

Association of Perceived Health Competence With Cardiac Rehabilitation Initiation

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Purpose: Cardiac rehabilitation (CR), a program of supervised exercise and cardiovascular risk management, is widely underutilized. Psychological factors such as perceived health competence, or belief in one's ability to achieve health-related goals, may play a role in CR initiation. The aim of this study was to evaluate the association of perceived health competence with CR initiation among patients hospitalized for acute coronary syndrome (ACS) after adjusting for demographic, clinical, and psychosocial characteristics.

Methods: The Vanderbilt Inpatient Cohort Study (VICS) characterized the effect of psychosocial characteristics on post-discharge outcomes in ACS inpatients hospitalized from 2011 to 2015. The primary outcome for this analysis was participation in an outpatient CR program. The primary predictor was the two-item Perceived Health Competence Scale (PHCS-2), which yields a score from 2 to 10 (higher scores indicate greater perceived health competence). Multiple logistic regression was used to evaluate the relationship between the PHCS-2 and CR initiation.

Results: A total of 1809 VICS participants (median age: 61 yr, 39% female) with ACS were studied, of whom 294 (16%) initiated CR. The PHCS-2 was associated with a higher odds of CR initiation (OR = 1.15/point increase; 95% CI, 1.06-1.26, $P = .001$) after adjusting for covariates. Participants with comorbid heart failure had a lower odds of CR initiation (OR = 0.31; 95% CI, 0.16-0.60, $P < .001$) as did current smokers (OR = 0.64; 95% CI, 0.43-0.96, $P = .030$).

Conclusion: Perceived health competence is associated with outpatient CR initiation in patients hospitalized with ACS. Interventions designed to support perceived health competence may be useful for improving CR participation.

Key Words: cardiac rehabilitation • perceived health competence • self-efficacy

KEY PERSPECTIVE

What is novel?

- Perceived health competence is a psychological construct characterizing belief in one's ability to achieve health-related goals.
- Among patients hospitalized with acute coronary syndrome, perceived health competence is highly associated with participation in outpatient cardiac rehabilitation (CR) programs.

What are the clinical and/or research implications?

- Patients with low perceived health competence are at risk for not enrolling in CR programs.
- Interventions to improve perceived health competence, such as motivational interviewing, may help encourage patients to attend CR.

Cardiac rehabilitation (CR) is a program of supervised exercise, dietary counseling, and cardiovascular risk factor management, which is an important therapy for patients hospitalized with cardiovascular disease. Cardiac rehabilitation decreases rehospitalization and mortality risk,¹ improves quality of life,¹ and is indicated for patients hospitalized with myocardial infarction.² Referral to CR is a quality measure in the American Heart Association's Get With the Guidelines Program.³ Despite improvements in CR referral rates,⁴ <25% of eligible patients initiate CR.⁵ Barriers to CR among referred patients are myriad, ranging from health system–related considerations such as insurance co-pays⁶ to psychosocial factors such as lower perceived health before myocardial infarction and lower

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educational attainment.⁷ Perceived health competence, or belief in one's ability to achieve health-related goals,⁸ is a psychological factor that may affect CR initiation. Perceived health competence is similar to self-efficacy, though self-efficacy was conceived by Bandura as being task-specific⁹ and thus is measured for specific behaviors such as medication adherence. Perceived health competence can be modified by health education and/or coaching¹⁰ and is associated with increased exercise, positive dietary habits, and decreased tobacco consumption.^{11,12} It is plausible that higher perceived health competence may increase motivation to pursue recommended treatments such as CR due to a belief that doing so can prevent adverse outcomes. However, the association between perceived health competence and CR initiation has not been studied. Therefore, we analyzed the relationship between perceived health competence and CR initiation among patients hospitalized with acute coronary syndrome (ACS) in the Vanderbilt Inpatient Cohort Study (VICS). We hypothesized that perceived health competence predicts CR initiation after adjustment for demographic, clinical, and psychosocial characteristics.

