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Perceived Control Predicts Symptom Status in Patients with Heart Failure

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Abstract

Background: Symptom status is an important indicator of disease progression in patients with heart failure (HF). Perceived control is a target of most self-care interventions and is associated with better outcomes in HF; however, little is known about the relationship between perceived control and symptom status in patients with HF.

Objective: To (1) determine the relationship of perceived control to HF symptom status, and (2) examine the associations of perceived control to self-care, and of self-care to symptom status.

Methods: A total of 115 patients with HF were included. Data on symptom status (Memorial Symptom Assessment Scale-HF), perceived control (Control Attitudes Scale-Revised), and self-care (Self-Care of Heart Failure Index) were collected. Other covariates included were age, gender, New York Heart Association (NYHA) class, comorbidity burden, and depressive symptoms. Multiple regression analyses were performed to analyze the data.

Results: Lower perceived control predicted worse symptom status after controlling for covariates ($p = 0.009$). Other covariates predictive of worse symptom status were younger age, NYHA class

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III/IV, and higher levels of depressive symptoms. Higher levels of perceived control were associated with better self-care ($p = 0.044$). Better self-care was associated with better symptom status ($p = 0.038$).

Conclusions: Lower levels of perceived control were independently associated with worse symptom status in patients with HF. Intervention strategies targeting perceived control should be tested to determine if they could improve symptom status.

Keywords

heart failure; perceived control; self-care; symptom status

Introduction

Heart failure (HF) is a chronic, symptom-driven condition. More than 30 physical and psychological symptoms have been reported in HF.^{1–5} The typical physical symptoms of HF include dyspnea, edema, sudden weight gain, and fatigue.^{6,7} Patients with worse HF symptom status have reduced quality of life, more hospital readmissions, and increased mortality.^{5–9} As a result, improving symptom status for patients with HF is important in order to reduce suffering and improve health outcomes.

Perceived control is a modifiable construct and it can be enhanced to improve health behaviors, including self-care, and thus improve health outcomes. Perceived control refers to an individual's belief that he or she has the ability to cope with negative events (for example, a diagnosis of HF) and bring about positive outcomes, such as improved symptom status. Patients' perceptions of control are at the root of good self-care because patients with higher levels of perceived control are more likely to fully engage in education and skill-learning opportunities that prepare them to better manage their health.¹⁰ Indeed, promotion of control over a negative diagnosis is at the heart of most education and counseling interventions. It is theorized that patients with higher levels of perceived control will engage in better self-care, which includes optimal symptom management and adherence to medications and diet, and thus have better symptom status than those who do not.^{11,12}

Patients' perceptions of control are predictive of physical and psychological health.^{13–15} In a study of patients with asthma, greater perceived control was related to lower asthma severity, fewer depressive symptoms, better physical health status, better asthma-specific quality of life, and decreased the likelihood of emergency department visits and hospitalizations.¹⁶ Yet, lower levels of perceived control are common in patients with HF and have been shown to have an adverse impact on patients' health-related quality of life.^{17,18} Higher levels of perceived control have been associated with reduced symptoms and complications in patients with coronary artery disease;¹⁴ however, little is known about the relationship between perceived control and symptom status in patients with HF.

Perceived control is changeable and foundational to most education and counseling, and self-care interventions.¹⁰ Determining the association of perceived control to symptom status could provide vital information for developing interventions. Therefore, the primary aim of this study was to determine whether perceived control independently predicted HF

symptom status. In determining the independent association of perceived control with symptom status, we controlled for variables known to be associated with symptom status including age, gender, New York Heart Association (NYHA) functional class, comorbidity burden, and depressive symptoms.^{19–21} A second aim was to determine the associations of perceived control to self-care, and of self-care to symptom status. Based on theories of perceived control,²² which is derived from locus of control theory, we hypothesized that patients with HF who had higher levels of perceived control would have better symptom status than those who had lower levels of perceived control.

