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Perceived Health Competence Predicts Health Behavior and Health-Related Quality of Life in Patients with Cardiovascular Disease

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Abstract

Objective—Evaluate the effect of perceived health competence, a patient's belief in his or her ability to achieve health-related goals, on health behavior and health-related quality of life.

Methods—We analyzed 2063 patients hospitalized with acute coronary syndrome and/or congestive heart failure at a large academic hospital in the United States. Multivariable linear regression models investigated associations between the two-item perceived health competence scale (PHCS-2) and positive health behaviors such as medication adherence and exercise (Health Behavior Index) as well as health-related quality of life (5-item Patient Reported Outcome Information Measurement System Global Health Scale).

Results—After multivariable adjustment, perceived health competence was highly associated with health behaviors ($p < 0.001$) and health-related quality of life ($p < 0.001$). Low perceived health competence was associated with a decrease in health-related quality of life between hospitalization and 90 days after discharge ($p < 0.001$).

Conclusions—Perceived health competence predicts health behavior and health-related quality of life in patients hospitalized with cardiovascular disease as well as change in health-related quality of life after discharge.

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Practice implications—Patients with low perceived health competence may be at risk for a decline in health-related quality of life after hospitalization and thus a potential target for counseling and other behavioral interventions.

1. Introduction

Since its introduction by Bandura almost 40 years ago, self-efficacy has proven to be one of the most important psychological constructs, particularly because of its demonstrated relationship to a wide range of behaviors and outcomes[1]. A measure of a related construct, the Perceived Health Competence Scale (PHCS), was developed to be specific to the health domain but not to any particular health behavior[2, 3]. The generalized construct measured by that scale was called “perceived health competence” instead of “health self-efficacy” in order to acknowledge Bandura’s assertion that the term “self-efficacy” is best applied to specific behaviors in specific situations. Theoretically, context-specific measures of attitudes are optimal for predicting specific behaviors and outcomes while broader, more general measures are better for predicting general patterns of behavior and outcomes[4, 5]. Therefore, the PHCS is well-suited to studying an index of self-reported health behaviors and summative measures of health-related quality of life.

The PHCS has been administered to diverse types of patients[2, 6–13] as well as generally healthy sub-populations in the United States and other countries[14–19]. These studies have confirmed that the PHCS is associated with a number of health outcomes such as better health status, lower depressive symptoms, and better quality of life[9, 20–24]. Additionally, the PHCS has been shown to correlate with health behaviors including increased exercise, better dietary habits, decreased smoking and drinking, and increased health information seeking behavior[2, 6, 12, 25]. Finally, higher perceived health competence has been associated with increased confidence in healthcare providers and social support[10, 26]. Overall, the evidence suggests that the PHCS is valid in a variety of populations and is associated with a variety of health outcomes, health behaviors, and psychosocial measures.

The purpose of these analyses is to examine the contributions of perceived health competence on self-reported health behavior and health-related quality of life in patients with cardiovascular disease while controlling for clinical and psychosocial factors. We hypothesize that perceived health competence is positively related to engaging in health behavior and also to reporting better health-related quality of life after adjusting for other predictors.

2. Methods

2.1. Study design and participants

The Vanderbilt Inpatient Cohort Study (VICS) is a prospective cohort study of patients with cardiovascular disease admitted to Vanderbilt University Hospital (VUH) in Nashville, Tennessee[27]. Inclusion criteria consisted of a likely diagnosis of acute coronary syndrome (ACS) and/or acute decompensated heart failure as determined by medical record review conducted by a physician. Exclusion criteria were severe cognitive impairment, altered mental status, unstable psychiatric illness, inability to communicate in English, age less than

18, or current hospice status. Eligible participants were identified by a physician screening the electronic medical record. These potential participants were visited by VICS study coordinators and offered the opportunity to participate in the study, after which they signed informed consent documents. Study participants were interviewed in the hospital and scheduled for three follow-up calls after discharge. Data were collected using Research Electronic Data Capture (REDCap)[28]. Patients enrolled in VICS between October 2011 and January 2014 were included in this analysis. The study was approved by the Vanderbilt University Institutional Review Board.

2.2. Baseline assessment

Participants completed a series of interviewer-administered baseline measures shortly after being admitted to VUH. Age, gender, educational attainment (highest grade or year of school completed), household income, self-reported race, marital status, and number of hospitalizations in the previous 12 months were collected during this time. Race was dichotomized to “White” versus “non-White.” Marital status was dichotomized to “Living with spouse/partner” versus “Not living with spouse/partner.” Household income was reported using the strata from the Behavioral Risk Factor Surveillance System (BRFSS) questionnaire with additional strata to improve precision[29].