METHODS

The VICS is a prospective cohort study of patients with cardiovascular disease admitted to Vanderbilt University Medical Center in Nashville, Tennessee.¹³ The VICS inclusion criteria consisted of a diagnosis of ACS and/or acute decompensated heart failure (HF). Exclusion criteria were altered mental status, severe cognitive impairment, unstable psychiatric illness, age <18 yr, current hospice status, or inability to communicate in English. Eligible participants were identified by a physician conducting an electronic medical record review. Potential participants were offered the opportunity to participate in the VICS by research staff after which informed consent was obtained. Study participants were interviewed during their hospital stay and scheduled for follow-up calls at approximately 3 d, 30 d, and 90 d after discharge. Study outcomes, including CR initiation, were ascertained during these follow-up calls. The initiation of CR was defined as a participant self-report of participating or having participated in an outpatient CR program during any of the three follow-up calls. Prior work demonstrated that the median time between discharge and the first CR session in a group of Medicare beneficiaries was 44 d,¹⁴ indicating that the VICS follow-up calls were likely to capture most participants who participated in CR programs. Patients enrolled in VICS between October 2011 and December 2015 were included in this analysis. The VICS cohort derivation is detailed in prior work.¹³ Patients with an admission diagnosis of HF without ACS were excluded from the present analysis, as HF was not approved as an indication for CR until February 2014.¹⁵ Data were stored using Research Electronic Data Capture (REDCap).¹⁶ The study was approved by the Vanderbilt University Institutional Review Board.

STUDY INSTRUMENTS

Psychosocial variables were obtained from a series of interviewer-administered measures administered shortly after participants were admitted to Vanderbilt University Medical Center. The primary predictor, perceived health competence, was assessed with two items (PHCS-2) chosen from the eight-item Perceived Health Competence Scale (PHCS).⁸ It was necessary to shorten several of the measures, including the PHCS, to keep the baseline interview <45 min.¹³ The PHCS-2 uses a 5-point Likert response scale ranging from 1

("strongly disagree") to 5 ("strongly agree"). The PHCS-2 is balanced with a positively ("I am able to do things for my health as well as most other people") worded item and a negatively ("It is difficult for me to find effective solutions for health problems that come my way") worded item. This structure is consistent with the original PHCS, which had four positively and four negatively worded items. The negatively worded item was reverse-coded before summing it with the positively worded item to produce a scale ranging from 2-10. Higher scores indicate greater perceived health competence.

We selected covariates using prior knowledge regarding their potential effect on CR initiation and perceived health competence. We also employed a VICS conceptual model¹³ relating self-care and health literacy to health outcomes for covariate selection. Clinical factors and comorbidities, including HF, diabetes, body mass index, smoking status, and length of hospitalization, were obtained from the electronic health record. Participant adherence to their preadmission medication regimen, which could potentially be associated with adherence to CR, was assessed with the 7-item Adherence to Refills and Medications Scale (ARMS-7).¹⁷ Scores were transformed to create a continuous value ranging from 0-2, with higher scores indicating more medication adherence. Health literacy, numeracy, and distrust of the health care system were included because of potential effects on participant perceived necessity of CR. Health literacy was assessed using the three-item Brief Health Literacy Screen (BHLS),¹⁸ resulting in a score ranging from 3-15, with higher scores indicating higher subjective health literacy. Resilient coping, or beliefs consistent with the ability to positively adapt to stressors, was measured by the 4-item Brief Resilient Coping Scale (BRCS).¹⁹ The BRCS has a score from 4-20, with higher scores indicating higher resilient coping. Health numeracy was assessed using the 3-item Subjective Numeracy Scale (SNS),²⁰ producing a score from 1-6, with higher scores indicating better subjective numeracy. Distrust of the health care system was assessed using the Revised Health Care System Distrust (HCSD) Scale,²¹ which produces a total score ranging from 9-45, with higher scores indicating higher distrust in the health care system. Perceived social support, associated with CR initiation in prior work,²² was assessed using 6 items from the ENRICH Social Support Inventory (ESSI).²³ These items resulted in a score from 6-30, with higher scores indicating more perceived social support. We also evaluated social support by characterizing home status (living alone, living with a partner, or married). Health-related quality of life, also associated with CR initiation in prior work,¹² was measured using the first five questions from the Patient-Reported Outcome Measurement Information System (PROMIS) Global-10 questionnaire (modified PROMIS Global-10).²⁴ These questions address quality of life and physical, mental, and social health status with five-point response scales.²⁴ The mean of these five items was calculated, with higher scores indicating better global health status. Depression has been associated with greater CR initiation in Medicare beneficiaries²⁵; thus, we evaluated depressive symptoms with the Patient Health Questionnaire-8 (PHQ-8).²⁶ These items resulted in a score from 0-20, with higher scores indicating greater depressive symptoms. Cognitive status was assessed with the Short Portable Mental Status Questionnaire (SPMSQ),²⁷ producing a score from 0-10, with higher scores indicating worse cognitive impairment. We conducted a complete case analysis, excluding missing data of participants from the aforementioned instruments, as overall missingness was low at 12%.

