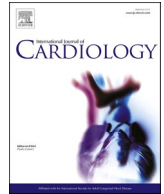




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Impact of stress coping style on self-care behaviors and prognosis in patients with heart failure: A prospective longitudinal observational study

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ABSTRACT

Background: Heart failure (HF) requires effective management and self-care education to improve outcomes. However, daily self-care routines necessary for managing HF can lead to psychological issues, including stress, potentially exacerbating the condition. Patient stress-coping behaviors may significantly impact prognosis.

Objective: We aimed to identify stress coping styles in patients with HF and examine their impact on self-care behavior and prognosis.

Methods: This study utilized a longitudinal prospective observational design. Patients were categorized into task-oriented (task), emotion-oriented (emotion), and avoidance (avoidance) coping groups using the Coping Inventory for Stress Situations. Stress levels and self-care behaviors were evaluated during hospitalization and 1 and 3 months after discharge. The primary outcome was a composite of HF readmission and all-cause mortality during the 180-day post-discharge period. Longitudinal changes in self-care behaviors were assessed according to stress intensity.

Results: We included 151 patients (age, 74 [60–80] years; female, 37.1 %) hospitalized for HF exacerbation between August 2021 and August 2023. The task group comprised 45 patients (29.8 %); emotion group, 47 (31.1 %); and avoidance group, 59 (39.1 %). The avoidance group had a higher risk of adverse events during follow-up (task, emotion, and avoidance: 8.9 % vs. 14.9 % vs. 32.2 %, $p = 0.004$). The avoidance-coping style was the only independent predictor of the primary outcome (hazard ratio: 3.84, 95 % confidence interval: 1.40–10.53, $p = 0.009$). Self-care behaviors were notably poorer in the avoidance group, particularly under conditions of high stress.

Conclusions: Stress-coping strategies impact both prognosis and self-care outcomes in patients with HF, and education programs should consider incorporating these strategies.

1. Introduction

Heart failure (HF) is one of the most debilitating conditions worldwide. It is associated with high mortality and morbidity, along with frequent hospitalizations [1]. Lifelong behavioral changes, including optimal self-care behavior, are recommended to reduce HF readmissions and improve patient outcomes [2].

In many cases, readmissions for HF exacerbations result from poor compliance, including non-adherence to medications and diets, which

can be prevented by self-care, as well as failure to effectively manage symptoms [3]. Maintaining physiological stability and improving health outcomes in patients with HF require effective self-care [4].

Self-care encompasses three key concepts: maintenance (e.g., taking medication as prescribed and adhering to recommended diets), monitoring (e.g., regular weighing), and management (e.g., changing diuretic doses in response to symptoms) [5]. Patients who engage in effective self-care have lower readmission rates, a better quality of life, and improved medical outcomes than those with insufficient self-care [6].

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However, despite the importance of self-care, patients may face numerous barriers to engaging in effective self-care, including practical, financial, and psychological factors. Additionally, the daily self-care routines of patients with HF are often associated with stress [5]. Stress occurs when environmental demands exceed an individual's ability to adapt to them [7]. In the case of HF, not only the disease itself but also the self-care behaviors they are forced to deal with are commonly perceived by patients as very stressful experiences, both physically and psychologically [8].

Although the relationship between stress and HF is not fully understood, research involving patients with cardiovascular diseases has shown that psychological stress can have multiple adverse effects on health outcomes [9,10]. Several systematic reviews and meta-analyses suggest that cognitive-behavioral therapy (CBT)-based interventions are effective for addressing psychological effects, such as depression, anxiety, and stress, in patients with HF [11]. Moreover, the largest CBT trial that targeted both depression and HF self-care found CBT efficacious for depression, but not for HF self-care or HF prognosis [12]. Psychological factors have been reported to negatively affect the prognosis of patients with HF. However, effective interventions aimed at improving the condition of patients with HF by considering their psychological effects have not yet been established. Therefore, the development of effective educational programs that consider the psychological factors of patients with HF is necessary to improve their self-care and prevent readmissions. However, first understanding the psychological aspects of patients with HF and how they impact their self-care behaviors and HF prognosis is important.

This study focused not only on the degree of stress but also on the coping behaviors of individuals when stressful situations arise. Lazarus and Folkman (1984) [13] define coping as “constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” while attempting to manage, master, or alter stressful situations by reducing or tolerating them [13]. A previous study demonstrated that effective coping strategies are essential for individuals to adapt to and manage health threats, particularly those involving HF [14]. Coping has also been reported to affect the outcomes of diseases such as cancer and HIV/AIDS [15]. However, in the field of HF, the effect of coping on disease management and prognosis has not yet been elucidated.