Methods

Design, Sample, and Setting

In this study, we used baseline data from a prospective, longitudinal study designed to test the effects of a 6-month nutrition intervention on HF symptoms, health-related quality of life, and clinical outcomes.²³ All patients in the parent study (n = 115) were included in this cross-sectional secondary analysis. Patients were recruited from outpatient clinics or hospitals in Kentucky. Adult patients who were able to read and speak English and who were diagnosed with chronic HF of NYHA functional class of II, III or IV were considered eligible. Patients were excluded from the parent study if they (1) had a body mass index [BMI] < 17 or > 46kg/m², (2) had a co-existing illness associated with systemic inflammation, (3) had decreased appetite or gastrointestinal absorption, (4) were taking dietary supplements that contained lycopene or omega-3 fatty acids, (5) were allergic to rice bran oil, (6) were referred for heart transplantation, or (7) had cognitive impairments.

Procedure

The University of Kentucky Institutional Review Board approved the study. Eligibility of patients was verified by a trained research nurse. Patients who agreed to participate in the study gave informed consent and signed the consent form. After receiving consent, patients were screened for cognitive function using the Montreal Cognitive Assessment (MOCA).²⁴ Patients with MOCA scores of 16 or below were excluded from the study.

Measures

Symptom Status—Symptom status was measured using the Memorial Symptom Assessment Scale-HF (MSAS-HF), which is a 32-item questionnaire modified from the Memorial Symptom Assessment Scale.^{25,26} The MSAS-HF contains three subscales that reflect physical, psychological, and HF-specific symptoms. Each item of the MSAS-HF consists of four domains: (1) presence or absence of the symptom (rated yes or no), (2) frequency of the symptom (rated 1 = rarely to 5 = all the time), (3) severity of the symptom (rated 1 = mild to 5 = extremely), and (4) distress associated with the symptom (rated 1 = a little bit to 5 = extremely). Symptom status scores are derived from the sum of each of the subscales of symptom prevalence, symptom frequency, symptom severity, and symptom distress. Total scores of MSAS-HF can range from 0 to 512, with higher scores indicating worse symptom status. The validity and reliability of this scale have been reported in HF patients.²⁶

Perceived Control—Perceived control was measured with the Control Attitudes Scale-Revised (CAS-R), which is an 8-item questionnaire with good reliability and validity in cardiac patients, including those with HF.²⁷ Each item is rated on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Examples of items include: “I can do a lot of things myself to cope with my heart condition”, and “I have considerable ability to control my symptoms”. The scores range from 8 to 40, with high scores reflecting greater perceived control.

Heart Failure Self-Care—Self-care was evaluated by the Self-Care of Heart Failure Index (SCHFI) which has 22 items with well-supported reliability and validity in HF studies.²⁸ The SCHFI contains three subscales that consist of 11-items for self-care maintenance, five-items for self-care management, and six-items for self-care confidence. Self-care maintenance is the process of maintaining physiologic stability, which includes symptom monitoring and treatment adherence. Self-care management is the process of responding to symptoms and treatments, which involves symptom recognition, symptom evaluation, treatment implementation, and treatment evaluation. Self-care confidence reflects an individual’s confidence in their ability to engage in self-care. The HF self-care subscales are scored separately or self-care maintenance and self-care management are summed to produce a total score. Self-care confidence is not included in the HF self-care total score because self-care confidence has been identified as a mediator or a moderator of self-care behaviors.²⁹ In this study, we used the self-care confidence subscale score and the total self-care score composed of self-care maintenance and self-care management. Responses on each item are measured on a four-point Likert scale from 1 to 4. Scores of each subscale are calculated separately by summing each item in each subscale and transforming to a 100-point scale, with higher scores meaning better self-care maintenance, self-care management, or self-care confidence. Scores of less than 70 reflect inadequate self-care.³⁰

Depressive Symptoms—Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 consists of nine items that are based on the criteria for diagnosing clinical depression and that are rated by patients using a Likert scale response (0: not at all to 3: nearly every day). Total scores of PHQ-9 can range from 0 to 27 with a score of 10 or higher indicating moderate to severe depression.³¹ This questionnaire has well-documented reliability and validity in patients with HF.³²