STATISTICAL ANALYSIS

Categorical variables were summarized as percentages and continuous variables were summarized as median (IQR). We calculated Pearson correlation coefficients for continuous variables and Wilcoxon rank sum tests for categorical variables to examine unadjusted marginal relationships between patient characteristics and CR use. Our threshold for significance was set as the standard level of $P < .05$ (two-sided). We used a single multiple logistic regression model to evaluate the association between the PHCS-2 and CR initiation after adjusting for clinical, demographic, and psychosocial variables. Nonlinear relationships were assessed for continuous variables with three knots (determined by what would produce the lowest Akaike's information criteria²⁸). These nonlinear relationships were nonsignificant and thus not included in the final model to simplify interpretation. For continuous variables, ORs were calculated/1 unit increase in the independent variable. Interaction analyses were performed between PHCS-2 and gender, race/ethnicity, income, insurance type, education, and length of stay. All analyses were conducted in R version 3.6.1.²⁹

RESULTS

A flow diagram for derivation of the study cohort is presented in Figure 1. Among the 2067 VICS participants hospitalized with ACS, we excluded 39 participants due to missing PHCS-2 data and 219 participants missing other survey data: 113 were missing ARMS-7, 80 were missing income information, 11 were missing the HCSD Scale, seven were missing the SNS, six were missing the BRCS, five were missing insurance status, five were missing the modified PROMIS Global-10, three were missing smoking status, two were missing ESS1, one was missing home status, and one was missing the PHQ-8 (note that some participants were missing more than one survey response). After excluding participants with missing data, a total of 1809 patients were included in all analyses.

Baseline characteristics for the 1809 participants included in the analysis are presented in Table 1. The mean age was 61 ± 11 yr. Among the participants, 61% were male, 12% were non-White, and 9% had a comorbid diagnosis of HF. Most participants were living with a married spouse (63%). The most common type of insurance for study participants was Medicare (47%), while 38% had commercial insurance. Study participants had an average of 14 ± 3 yr of education and median household income was the \$35 000-\$50 000 bracket. A total of 294 (16%) participants initiated CR.

The VICS participants generally had high levels of perceived health competence as measured by the PHCS-2, with a median score of 8 (6, 10) out of 10. The distribution of PHCS-2 scores was skewed, with a left-sided tail of participants with low perceived health competence (Figure 2). Participants initiating CR had higher perceived health competence than participants who did not initiate CR (median PHCS-2 score: 10 vs 8, respectively, $P < .001$). There were significant correlations between the PHCS-2 and the other nine psychosocial instruments: (1) Modified PROMIS Global-10 ($r = 0.524$, $P < .001$); (2) PHQ-8 ($r = -0.456$, $P < .001$); (3) BHLS ($r = 0.278$, $P < .001$); (4) BRCS ($r = 0.251$, $P < .001$); (5) ESS1-6 ($r = 0.235$, $P < .001$); (6) ARMS-7 ($r = -0.230$, $P < .001$); (7) SNS ($r = 0.214$, $P < .001$); (8) HCSD ($r = -0.187$, $P < .001$); and (9) SPMSQ ($r = -0.061$, $P < .001$).