Therefore, understanding the coping styles of patients with HF when they experience stress may enable us to develop and test interventions aimed at improving self-care behaviors and HF prognosis. The current study aimed to identify stress coping styles in patients with HF and how they affect self-care behaviors and HF prognosis. This study will pave the way for the creation of innovative self-care educational strategies for patients with HF, which will reduce readmissions and improve outcomes.

2. Methods

2.1. Design, sample, and setting

This study utilized a longitudinal prospective observational design. Patients with acute exacerbations of HF were recruited and followed up for 6 months to assess 6-month cardiac event-free survival.

Patients diagnosed with HF were eligible for participation in the study if they were admitted to the hospital with a primary diagnosis of exacerbation of HF. The exclusion criteria were as follows: 1) patients diagnosed with dementia or suspected of dementia based on MMSE during hospitalization; 2) patients who were not independent in daily living, such as those living in institutions where caregivers were typically responsible for health management; 3) patients with communication difficulties, including impaired consciousness, aphasia, severe hearing loss, visual impairment, and non-native Japanese speakers; or 4) patients who could not provide consent for the research. The study had

been approved by the Research Ethical Committees both in Kobe City Medical Center General Hospital (k230703), and Kyoto University (R3105-2).

2.2. Study flow

We recruited patients with acute HF exacerbations who were admitted to the cardiology department. Eligible patients were invited to participate in the study when their general condition was confirmed as stable by the attending physician. After obtaining informed consent, baseline assessments (demographic and medical data, coping style, stress and self-care behaviors) were conducted just before discharge during hospitalization. Follow-up assessments (stress and self-care behaviors) were conducted by the therapist during the regular medical examinations on both 1 and 3 months (± 14 days) after discharge. Baseline assessments were conducted between August 2021 and February 2023, follow-up assessments were conducted between September 2021 and August 2023.

However, participants who were readmitted within 1 or 3 months were requested to retrospectively report their self-care behavior prior to readmission. Patients readmitted within 1 month of discharge were considered part of the 1-month post-discharge assessment, while those readmitted between 1 and 3 months were classified as part of the 3-month assessment, unless they were unable to complete the questionnaire due to their condition, such as stroke. Participants who were readmitted within 1 month were excluded from the 3-month post-discharge assessments because we were unable to standardize their discharge time. All participants were included in the observation to track the occurrence of events during the 180 days after discharge, including HF readmission and mortality.

All questionnaires were intended to be completed by patients. However, in cases where patients experienced difficulty understanding the questions, a therapist was present during the assessment to provide clear explanations. Before the assessment, we reassured the participants that their questionnaire responses would not affect their treatment, aiming to alleviate any potential burden on the medical staff and encourage honest responses.

Demographic (age, female sex, body mass index, etc.) and medical data (New York Heart Association [NYHA] class, echocardiography data, blood test data, medical history, etc.) were collected from medical records.

2.3. Questionnaires

2.3.1. Coping style

Coping refers to the cognitive and behavioral efforts made to manage internal or external stimuli that may exceed personal resources [13]. The Coping Inventory for Stressful Situations (CISS) was utilized in the present study to assess coping styles during stressful situations. The CISS consists of 48 items, with 16 items per scale, and measures three basic coping strategies: task-oriented, emotion-oriented, and avoidance coping [16].

Patients were asked to indicate how much they generally engaged in various activities when encountering difficult, stressful, or upsetting situations. The CISS inventory captures various behaviors exhibited by individuals in stressful situations, with each item indicating the frequency of occurrence on a 5-point scale (1 [“never”] to 5 [“always”]). Task-oriented coping involves directly dealing with a stressful situation, such as “focusing on the problem and seeing how I can solve it.” Emotion-oriented coping focuses on managing the associated emotions, such as “blame myself for having gotten into this situation.” Avoidance coping refers to behaviors aimed at avoiding the stressor, such as “treating myself to a favorite food or snack.” Scale scores are obtained by summing the item scores, with higher scores indicating greater use of a specific coping strategy. The raw scores were converted into standardized scores for comparison.

In this study, patients were categorized into coping types based on their relatively higher scores to clarify their characteristics.