Perceived health competence was assessed with two items chosen from the eight-item Perceived Health Competence Scale[3]. The PHCS-2 uses a 5-point Likert response scale ranging from 1 = “strongly disagree” to 5 = “strongly agree.” Because the original PHCS scale was balanced with four positively and four negatively worded items, the PHCS-2 also contains both a positively (“I am able to do things for my health as well as most other people”) and a negatively (“It is difficult for me to find effective solutions for health problems that come my way”) worded item which were correlated -0.38 ($p < 0.001$) with one another in this sample. The negatively worded item was reverse-coded before summing it with the positively worded item to produce a summed scale that could range from 2 to 10. The higher the PHCS-2 score, the greater the patient’s perceived health competence.

Perceived social support was assessed using six items from the ENRICH Social Support Inventory (ESSI)[30]. Participants were asked questions about emotional and instrumental support and each question had a 5-item response scale. The ESSI score is reported as a continuous score ranging from 6 to 30, where higher scores indicate more perceived social support. Cronbach’s alpha for the ESSI-6 in this sample was 0.85.

Depressive symptoms during the two weeks prior to hospitalization were captured with the Patient Health Questionnaire-8 (PHQ-8)[31]. The 8-items are summed, and the PHQ-8 score ranges from 0 to 24 with higher scores indicating more severe depressive symptoms. Cronbach’s alpha at baseline in this sample was 0.81. Religiosity was assessed with an index consisting of four items: “How religious (or spiritually-oriented) do you consider yourself to be;” “How much do you agree or disagree with the following statement: ‘My whole approach to life is based on my religion;’” “How often do you attend religious services or related activities;” and “How often do you spend time by yourself in religious or spiritual activities, such as prayer, meditation, or reading religious books?” The Cronbach’s alpha for the index in this sample was 0.80, and participants indicating an affiliation with an organized

religion (88.5% of the sample) scored significantly higher on this measure of religiosity than those who were non-affiliated ($p<0.001$).

Health-related quality of life was measured using the first five questions from the Patient-Reported Outcome Measurement Information System Global Health Scale (GHS-5) that address physical, mental, and social health status as well as quality of life using a 5-item response instrument[32]. In our sample, this set of five items is both unidimensional and internally consistent with a Cronbach's alpha of 0.83. The mean of all five items was calculated, with higher scores indicating better global health status or health-related quality of life. The GHS-5 scale was administered at baseline as well as 90 days after discharge.

Health behavior was assessed with an index covering six domains: medication adherence; resilient coping; smoking, alcohol consumption, diet, and exercise. Each domain received a score from "0" (indicating the absence of desirable behavior) to "2" (indicating a highly desirable level of the behavior). Patients' adherence to their pre-admission medication regimen was assessed with 7 items from the Adherence to Refills and Medications Scale (ARMS-7)[33]. For the purpose of constructing the Health Behavior Index (HBI), ARMS-7 scores were transformed to range from 0 to 21 and were divided by 10.5 to create a continuous value ranging from 0 to 2, with higher scores indicating more medication adherence. Resilient coping was assessed by the 4-item Brief Resilient Coping Scale (BRCS)[11]. The BRCS is a measure of the ability to positively adapt to significant stressors and was originally validated in patients with rheumatoid arthritis[11]. For the purpose of constructing the HBI, BRCS scores were transformed to range from 0 to 16 and were divided by 8 to create a continuous value that could range from 0 to 2, with higher scores indicating beliefs and actions consistent with the ability to rebound from or positively adapt to significant stressors. The other health behaviors were measured using the Behavioral Risk Factor Surveillance System (BRFSS) questionnaire, the Starting the Conversation (STC) scale and the Exercise Vital Sign questions[34]. Current smokers were coded "0" while non-smokers were coded "2." Excessive consumers of alcohol were coded "0," abstainers were coded "1," and moderate drinkers were coded "2." Diet was coded as the sum of responses to three questions from the STC scale. The sum was recoded to range from 0 to 6, then divided by 3 to create a continuous value ranging from 0 to 2 with higher scores reflecting better diet. Exercise was assessed by the product of two variables—the number of days per week (0 to 7) and the average number of minutes per day of exercise. This cross-product was categorized as follows: zero was coded "0;" 1 – 149 was coded "1;" and ≥ 150 was coded "2." The resultant HBI was the sum of the six subdomain scores and could range from 0 to 12, with higher scores signifying a healthier lifestyle.