Comorbidity Burden—Comorbidity burden was measured from patient interview and medical record review using the Charlson Comorbidity Index (CCI).³³ The CCI consists of 19 comorbid illness and each comorbid illness is assigned a different weight of 1, 2, 3 or 6 depending on illness seriousness. The scores of CCI can range from 0 to 37 with higher scores indicating higher comorbidity burden and representing an increased risk of death within one year.³³ The CCI is a valid and reliable measure and has been widely used in previous HF studies.^{34–36}

Demographic and Clinical Characteristics—Demographic characteristics (i.e., age, gender, race/ethnicity, education, and marital status) were collected using a demographic questionnaire. New York Heart Association classification was determined by trained

research assistants via a careful patient interview. Patients were classified into NYHA categories (class I to class IV) based on how much they are limited by experiencing symptoms during physical activity.³⁷ The NYHA functional class is the most commonly used classification system in HF.³⁸

Data Analyses

Statistical analyses were conducted using IBM SPSS software version 26. To assess our first aim, a multiple regression analysis was conducted to determine whether perceived control predicted symptom status after controlling for age, gender, NYHA functional class, total comorbidity scores, and total depressive symptom scores. The outcome variable was the sum scores of two subscales of MSAS-HF (i.e., physical and HF-specific symptoms). The psychological subscale of the MSAS-HF was not included in this analysis because items in the psychological subscale of MSAS-HF overlap with depressive symptoms. Predictors were entered into a regression model in four blocks in the following order: block 1 included age and gender; block 2 was NYHA functional class and comorbidity burden; block 3 was depressive symptoms and block 4 was perceived control. This sequence was used in order to determine the contribution of perceived control after controlling for demographic, clinical, and psychological covariates. To determine whether the symptom descriptors rendered different results from the total score for HF symptom status, multiple linear regression analyses were performed to examine the association between perceived control and the symptom descriptors of prevalence, frequency, severity, and distress after controlling for the same covariates (i.e., age, gender, NYHA functional class, total comorbidity scores, and total depressive symptom scores). To test our second aim, multiple linear regression analyses were performed to examine the associations of perceived control to self-care, and of self-care to symptom status after controlling for age, gender, NYHA functional class, and total comorbidity scores. The assumptions of linear regression modeling including independence of the errors, linearity of the relationship between predictor variables and dependent variable, homoscedasticity of residuals, multicollinearity, and normality of the error distribution were checked, with no violations observed.

Results

Sample Characteristics

Sample characteristics are outlined in Table 1. The mean age of patients was 63 ± 12 years. The majority of patients were men (60%), Caucasian (70%), had at least a high school education (89%), and were classified in NYHA functional class III and IV (65%). The mean score of the PHQ-9 was $6.1 (\pm 5.0 \text{ SD})$ and 24.3% of patients had a PHQ-9 score of 10 or greater reflecting moderate to severe depressive symptoms (Table 1). The mean score of CAS-R for perceived control was $29.7 (\pm 3.8 \text{ SD})$; range from 19 to 39, reflecting relatively higher levels of perceived control.²⁷ The mean scores for self-care maintenance, management, and confidence were $61.3 (\pm 20.5 \text{ SD})$, $63.5 (\pm 19.9 \text{ SD})$, and $60.4 (\pm 15.6 \text{ SD})$ respectively, revealing inadequate self-care in HF. The average number of symptoms that patients had was 9.1 ± 5.9 (range 0–28) demonstrating a wide variety of symptoms experienced. Highly prevalent symptoms included shortness of breath (68.7%), lack of

energy (64.3%), difficulty sleeping (52.2%), feeling drowsy (47%), and swelling of arms and legs (46.1%).