2.3.2. Perceived stress

Perceived stress levels were evaluated using the Perceived Stress Scale-10 (PSS-10) [17]. The PSS-10 comprises 10 items rated on a 5-point Likert-like response scale, ranging from 0 (never) to 4 (very often). The items include “felt upset because of something that happened unexpectedly” and “felt angered because of things that happened that were outside of your control,” etc. The total PSS-10 score ranges from 0 to 40, with higher scores indicating higher levels of perceived stress. However, the PSS is not a diagnostic instrument; therefore, cutoff values are not applicable. We used the intensity of perceived stress (low stress, 0–13; moderate stress, 14–26; and high stress, 27–40), which has been used in previous studies [18]. The PSS was administered at baseline and at the 1- and 3-month follow-up assessments.

2.3.3. Self-care

We used the Self-Care of Heart Failure Index (SCHFI, version 7.2) [19] to assess the level of self-care maintenance, self-care management, symptom perception, and self-care confidence subscales.

The revised SCHFI (v7.2) comprises 29 items categorized into 4 sections, each assessing different aspects of self-care: self-care maintenance, symptom perception, self-care management, and self-care confidence. The Self-Care Maintenance Scale includes 10 behaviors that people with HF use to help themselves, such as “try to avoid getting sick?” and “eat a low salt diet?”, measured at frequencies ranging from 1 (never) to 5 (always). The Symptom Perception Scale includes nine items on changes that people with HF commonly monitor, such as “monitor your weight daily” and “check your ankles for swelling,” assessed at frequencies ranging from 1 (never) to 5 (always). Additionally, the scale includes two items on how quickly symptoms related to HF were recognized and identified, with responses ranging from “have not had symptoms” or 0 (did not recognize the symptoms) to 5 (very quickly). The Self-Care Management scale includes eight items. Seven of these items assess how likely individuals are to use behaviors that control HF symptoms, such as “further limit the salt you eat that day?” and “limit your activity until you feel better?”, on a scale ranging from 1 (unlikely) to 5 (very likely). One Self-Care Management question assesses how confident patients are in the effectiveness of the treatment they used, with responses ranging from 0 (I did not do anything) or 1 (not sure) to 5 (very sure).

Each section is scored separately. Response choices for all items in the sections were summed as a raw scale score. Subsequently, the raw score was transformed into a standard score, ranging from 0 to 100, using a specific formula, with higher scores indicating better self-care [19].

2.4. Event-free survival

Event-free survival was defined as the combined endpoint of cardiac hospitalization or all-cause mortality 180 days after discharge. Hospitalization data were obtained by reviewing medical records.

2.5. Statistical analyses

The patients were divided into three groups—the task-oriented coping group (task group), emotion-oriented coping group (emotion group), and avoidance group—based on their comparatively higher standardized scores on the CISS for each coping style. Kruskal–Wallis tests were conducted to examine differences in age, left ventricular ejection fraction, N-terminal pro-B-type natriuretic peptide (NT-proBNP) levels, and other demographic and clinical characteristics among the three coping groups. Similarly, Fisher’s exact test was conducted to examine differences in nominal variables, such as sex, NYHA class, or previous medical history, among the three coping groups. The

log-rank test with a Holm correction was used to compare event-free survival among the three coping groups. To examine the association between coping strategies and event-free survival (cardiac hospitalization or all-cause mortality), an adjusted Cox regression analysis (survival analysis) was used to determine whether different types of coping styles independently predicted event-free survival. The following covariates were considered in the adjusted analyses: age, sex, mild cognitive impairment, HF with reduced ejection fraction (HFrEF), history of hospitalization for HF, living alone, and NT-proBNP levels. Line graphs were used to illustrate the median values of disease control over time for each coping type, categorized by the degree of stress. The line graphs provide a visual representation of how disease control varied over time based on coping style and stress level. We conducted an analysis using EZR analysis software (Saitama Medical Center, Jichi Medical University, Saitama, Japan). Statistical significance was set at $p \leq 0.05$.

3. Results

3.1. Study patients

A total of 466 patients were admitted to our hospital due to acute exacerbations of HF between August 20, 2021, and March 1, 2023. We excluded patients who were transferred to a rehabilitation hospital ($n = 15$) and those lost to follow-up ($n = 1$). Finally, 151 patients who completed the baseline assessment during hospitalization and provided written informed consent were included in the study. Of the participants, 135 and 120 completed the 1- and 3-month post-discharge assessments, respectively.