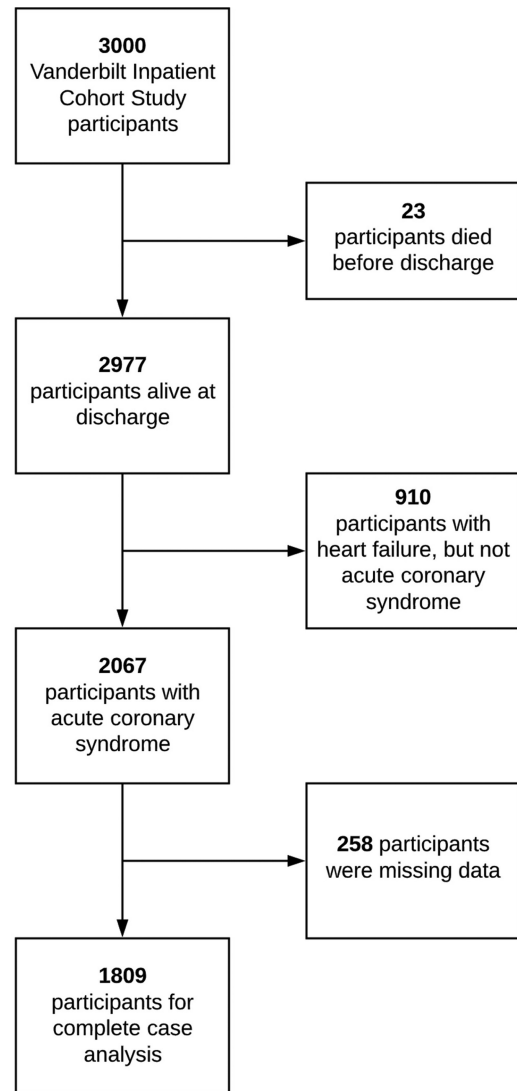


Figure 1. Flow diagram for study participants (N = 1809).

We evaluated the association of perceived health competence with CR initiation using a single multiple logistic regression model with the PHCS-2 as the predictor variable and CR initiation as the dependent variable (Table 2; see Supplemental Digital Content Central Infographic, available at: <http://links.lww.com/JCRP/A423>). The multiple logistic regression model was adjusted for all 21 covariates listed in Table 2. Perceived health competence was associated with a higher odds of CR initiation (OR = 1.15; 95% CI, 1.06-1.26/1-point PHCS-2 increase, $P = .001$) after adjusting for demographic, clinical, and psychosocial factors (Table 2).

Several demographic and clinical covariates were also associated with CR initiation. Participants with comorbid HF had lower odds of initiating CR (OR = 0.31; 95% CI, 0.16-0.60), as did current smokers (OR = 0.64; 95% CI, 0.43-0.96). Participants with commercial insurance had higher odds of initiating CR compared with those with Medicare (OR = 1.63; 95% CI, 1.13-2.34), as did participants with higher income levels (OR = 1.15; 95% CI, 1.06-1.26) and those living with a partner as compared with those who were married (OR = 1.58; 95% CI, 1.06-2.37). In addition to the PHCS-2, higher modified PROMIS Global-10 scores

Table 1

Baseline Characteristics for Participants Hospitalized for Acute Coronary Syndrome in the Vanderbilt Inpatient Cohort Study, Stratified by Cardiac Rehabilitation Initiation (N = 1809)^a

Characteristic	All, N = 1809	CR Noninitiators, N = 1515 (84)	CR Initiators, N = 294 (16)	P Value
Demographic				
Age, yr	61 (53, 68)	61 (53, 68)	63 (56, 70)	.003
Female	706 (39)	598 (39)	108 (37)	.38
Non-White	214 (12)	188 (12)	26 (9)	.08
Education, yr	13 (12, 16)	13 (12, 16)	14 (12, 16)	<.001
Income, \$				<.001
<10 000	108 (6)	102 (7)	6 (2)	
10 000-14 999	114 (6)	107 (7)	7 (2)	
15 000-19 999	104 (6)	97 (6)	7 (2)	
20 000-24 999	186 (10)	167 (11)	19 (6)	
25 000-34 999	251 (14)	217 (14)	34 (12)	
35 000-49 999	307 (17)	256 (17)	51 (17)	
50 000-74 999	279 (15)	221 (15)	58 (20)	
75 000-99 999	191 (11)	150 (10)	41 (14)	
≥100 000	269 (15)	198 (13)	71 (24)	
Insurance				<.001
Commercial	694 (38)	543 (36)	151 (51)	
Medicare	851 (47)	731 (48)	120 (41)	
Medicaid	92 (5)	85 (6)	7 (2)	
Other	55 (3)	44 (3)	11 (4)	
No insurance	117 (7)	112 (7)	5 (2)	
Clinical				
Heart failure	168 (9)	157 (10)	11 (4)	<.001
Body mass index, kg/m ²	30 (26, 34)	30 (26, 34)	29 (26, 34)	.84
Diabetes	790 (44)	665 (44)	125 (43)	.66
Length of stay, d	3 (2, 5)	3 (2, 5)	3 (2, 7)	<.001
Current smoker	430 (24)	393 (26)	37 (13)	<.001
Psychosocial				
PHCS-2	8 (6, 10)	8 (6, 10)	10 (7, 10)	<.001
ARMS-7	8 (7, 11)	8 (7, 11)	8 (7, 10)	.046
BHLS	13 (10, 15)	13 (10, 15)	13 (11, 15)	.004
BRCS	16 (15, 17)	16 (15, 17)	16 (15, 17)	.23
ESSI-6	27 (24, 30)	27 (24, 30)	28 (25, 30)	.11
HCS	25 (20, 29)	25 (21, 29)	25 (20, 29)	.51
Modified PROMIS Global-10	3.0 (2.4, 3.6)	3.0 (2.4, 3.6)	3.4 (2.8, 4.0)	<.001
PHQ-8	6 (3, 11)	7 (3, 11)	5 (3, 9)	<.001
SNS	4.7 (3.7, 5.7)	4.7 (3.7, 5.7)	5.0 (4.0, 6.0)	<.001
SPMSQ	1 (1, 2)	1 (1, 2)	1 (1, 2)	.90