Prediction of HF Symptom Status

Table 2 shows the results of multiple regression analysis predicting HF symptom status from age, gender, NYHA functional class, total comorbidity scores, depressive symptom scores, and perceived control scores. Each block of the model was significant, as was the overall regression model ($p < 0.001$). The R^2 in the final model was 0.547 (adjusted $R^2 = 0.522$), indicating that approximately 52% of the variance in HF symptom status was explained by these predictors. Perceived control was an independent predictor of symptom status after adjusting for covariates ($p = 0.009$). Lower perceived control predicted worse symptom status. Every one-point increase in perceived control scores was associated with a 2.6-point decrease in the symptom status scores while other covariates were held constant.

Other predictive covariates were age, NYHA functional class, and depressive symptoms. When compared to older patients, younger patients had worse symptom status ($p = 0.015$). When compared to NYHA functional class II, NYHA functional class III and IV had worse symptom status ($p = 0.021$). Having greater depressive symptoms was predictive of worse symptom status ($p < 0.001$).

Perceived control was an independent predictor of the symptom frequency, severity, and distress (not shown in tables). Lower levels of perceived control were associated with greater symptom frequency ($F[6,105] = 16.608$, $R^2 = 0.487$, unstandardized $B = -0.741$, standard error (SE) = 0.316, $p = 0.021$), as well as greater severity ($F[6,105] = 19.540$, $R^2 = 0.528$, unstandardized $B = -0.921$, SE = 0.306, $p = 0.003$), and greater distress ($F[6,105] = 20.690$, $R^2 = 0.542$, unstandardized $B = -0.904$, SE = 0.318, $p = 0.005$). Perceived control was not a significant predictor of symptom prevalence ($F[6,108] = 16.077$, $R^2 = 0.472$, unstandardized $B = -0.172$, SE = 0.095, $p = 0.074$).

Associations of Perceived Control, Self-Care, and Symptom Status

Perceived control was predictive of HF self-care confidence and HF self-care after controlling for covariates (Table 3). Higher levels of perceived control were related to better HF self-care confidence and HF self-care.

Heart failure self-care confidence and HF self-care were predictive of symptom status after controlling for covariates (Table 4). Both HF self-care confidence and HF self-care were negatively associated with symptom status, indicating that better HF self-care confidence and HF self-care were related to better symptom status.

Discussion

Results of this study suggest the importance of perceived control to symptom perception and expression. We found that lower levels of perceived control independently predicted total symptom status score as well as the symptom descriptors of frequency, severity, and distress from HF symptoms. Additionally, higher levels of perceived control were associated with better self-care and better self-care was associated with better symptom status. These data

support the theoretical framework whereby perceived control is thought to improve engagement in self-care, thus resulting in improvement in symptom status.¹⁰

Given our findings, intervention strategies focused on enhancing the perception of control over symptoms may be essential to improve symptom status. Perceived control is a modifiable factor and may be increased with education and counseling that promotes self-care ability, increases confidence, and improves self-management behavior. For example, Hwang et al. found that perceived control was a significant determinant of self-care in HF.¹¹ Westlake et al. found an improvement in perceived control after a 3-month web-based HF and symptom management education.³⁹ Evangelista et al. reported that interventions enhancing perceived control, patient activation, and disease management increased HF patients' confidence to actively engage in self-management of their condition to control their symptoms.⁴⁰

Moreover, perceived control is a key element to reduce emotional stress (i.e., anxiety and depression).¹³ In patients with HF and other cardiac illnesses, patients with higher levels of perceived control had less depression.^{15,27} Perceived control also plays a vital role in decreasing symptom distress and severity.¹⁶ In an HF study of patients receiving palliative care, greater improvement in perceived control was associated with greater reductions in symptom distress.⁴⁰ Among post-cardiac surgery HF patients, both perceived control and depression improved by three months after receiving psychoeducational interventions.⁴¹ Accordingly, evidence suggests that patients' perception of control could be increased by means of interventions that strengthen patients' confidence and ability to cope with illness and adverse situations. Additional strategies, such as supportive interventions for depression which is also a significant predictor of symptom status, may enhance the effect of improving symptom status in patients with HF.