The 151 participants were divided into three groups based on their CISS scores: task group, 45 participants; emotion group, 47 participants; and avoidance group, 59 participants. The demographic and clinical characteristics of the patients are summarized in Table 1. In the Avoidance group, relatively higher numbers of participants living alone ($p = 0.05$), and relatively fewer patients with low cardiac function (HFrEF) were observed ($p = 0.09$). Within 6 months after discharge, 25 patients were hospitalized for HF and 8 died.

3.2. Impact of stress coping style on HF prognosis

Among the 33 patients who experienced events during the 6 months, 5 were in the Task group, 7 were in the Emotional group, and 21 were in the Avoidance group. The log-rank test with Holm correction revealed that patients in the Avoidance group experienced significantly more events compared to those in the Task group (Task vs Avoidance: $p = 0.015$) and Emotion group (Emotion vs Avoidance: $p = 0.038$). However, there was no significant difference between the Task and Emotion groups (Task vs Emotion: $p = 0.60$) (Fig. 1).

In analyses adjusted for age, sex, mild cognitive impairment, history of hospitalization for HF, HFrEF, living alone, and NT-proBNP, where stress coping styles were the independent variables, the avoidance coping style was the only significant predictor of event-free survival (Table 2).

3.3. Association between stress coping and self-care behaviors

The longitudinal changes in self-care behaviors are summarized in Table 1. No significant differences were observed among the three groups in the total scores for each self-care section.

In Fig. 2, line graphs are used to illustrate the median values of the SCHFI scores over time for each coping style, categorized by the degree of baseline stress intensity. Stress intensity was stratified into three categories: high, medium, and low. The high stress category comprised 9 participants in the Task group, 17 in the Emotion group, and 9 in the Avoidance group. The medium-stress category comprised 29 participants in the Task group, 27 in the Emotion group, and 39 in the Avoidance group. The low-stress category comprised 7 participants in

Table 1

Demographic and clinical characteristics.

