care behavior and the quality of patient-physician communication) cannot be assumed from our results. Notably, a previous meta-analysis has demonstrated that training physicians in communication skills results in substantial and significant improvement in patient adherence [45]. Although the quality of patient-physician communication was not significantly different among attending physicians (data not shown), the development of an educational program for physicians to improve their communication with patients could be an important future direction of this field. Finally, our findings may not be generalizable to other countries. Since HF is a global health issue, further studies with international collaborations should be conducted. Despite these limitations, our study provides insight into the perspectives of patients with HF regarding self-care behavior and its associations with patients' characteristics and the quality of patient-physician communication.

In conclusion, there were substantial disparities in confidence levels regarding self-care in patients hospitalized with HF. Patients had relatively low confidence regarding eating a low-salt diet, performing regular exercise, and getting a flu vaccination. Low confidence levels in self-care were associated with younger age, lower education level, and low quality of patient-physician communication. Our findings underscore the need to provide intensive education programs to improve patients' knowledge and confidence regarding self-care behavior. Further, interventions that aim to enhance patient-physician communication concerning self-care behavior warrant further investigation.

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Declaration of competing interest

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