2.3. Follow-up assessment

Follow-up surveys were conducted by phone within one week of discharge, 30 days after discharge and 90 days after discharge. During the 30 and 90 day calls, patients were administered the GHS-5. There was an overall completion rate of 86% across all follow-up calls.

2.4. Statistical analysis

To describe our patient sample we summarized categorical variables with percentages and continuous variables with percentiles (i.e. 10th, 50th, 90th). To examine the unadjusted marginal relationships between patient characteristics and the PHCS-2, we used Wilcoxon rank-sum tests for categorical variables and Spearman's rho for continuous variables.

In the primary analyses we used multivariable linear regression models to examine the independent associations between the pre-specified predictor set, including the PHCS-2, for the Health Behavior Index and the GHS-5 measure of health-related quality of life. We fit three models: a baseline Health Behavior Index outcome model, a baseline GHS-5 outcome model, and a 90-Day GHS-5 outcome model adjusting for the baseline GHS-5 scores. In the latter two models we also adjusted for Health Behavior Index scores. Each model examined the association with the PHCS-2 while controlling for demographic, psychosocial, and behavioral measures. Continuous variable functional forms were initially fit as linear effects for ease of interpretation. However, with strong evidence of a non-linear covariate effect (p-value<0.001 for the overall non-linear effect test) across the multivariable models, each continuous variable effect was permitted to be flexible using restricted cubic splines with four knots. This form of spline uses cubic terms in the center of the data and restricts the outer line segments, preventing distortion due to non-linearity[35]. This relationship was most evident in the baseline GHS-5 model, where the effect for age when entered as a linear effect was non-significant (p-value= 0.146). However, with increased flexibility in the functional form using splines, the effect for age resulted in a u-shaped form and was associated with a p-value less than 0.001. Appendices A, B and C detail individual non-linear covariate effects derived from the fully adjusted models for the HBI, baseline GHS-5 and 90-day GHS-5 respectively. As with the primary analyses, all continuous variables are modeled using flexible, non-linear restricted cubic spline functions. The associated regression parameter estimates are interpreted as the expected change in the outcome per unit change in each covariate. All analyses were conducted in R version 3.1.2[36].

3. Results

The Table displays descriptive statistics for the sample of 2063 patients included in these analyses, as well as the unadjusted associations between the predictor variables and the three criterion variables (the HBI and baseline GHS-5 scores as well as GHS-5 scores assessed 90 days post-discharge). The modal participant in this study was a White male, married or living with a partner, who was hospitalized for acute coronary syndrome. With the exception of the relationship between a patient's diagnosis and the index of health behavior, all of the unadjusted associations shown in the Table are significant (p-value <0.05 for each comparison). Males, Whites, and those patients who were married or partnered reported engaging in more positive health behaviors and rated their health-related quality of life higher than females, non-Whites, and those who were not married or partnered. Patients with heart failure had lower health-related quality of life than patients with acute coronary syndrome at both time periods. The number of hospitalizations in the prior year and depression were both negatively associated with the three criterion measures.

Results from the multivariable linear regression models, capturing adjusted relationships between the PHCS-2 and outcomes, are displayed in Figures 1, 2, and 3, with y-axes depicting the expected change in the HBI (Figure 1) and the GHS-5 measures (Figures 2 and 3) associated with changes in the PHCS-2 while holding all other variables constant. Several of the covariates were highly related to study outcomes.

The PHCS-2 was highly associated with the HBI, the baseline GHS-5 score, and the 90-day post-discharge GHS-5 score ($p < 0.001$ in all cases; Figures 1, 2, and 3, respectively) even after adjusting for covariates. Perceived health competence exhibited a non-linear association with the HBI (Figure 1), with a strong effect at the higher end of the PHCS-2 distribution and a weaker effect at the lower end. For example, the expected change in the HBI associated with a two-point increase from the median PHCS-2 value of 8 was 0.48 (95% CI: 0.29 – 0.68). In contrast, the PHCS-2 association with the baseline GHS-5 score (Figure 2) was relatively linear, with a two-point increase and decrease from the median of 8 being associated with a 0.25 (95% CI: 0.17 – 0.33) and -0.13 (95% CI: -0.20 to -0.06) change in the expected GHS-5 baseline score, respectively. Finally, the PHCS-2 exhibited a non-linear relationship with 90-day follow-up GHS-5 scores (baseline GHS-5 scores are included in this model). In contrast to the association of PHCS-2 with HBI, strongest associations between PHCS-2 and 90-day GHS-5 scores were observed at lower PHCS-2 values. This association was flat at values above the median value of 8. Complete models with all covariate effects are included in appendices A, B and C. These appendices illustrate the expected change of the outcome variables (HBI, baseline GHS-5, and 90-day GHS-5) associated with a concomitant change in each of the predictor variables.