	All (n = 151)	Task-oriented Coping (n = 45)	Emotion-oriented Coping (n = 47)	Avoidance-oriented Coping (n = 59)	p value
Age	74 [68–80]	74 [63–80]	73 [66–78]	76 [71–81]	0.237
Female, n (%)	56 (37.1)	17 (37.8)	19 (40.4)	20 (33.9)	0.773
Living alone, n (%)	47 (31.1)	12 (26.7)	10 (21.3)	25 (42.5)	0.050
Education ≥ 12 years, n (%)	130 (86.1)	39 (86.7)	39 (83)	52 (88.1)	0.765
Body mass index	21.5 [18.7–25.2]	22.1 [20.2–25.9]	22.0 [18.4–26.2]	20.8 [18.1–23.7]	0.113
Current smoker, n (%)	25 (15.9)	7 (15.6)	7 (14.9)	11 (18.6)	0.889
Past smoker, n (%)	59 (39.1)	16 (35.6)	22 (46.8)	21 (35.6)	0.365
Walking aid, n (%)	19 (12.6)	6 (13.3)	7 (14.9)	6 (10.2)	0.747
Medical History					
NYHA III, n (%)	20 (13.2)	4 (8.9)	10 (21.3)	6 (10.2)	0.177
LVEF (%)	41.1 [29.2–60.4]	38.8 [30.6–59.8]	36.9 [27.9–54.1]	48.7 [31.4–62.9]	0.101
HFrEF, n (%)	73 (48.3)	24 (53.3)	27 (57.4)	22 (37.3)	0.091
History hospitalization for HF, n (%)	24 (15.9)	8 (17.8)	5 (10.6)	11 (18.6)	0.483
Diabetes, n (%)	58 (38.4)	18 (40.0)	21 (44.7)	19 (32.2)	0.405
Hypertension, n (%)	83 (55.0)	27 (60.0)	24 (51.1)	32 (54.2)	0.703
Hyperlipidemia, n (%)	48 (31.9)	11 (24.4)	14 (29.8)	23 (39)	0.275
Cerebrovascular disease, n (%)	19 (12.6)	4 (8.9)	9 (19.1)	6 (10.2)	0.290
Chronic kidney disease, n (%)	46 (30.5)	13 (28.9)	13 (27.7)	20 (33.9)	0.793
Hemodiafiltration, n (%)	9 (6.0)	2 (4.4)	4 (8.5)	3 (5.1)	0.753
Cancer, n (%)	25 (16.6)	6 (13.3)	11 (23.4)	8 (13.6)	0.344
History of MI, n (%)	26 (17.2)	6 (13.3)	11 (23.4)	9 (15.3)	0.431
History of atrial fibrillation, n (%)	68 (45.0)	18 (40.0)	22 (46.8)	28 (47.5)	0.750
Diuretic, n (%)	120 (79.5)	33 (73.3)	28 (59.6)	41 (69.5)	0.360
Beta blocker, n (%)	110 (72.8)	35 (77.8)	34 (72.3)	41 (69.5)	0.643
ACE inhibitor or ARB, n (%)	47 (31.1)	14 (31.1)	13 (27.7)	20 (33.9)	0.795
Aldosterone antagonists, n (%)	104 (68.9)	34 (75.6)	32 (68.1)	38 (64.4)	0.502
Cardiotonic, n (%)	9 (6.0)	1 (2.2)	5 (10.6)	3 (5.1)	0.260
Laboratory Data					
NT-proBNP	1583.0 [669.50–1603.50]	1379 [662.0–2446.0]	1630 [815.5–4238.0]	1583 [649.5–3475.5]	0.661
Creatinine	1.17 [0.91–1.68]	1.18 [0.97–1.81]	1.09 [0.84–1.44]	1.17 [0.93–1.73]	0.402
eGFR	43 [27.5–57.5]	42 [26–55]	44 [32–61]	42 [26–56.5]	0.452
BUN	23.5 [18.45–33.05]	23.9 [19.20–32.80]	23.5 [17.65–29.65]	24.8 [18.15–36.25]	0.746
HbA1c	6.20 [5.7–6.7]	6.2 [5.9–6.6]	6.4 [5.9–7.15]	6.1 [5.6–6.50]	0.163
Hb	11.90 [10.2–14.3]	12.1 [10.6–14.2]	11.5 [10.2–14.25]	11.8 [10.1–14.20]	0.936
Alb	3.40 [3.1–3.7]	3.4 [3.1–3.6]	3.3 [3.05–3.5]	3.5 [3.1–3.7]	0.198
Psychological functions					
MMSE	28 [26–30]	29 [27–30]	28 [26–29]	28 [26–29]	0.159
MoCA	24 [22–27]	26 [23–28]	24 [22–27]	24 [21–27]	0.327
MCI, n (%)	86 (56.9)	22 (48.9)	27 (57.4)	37 (62.7)	0.373
CISS-Task	46 [35–57]	58 [55–64]	42 [34–48]	40 [34–48]	<0.001
CISS-Emotion	48 (38–55)	42 (37–50)	56 (51.5–64)	44 (36–50.5)	<0.001
CISS-Avoidance	46 [35–57]	45 [39–55]	50 [41.5–53]	54 [48.0–60]	<0.001
Baseline Stress	21 [16–25]	20 [16–23]	24 [19–27]	20 [15–23]	0.003
Baseline Stress intensity, n (%)	Low: 21 (13.9) Medium: 95 (62.9) High: 35 (23.2)	Low: 7 (15.6) Medium: 29 (64.4) High: 9 (20.0)	Low: 3 (6.4) Medium: 27 (57.4) High: 17 (36.2)	Low: 11 (18.6) Medium: 39 (66.1) High: 9 (15.3)	0.079
Self-care behaviors (Scores range from 0 to 100 in each section)					
SCHFI scores in baseline					
Self-care maintenance	57 [42–70]	55 [40–70]	55 [45–68]	60 [43–70]	0.863
Symptom perception	47 [31–63]	54 [29–68]	47 [31–62]	45 [30–63]	0.649
Self-care management	37 [25–54]	40 [25–62]	43 [31–51]	37 [25–51]	0.860
SCHFI scores in one-month after discharge					
Self-care maintenance	72 [65–80]	75 [70–81]	72 [65–86]	72 [62–80]	0.456
Symptom perception	81 [64–94]	83 [72–94]	86 [63–92]	77 [59–90]	0.238
Self-care management	68 [50–81]	68 [50–81]	68 [53–81]	68 [50–81]	0.722
SCHFI scores in three-month after discharge					
Self-care maintenance	72 [60–80]	75 [62–80]	75 [61–83]	70 [55–75.0]	0.358
Symptom perception	83 [61–93]	83 [66–94]	84 [62–94]	73 [50–88]	0.139
Self-care management	68 [50–81]	68 [50–81]	65 [53–81]	68 [50–84]	0.921

Data are presented as mean ± standard deviation or median [interquartile range].