In addition to predicting HF symptom status, perceived control also predicted self-care suggesting that perceived control could be targeted in interventions to enhance patients' engagement in appropriate HF self-care. Other researchers have found that greater perceived control was related to better self-care behaviors in patients with HF.¹² Another HF study revealed a significant association between health literacy and self-care among patients with greater perceived control.⁴² Evidence suggests that as patients gain confidence in their ability to control their illness, their self-care engagement and performance are enhanced. Moreover, self-care is essential in helping patients to prevent HF exacerbations. Self-care interventions, which target improvement of patients' knowledge, ability, adherence, and confidence in maintaining health and managing illness, reduce hospital readmissions and all-cause mortality, as well as improvement in quality of life in patients with HF.^{43,44} Consequently, our findings that perceived control, self-care, and symptom status are related suggest future research to determine whether self-care is a mediator or moderator between perceived control and symptom status.

Our findings that covariates in our model including age, NYHA functional class, and depressive symptoms were predictors of symptom status were consistent with previous studies. Park and colleagues reported that HF physical and psychological distress were significantly influenced by age and comorbidities.²¹ In a study of HF symptom clusters,

older patients experienced more symptom occurrence.¹⁹ Evidence from one study indicated that NYHA class III and IV patients with HF experienced higher distress from physical symptoms than did NYHA class I and II patients.²⁰ Furthermore, prior investigators have demonstrated that depression was associated with symptom status in patients with HF, showing that patients who had more severe depression experienced more physical symptoms and higher symptom burden.^{9,45} More importantly, the major finding in the present study revealed that perceived control significantly predicted symptom status in the company of these covariates, which supported the association we hypothesized.

Limitations

There are some limitations that should be noted in this study. First, our sample in this study was primarily white, most had at least a high school education, and the sample was recruited from one southern state in the United States, which limited generalizability. Second, this was a secondary analysis study so variables (such as HF etiology or ejection fraction) that were not collected in the primary study were not included in our statistical analyses. Third, we only used baseline data in this study, our findings were cross-sectional and causality cannot be inferred. Future studies are recommended to examine how perceived control and symptom status may change over time, especially after implementation of interventions to increase perceived control. Our findings, along with previous research demonstrating that interventions can improve perceived control and health status,⁴⁶ suggest that enhancing perceived control may improve symptom status in patients with HF.

Conclusions

This study demonstrates that greater perceived control in patients with HF is associated with better HF symptom status. Even in the presence of depressive symptoms, a known, major predictor of worse symptom status, lower perceived control independently predicts worse symptom status. Moreover, higher perceived control predicted better self-care suggesting a pathway whereby perceived control may improve symptom status. Thus, interventions need to be tested that enhance patients' perceptions of control in order to improve self-care and symptom status in this patient population.

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Table 1.

Sample Characteristics (N=115)

Characteristics	Mean ± SD or n (%)
Age, year	63 ± 12
Gender (male)	69 (60.0)
Ethnicity (Caucasian)	80 (69.6)
Education high school	102 (88.7)
Married / Cohabitating	57 (49.6)
NYHA class, III/IV	75 (65.2)
Charlson Comorbidity Index score	3.3 ± 1.8
Depressive symptom score (PHQ-9)	6.1 ± 5.0
Perceived control score (CAS-R)	29.7 ± 3.8
Self-care maintenance score (SCHFI)	61.3 ± 20.5
Self-care management score (SCHFI)	63.5 ± 19.9
Self-care confidence score (SCHFI)	60.4 ± 15.6
Symptom status score (MSAS-HF)	85.3 ± 65.6

CAS-R= Control Attitudes Scale-Revised; HF= heart failure; MSAS-HF= Memorial Symptom Assessment Scale-Heart Failure; NYHA= New York Heart Association; PHQ-9= Patient Health Questionnaire-9; SCHFI= Self-Care of Heart Failure Index