4. Discussion and Conclusion

4.1 Discussion

In this cohort of 2063 patients hospitalized with acute coronary syndrome and/or congestive heart failure, perceived health competence as measured by the PHCS-2 was positively associated with health behaviors (HBI) and health-related quality of life (GHS-5) upon admission as well as health-related quality of life 90 days after discharge. The PHCS-2 exhibited stronger effects on health behaviors at the higher end of its distribution, a relatively linear positive association with health-related quality of life on admission, and stronger associations with changes in health-related quality of life from baseline to 90 days post-discharge at the lower end of its distribution. Our analyses rigorously controlled for clinical, demographic, psychological and social factors.

Prior work has demonstrated that high levels of perceived health competence predict dietary and health information-seeking behaviors[25]. Conversely, breast cancer patients who exhibited the greatest difficulty in accessing information regarding their diagnoses had lower levels of perceived health competence[2]. In addition, perceived health competence is also associated with better patient adherence with renal dialysis[26]. Our study builds upon prior work characterizing this construct in outpatient settings and in other disease conditions by investigating perceived health competence in patients hospitalized with cardiovascular disease.

Hospitalizations represent an inflection point for many patients, with some recovering and even improving in the early post-discharge period while others experience a rapid decline in functional status[37]. The PHCS-2 demonstrated a positive, linear relationship with health-related quality of life both at baseline and 90 days after discharge, even after controlling for the baseline GHS-5 measurement as well as baseline health behavior. This longitudinal analysis suggests that patients with low perceived health competence are at particular risk for a decline in health-related quality of life after discharge. Conversely, patients with high perceived health competence may be best able to utilize the therapies and education provided during a hospitalization to achieve their health-related goals.

Interestingly, the PHCS-2 demonstrated a non-linear association with health behaviors (HBI) in contrast to its linear association with health-related quality of life. The PHCS-2 had a much stronger effect on health behaviors at the higher end of its distribution. These results raise the possibility that there may be a threshold value of perceived health competence before additional gains in this construct are translated to an improvement in health behaviors. In this setting, clinicians might be advised that counseling interventions designed to improve perceived health competence and self-efficacy may not have immediate results. Future work could focus on further defining and characterizing the threshold of perceived health competence necessary to significantly affect health behavior.

Importantly, our analysis controlled for depressive symptoms. Depression, health behaviors and health-related quality of life are tightly interwoven in patients with cardiovascular disease. For example, depressive symptoms are more strongly associated with self-rated health and health-related quality of life than more traditional measures of cardiac function such as ejection fraction and ischemia in patients with coronary artery disease[38]. Moreover, the association between depressive symptoms and adverse cardiovascular events in these patients appears to be mediated by behavioral factors, particularly physical inactivity[39]. Perceived health competence is directly associated with positive health behaviors, and thus represents an important construct that adds to the understanding of psychosocial predictors of adverse outcomes in hospitalized patients especially in the context of depression.

To the extent that that low perceived health competence serves as a predictor of adverse outcomes in patients with cardiovascular disease, it could also serve as a target for therapeutic interventions. Perceived health competence is closely related to self-efficacy, and cardiac rehabilitation programs have proven effective at increasing self-efficacy and a variety of other psychological constructs[40–47]. Cardiovascular patients with low perceived health competence could be encouraged to enroll in outpatient cardiac rehabilitation programs after discharge. Counseling methods could be employed during an inpatient stay to address low perceived health competence. Motivational interviewing, for example, is highly effective at supporting self-efficacy and has been used in a variety of settings in cardiovascular patients, ranging from diabetes care to obesity and smoking[48–52]. The effect of these interventions and others on perceived health competence warrants further investigation.