LVEF, left ventricular ejection fraction; HFrEF, heart failure with reduced ejection fraction (LVEF of ≤ 40 % according to the American Heart Association); NT-proBNP, N-terminal pro b-type natriuretic peptide.

the Task group, 3 in the Emotion group, and 11 in the Avoidance group. Specific characteristics were observed in longitudinal changes in self-care behaviors according to stress intensity and coping style (Fig. 2). The Avoidance group exhibited poorer self-care behavior when the stress intensity was high and better self-care behavior when the stress intensity was low. Conversely, the Task group demonstrated better self-care behavior when the stress intensity was high and poorer self-care behavior when the stress intensity was low.

4. Discussion

This study investigated the effects of coping styles on the prognosis and daily self-care behavior of patients with HF. Our findings indicated that 39.1 % of patients employed avoidance coping styles, and being in the avoidance group was associated with an increased risk of adverse events. Additionally, self-care behavior was relatively poorer in the avoidance group than in the other groups, particularly under high stress

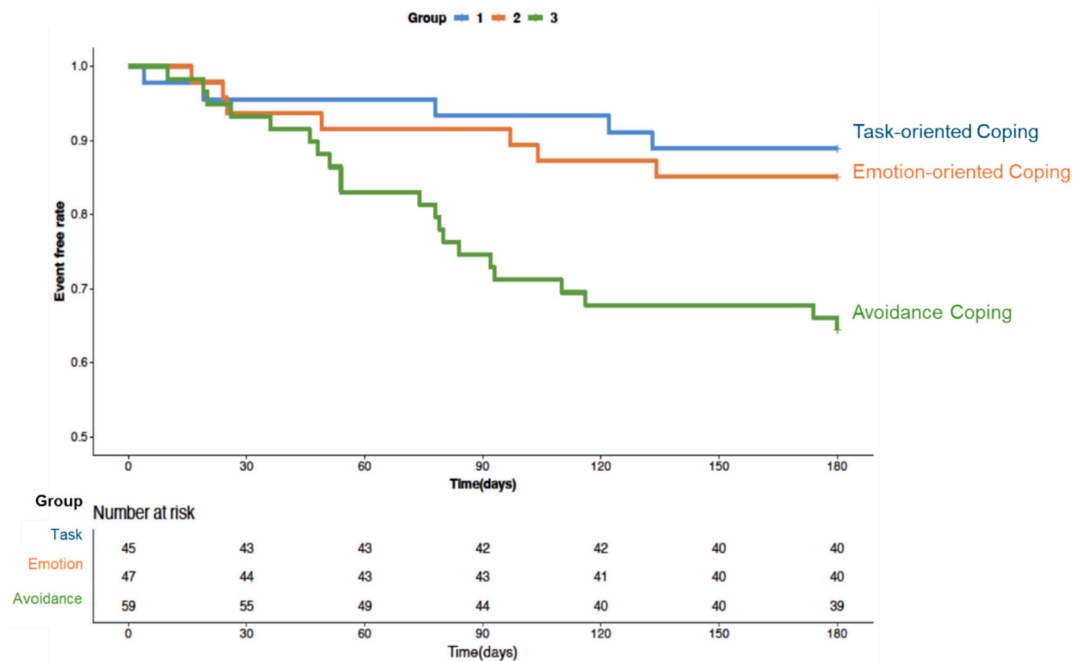


Fig. 1. Comparisons of event-free survival among the coping style groups.

Table 2

Univariable and multivariable analyses for predicting cardiac events within 180 days of discharge.

	Univariable analysis		Multivariable analysis	
	Hazard Ratio (95 %CI)	p value	Adjusted Hazard Ratio (95 %CI)	p value*
Coping style				
Task-oriented coping	1.0 (reference)	–	1.0 (reference)	–
Emotion-oriented coping	1.37 (0.44–4.33)	0.582	1.38 (0.43–4.41)	0.587
Avoidance coping	3.67 (1.39–9.77)	0.009	3.84 (1.40–10.53)	0.009

*Adjusting variables: Age, female sex, mild cognitive impairment, HFrEF, history of hospitalization for HF, living alone, and NT-proBNP.

intensity. The impact of avoidance coping on the prognosis of HF observed in this study was consistent with that observed in previous studies [20,21]. However, little is known about how HF prognosis and coping styles are associated, or how each coping type can affect the self-care of patients with HF. This study is the first to evaluate the coping styles of Japanese patients with HF, focusing on coping patterns and tracking the prognosis and self-care characteristics of each coping type after discharge.