Table 2.
Multiple Regression Analysis of Predictors of Heart Failure Symptom Status (N=115)

Variable	B	SE	B	p-value	R ²	Adjusted R ²	F statistic	p-value
Step 1								
Age	-1.434	0.413		0.001	0.119	0.104	F(2,112) = 7.594	0.001
Gender (female)	21.613	9.744	0.198	0.029				
Step 2								
Age	-1.532	0.382	-0.332	< 0.001	0.264	0.237	F(4,110) = 9.857	< 0.001
Gender (female)	12.545	9.439	0.115	0.187				
NYHA class (III/IV)	34.192	9.840	0.305	0.001				
Comorbidity	5.649	2.496	0.190	0.026				
Step 3								
Age	-0.830	0.324	-0.180	0.012	0.517	0.495	F(5,109) = 23.374	< 0.001
Gender (female)	11.806	7.678	0.108	0.127				
NYHA class (III/IV)	19.825	8.226	0.177	0.018				
Comorbidity	3.906	2.043	0.131	0.059				
Depression	5.813	0.768	0.544	< 0.001				
Step 4								
Age	-0.781	0.316	-0.169	0.015	0.547	0.522	F(6,108) = 21.754	< 0.001
Gender (female)	12.206	7.473	0.112	0.105				
NYHA class (III/IV)	18.829	8.013	0.168	0.021				
Comorbidity	3.563	1.992	0.120	0.077				
Depression	5.121	0.791	0.479	< 0.001				
Perceived control	-2.628	0.986	-0.188	0.009				

NYHA= New York Heart Association; B= unstandardized coefficient; B= standardized coefficient; SE= standard error

Multiple Regression Analyses of Prediction of Self-care Confidence and Self-care by Perceived Control (N=115)

Table 3.

Variable	Self-care confidence			HF Self-care (maintenance and management)		
	B	SE	p-value	B	SE	p-value
Age	-0.088	0.126	0.487	0.087	0.300	0.031
Gender (female)	-1.588	3.073	0.606	2.413	7.254	0.036
NYHA class (III/IV)	-1.706	3.227	0.598	5.766	8.212	0.079
Comorbidity	-0.235	-0.027	0.774	0.953	1.994	0.634
Perceived control	1.144	0.383	0.003	1.820	0.890	0.044
Model summary	$R^2 = 0.092$, adj. $R^2 = 0.051$, $F(5,109) = 2.222$, $p = 0.057$			$R^2 = 0.059$, adj. $R^2 = 0.005$, $F(5,87) = 1.090$, $p = 0.372$		

HF= heart failure; NYHA= New York Heart Association; B= unstandardized coefficient; B= standardized coefficient; SE= standard error

Table 4

Multiple Regression Analyses of Prediction of Symptom Status (Total Score) by Self-care Confidence and Self-care (N=115)

Variable	Symptom status				Symptom status			
	<i>B</i>	<i>SE</i>	<i>B</i>	<i>p-value</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>p-value</i>
Age	-1.899	0.467	-0.336	< 0.001	-1.646	0.528	-0.291	0.002
Gender (female)	14.656	11.565	0.110	0.208	9.922	12.896	0.074	0.444
NYHA class (III/IV)	34.854	12.087	0.254	0.005	36.625	14.523	0.250	0.013
Comorbidity	6.288	3.060	0.173	0.042	9.942	3.533	0.268	0.006
Self-care confidence	-0.748	0.346	-0.178	< 0.033	—	—	—	—
HF Self-care (maintenance and management)	—	—	—	—	-0.393	0.186	-0.195	0.038
Model summary	$R^2 = 0.270$, adj. $R^2 = 0.236$, $F(5, 109) = 8.043$, $p = < 0.001$				$R^2 = 0.267$, adj. $R^2 = 0.225$, $F(5, 87) = 6.327$, $p = < 0.001$			

HF= heart failure; NYHA= New York Heart Association; *B*= unstandardized coefficient; *B*= standardized coefficient; *SE*= standard error