Several limitations of our study should be noted. First, the previously validated, eight-item PHCS was shortened to the two-item PHCS-2 in the VICS due to the large number of

demographic and psychosocial measures being assessed in the study. As such, we have no data directly characterizing the relationship of the PHCS-2 to the full PHCS for this population, nor is there information on the test-retest reliability of the PHCS-2 in this sample. However, the analyses detailed in this manuscript suggest that the PHCS-2 has convergent validity based upon its association to measures of health behavior and self-reported health status. Furthermore, the fact that baseline PHCS-2 scores were associated with longitudinal change in the GHS-5 measure in addition to static health-related quality of life supports the predictive validity of the PHCS-2. Second, the study population was drawn from a single academic medical center and participants were largely white, male and married. As a result, these findings could have limited generalizability. However, the PHCS as well as the GHS, PHQ-8 and ESSi-6 have been previously validated amongst a wide variety of ages, ethnic backgrounds and internationally[2, 3, 21, 25, 26, 53, 54]. Third, the HBI was developed for the Vanderbilt Inpatient Cohort Study, making use of the specific set of health behaviors assessed in that cohort. Despite the HBI's uniqueness, an index of health behaviors is the most appropriate measure to use as an outcome of a generalized measure such as the PHCS-2. The HBI was predicted by a number of constructs that are antecedents to health behavior (Appendix A) and is positively related to baseline global health status (Appendix B), lending further support for the use of this unique measure.

4.2. Conclusion

Perceived health competence, as measured by the PHCS-2, is associated with positive health behaviors in patients hospitalized with acute coronary syndrome and/or congestive heart failure. The PHCS-2 also predicts health-related quality of life upon admission and the change in quality of life 90 days after discharge. Further research should explore the use of the PHCS-2 in predicting other outcomes in hospitalized patients, as well as the effectiveness of interventions designed to address low levels of perceived health competence.

4.3. Practice Implications

Practicing clinicians should consider the benefits of supporting self-efficacy and perceived health competence in patients hospitalized with cardiovascular disease. Future research should explore the efficacy of cardiac rehabilitation, motivational interviewing and other interventions in attenuating the negative effect of low perceived health competence on post-discharge outcomes.

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Appendix A

Appendix A.

Predictors of positive health behaviors as measured by the Health Behavior Index (HBI) in the Vanderbilt Inpatient Cohort Study. All associations displayed are obtained from the fully adjusted model, and all continuous variables are modeled using flexible, non-linear restricted cubic spline functions. The y-axes for each figure denote the expected change in the HBI. P-values correspond to a 3 degree of freedom test.

Appendix B

Appendix B. Predictors of health-related quality of life at baseline as measured by 5-item Patient Reported Outcome Measurement Information System Global Health Scale (GHS-5) in the Vanderbilt Inpatient Cohort Study. All associations displayed are obtained from the fully adjusted model, and all continuous variables are modeled using flexible, non-linear restricted cubic spline functions. The y-axes for each figure denote the expected change in the GHS-5. P-values correspond to a 3 degree of freedom test.

Appendix C

Appendix C.

Predictors of health-related quality of life 90 days after discharge as measured by 5-item Patient Reported Outcome Measurement Information System Global Health Scale (GHS-5) in the Vanderbilt Inpatient Cohort Study. All associations displayed are obtained from the fully adjusted model, and all continuous variables are modeled using flexible, non-linear restricted cubic spline functions. The y-axes for each figure denote the expected change in the GHS-5. P-values correspond to a 3 degree of freedom test.

Highlights

- Perceived health competence is associated with positive health behaviors.
- Perceived health competence is also associated with quality of life.
- Low health competence predicts a decline in quality of life after discharge.

Figure 1. Multivariable-adjusted association of perceived health competence, measured by the two-item Perceived Health Competence Scale (PHCS-2), with positive health behaviors as measured by the Health Behavior Index (HBI, $p < 0.001$ by 3 degree of freedom test). The non-linear association with HBI is displayed with the solid line and the shaded, 95% confidence interval region. All PHCS-2 values are compared to a reference value of eight.

Figure 2. Multivariable-adjusted association of perceived health competence, measured by the two-item Perceived Health Competence Scale (PHCS-2), with health-related quality of life at baseline as measured by the 5-item Patient Reported Outcome Measurement Information System Global Health Scale (GHS-5, $p < 0.001$ by 3 degree of freedom test). The non-linear association with the baseline GHS-5 is displayed with the solid line and the shaded, 95% confidence interval region. All PHCS-2 values are compared to a reference value of eight.