Previous studies have used avoidance coping to describe coping behaviors or reactions, including denial, wishful thinking, escape, social withdrawal, distancing, distraction, minimization, and any mode that indicates behavioral, emotional, and/or mental disengagement [22]. It can also refer to “cognitive or behavioral attempts to ignore or avoid the existence of the problem or illness.” [23] A systematic review of the relationship between coping and medication adherence in previous studies has reported that task- and emotion-focused coping are beneficial for medication adherence among patients with chronic diseases [24]. However, patients who employ avoidance coping, dealing with the stress of their illness by either pretending that they are not ill or ignoring the severity of their symptoms, are less likely to adhere to prescribed medications [25]. Therefore, in patients with HF, daily self-care is particularly crucial compared with other chronic diseases. It is essential

for patients with HF to understand their illness, recognize symptoms, and take prompt action for resolution (e.g., taking diuretics if there is a sudden increase in weight and seeking early medical attention if shortness of breath worsens more than usual). According to our findings, it may be speculated that patients with HF who employ avoidance coping may be less motivated to learn about their illness than patients in the other two groups. Additionally, they may avoid confronting symptoms or seeking solutions to the problems. This avoidance behavior may exacerbate HF.

Our study uniquely tracked patients' health management at 90 days after hospital discharge by considering stress levels and coping strategies. We found that patients who relied on avoidance coping and experienced high stress during hospitalization tended to exhibit poorer post-discharge self-care than those who employed task-oriented coping. However, when stress levels were low during hospitalization, patients employing avoidance coping showed improved post-discharge self-care, challenging previous notions of stress [26] and decision-making [27] in patients with HF. Despite the poor prognosis associated with avoidance coping, stress levels were not significantly higher in the avoidance group than in the task group. Providing appropriate guidance to patients in the avoidance group during periods of low stress may prevent readmission. It can also help maintain their quality of life.

The avoidance group was also characterized by a relatively high number of patients living alone, which is associated with psychological distress [28]. In addition to the tendency to escape stressful situations, the prevalence of living alone may lead to a lack of essential support from healthcare providers, potentially contributing to a detrimental cycle of readmission. Previous studies have reported that avoidance coping and lower perceived social support are associated with depressive symptoms in patients with HF. It can be inferred that those in the Avoidance group, who were comparatively more likely to live alone in this study, were more isolated from society, and their psychological problems could have been more severe [29]. For patients with HF who tend to employ avoidance coping in response to stressful situations, fostering a sense of trust in healthcare providers and collaboratively exploring strategies that facilitate the gradual incorporation of self-care into their daily lives is crucial.

Given the limited research on stress-coping mechanisms in HF, our observational study aimed to identify key coping styles influencing HF