Figure 3. Multivariable-adjusted association of perceived health competence, measured by the two-item Perceived Health Competence Scale (PHCS-2), with health-related quality of life 90 days after discharge as measured by the 5-item Patient Reported Outcome Measurement Information System Global Health Scale (GHS-5, $p < 0.001$ by 3 degree of freedom test). The non-linear association with the 90-day GHS-5 is displayed with the solid line and the shaded, 95% confidence interval region. All PHCS-2 values are compared to a reference value of eight.

Table

Characteristics of patients in the Vanderbilt Inpatient Cohort Study (VICS), including unadjusted associations with the Health Behavior Index, baseline 5-item Patient Reported Outcome Measurement Information System Global Health Scale (GHS-5) and 90-day GHS-5 (N=2063).

Characteristic	Summary [†]	Health Behavior Index [*]	p-value [±]	Baseline GHS-5 [*]	p-value [±]	90-day GHS-5 [*]	p-value [±]
All	N=2063	8.0 (5.8, 10.1)		3.0 (1.8, 4.0)		3.0 (2.0, 4.2)	
Gender			<0.001		<0.001		<0.001
Male	58% (1197)	8.2 (5.9, 10.2)		3.0 (1.8, 4.2)		3.2 (2.0, 4.2)	
Female	42% (866)	7.8 (5.7, 9.9)		2.8 (1.8, 4.0)		3.0 (1.8, 4.0)	
Race			<0.001		<0.001		0.002
White	83% (1717)	8.1 (5.9, 10.2)		3.0 (1.8, 4.0)		3.2 (2.0, 4.2)	
Non-white	17% (341)	7.8 (5.7, 9.5)		2.8 (1.8, 4.0)		2.8 (2.0, 4.2)	
Marital Status			<0.001		<0.001		<0.001
Not living with spouse	41% (836)	7.8 (5.6, 9.9)		2.8 (1.8, 4.0)		3.0 (1.8, 4.0)	
Living with spouse	59% (1227)	8.2 (6.0, 10.2)		3.0 (2.0, 4.2)		3.2 (2.0, 4.2)	
Heart Failure [†]			0.66		<0.001		<0.001
No	68% (1413)	8.0 (5.6, 10.2)		3.0 (2.0, 4.2)		3.2 (2.0, 4.2)	
Yes	32% (650)	8.0 (6.3, 9.7)		2.6 (1.6, 3.8)		2.8 (1.9, 4.0)	
Age, years	61 (44, 76)	0.22	<0.001	0.14	<0.001	0.07	<0.001
Education, years	13 (11, 18)	0.30	<0.001	0.27	<0.001	0.18	<0.001
Income ²	6 (2, 9)	0.30	<0.001	0.37	<0.001	0.32	<0.001
Social Support ³	27 (19, 30)	0.17	<0.001	0.27	<0.001	0.21	<0.001
Depression ⁴	7 (2, 16)	-0.30	<0.001	-0.54	<0.001	-0.43	<0.001
Perceived health competence ⁵	8 (5, 10)	0.27	<0.001	0.51	<0.001	0.42	<0.001
Hospitalization within 12 months	1 (0, 4)	-0.06	<0.001	-0.36	<0.001	-0.29	<0.001
Religiosity Index ⁶	0.6 (-4.6, 3.4)	0.12	<0.001	0.10	<0.001	0.04	<0.001

[†] Categorical variables are displayed as % (N). Continuous variables are displayed as Median (10th, 90th percentile).

^{*} For categorical variables associations are displayed using medians and percentiles; for continuous variables, associations are displayed using Spearman's rho.

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[±]Wilcoxon test was performed on all categorical variables and Spearman correlation was performed on all continuous variables.

¹Heart Failure indicates a diagnosis of acute decompensated heart failure as adjudicated by a physician chart review.

²Income was characterized as an ordinal variable with a range of 1–9, with 1 denoting annual household income <\$10,000 and 9 indicating \$100,000.

³Social support was assessed using six items from the ENRICHD Social Support Inventory and reported as a continuous score ranging from 6 to 30, with higher scores indicating more perceived social support.

⁴Depressive symptoms were evaluated using the Patient Health Questionnaire 8 and reported as a continuous score ranging from 0 to 24, with higher scores indicating more severe depressive symptoms.

⁵Perceived health competence was measured using two items from the perceived health competence scale and reported as a continuous score ranging from 2 to 10, with higher scores indicating greater perceived health competence.

⁶The Religiosity Index was formed by converting each of the four religiosity questions into z-scores then summing the z-scores across the 4 items. Each separate z-score has a mean of zero.