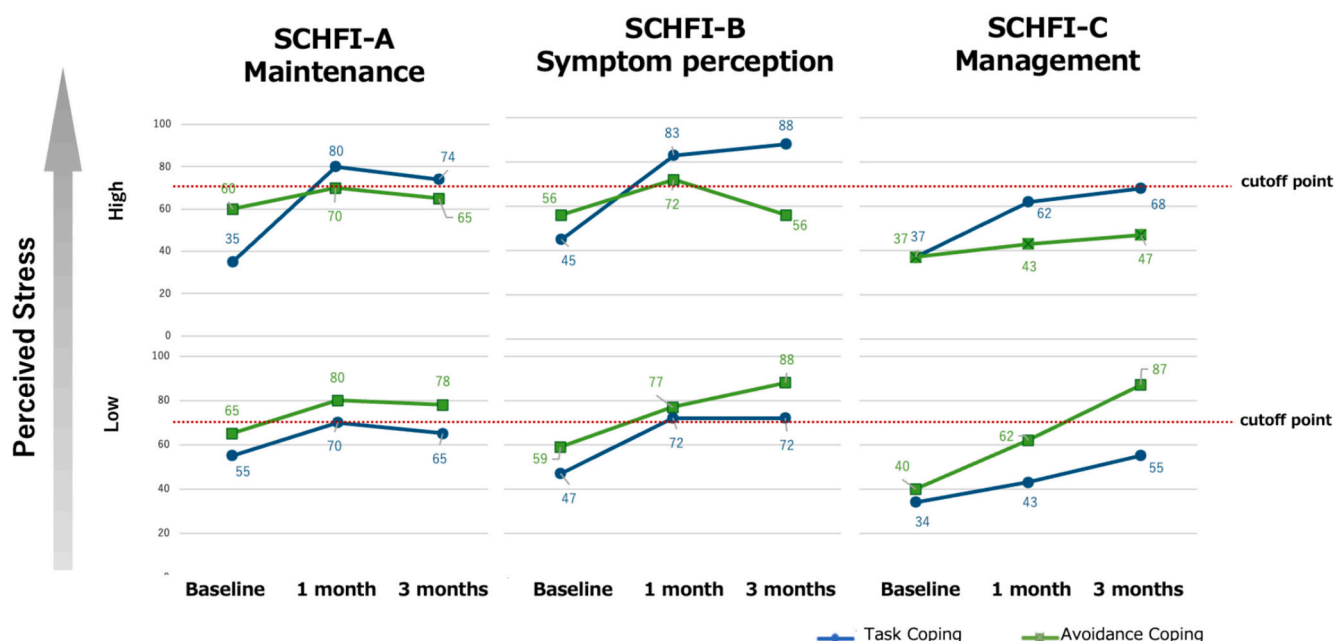


Fig. 2. SCHFI over time categorized by the intensity of stress.

Perceived stress levels: Defined by PSS-10 scores, with 0–13 points indicating low stress levels and 27–40 points indicating high stress levels. Line graphs of the median values of SCHFI over time for each coping type, categorized by the intensity of stress.

outcomes and self-care behaviors. We found that avoidance coping was linked to a higher risk of adverse events and reduced self-care, emphasizing the need for targeted interventions. For instance: (1) task-oriented coping could benefit from problem-solving techniques and structured disease management with clear goals; (2) emotion-oriented coping may improve with emotional regulation training, such as mindfulness or relaxation techniques; and (3) avoidance coping could be addressed through group therapy or cognitive-behavioral strategies to reduce avoidance behaviors and enhance engagement. Helping HF patients balance these coping strategies may improve their ability to manage stress.

LIMITATIONS.

Despite the valuable insights gained from this study, several study limitations should be noted. First, the present study sample consisted only of participants who provided consent to participate, potentially biasing the results towards individuals who were more compliant or motivated to engage in self-care practices. Second, the study was conducted in a specific setting and may not fully represent the diverse population of patients with HF. Including a more diverse sample from multiple healthcare settings would enhance the generalizability of the findings. Additionally, while the present study defined the level of stress during hospitalization as perceived stress, we did not account for stress arising from life events unrelated to the illness. Third, the relatively small sample size may limit the study's generalizability. Although the chi-square test for homogeneity showed no significant differences across coping style groups ($p = 0.32$), the limited sample size may have reduced statistical power to detect subtle imbalances. Finally, while we adjusted for several factors in the analyses, not all relevant factors could be accounted for. For example, variables such as medication adherence, socioeconomic status, and coexisting psychological conditions were not included in the analysis.

In spite of these several study limitations, this study provides important insights into the role of stress coping in the self-care and prognosis of patients with HF. Addressing these limitations in future research will strengthen our understanding of effective interventions and improve outcomes for patients with HF.

5. Conclusions

Avoidance coping was associated with an increased risk of adverse events and lower engagement in self-care activities in patients with HF. These findings highlight the importance of understanding coping styles in the design of targeted interventions to improve self-care and outcomes in HF. Further research is needed to validate tailored intervention programs based on each patient's coping style, with the potential to reduce readmissions and enhance quality of life for HF patients.

CRedit authorship contribution statement

Yu Shimode: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Takeshi Kitai:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Kentaro Iwata:** Writing – review & editing, Supervision, Methodology, Investigation. **Ryosuke Murai:** Writing – review & editing, Supervision. **Chisato Miyakoshi:** Writing – review & editing, Supervision. **Sachiko Izawa:** Writing – review & editing, Supervision. **Yutaka Furukawa:** Writing – review & editing, Supervision. **Nobuo Kohara:** Writing – review & editing, Supervision. **Hiroyuki Inadomi:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Data availability

Raw data were generated at Kobe City Medical Center General Hospital, Kobe, Japan. Derived data supporting the findings of this study are available from the corresponding author Takeshi Kitai on request.

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