Abbreviations: ARMS-7, 7-item Adherence to Refills and Medication Scale; BHLS, Brief Health Literacy Screen; BRCS, Brief Resilient Coping Scale; CR, cardiac rehabilitation; ESSI-6, 6-item ENRICH Social Support Instrument; HCS, Health Care System Distrust Scale; PHCS-2, 2-item Perceived Health Competence Scale; PHQ-8, Patient Health Questionnaire-8; PROMIS, Patient-Reported Outcomes Measurement Information System; SNS, Subjective Numeracy Scale; SPMSQ, Short Portable Mental Status Questionnaire.

^aData presented as median (IQR) or n (%). Percentages are column percentages.

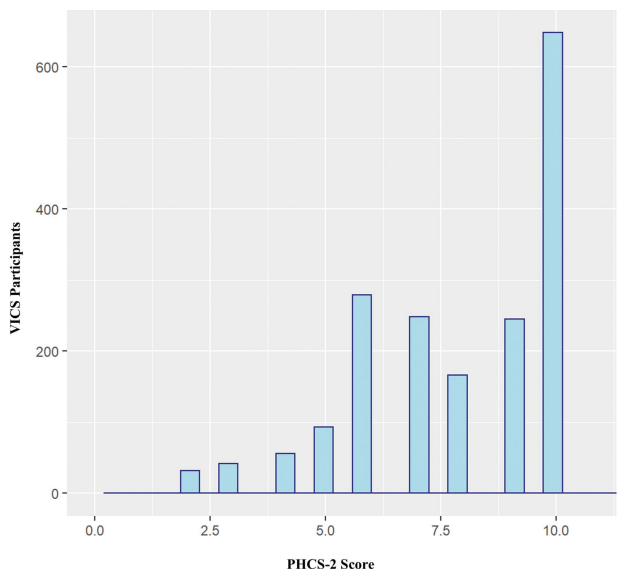


Figure 2. Distribution of PHCS-2 scores in the Vanderbilt Inpatient Cohort Study (N=1809). Abbreviations: PHCS-2, two-item Perceived Health Competence Scale; VICS, Vanderbilt Inpatient Cohort Study. This figure is available in color online (www.jcrpjournal.com).

were associated with higher odds of initiating CR (OR = 1.26; 95% CI, 1.02-1.57/1-point increase). The HCSD was also associated with CR initiation (OR = 1.02; 95% CI, 1.00-1.05/1-point increase).

The model-estimated relationship between perceived health competence and probability of CR initiation, adjusting for demographic, clinical, and psychosocial factors, is displayed in Figure 3. This relationship is primarily linear, and nonlinear terms evaluated for the PHCS-2 and CR initiation were found to be nonsignificant.

DISCUSSION

In this study, we found that perceived health competence, a modifiable psychological characteristic, was strongly associated with CR initiation in patients hospitalized for ACS. Perceived health competence was measured alongside numerous other clinical and psychosocial variables, allowing for a comprehensive assessment of the relationship of this construct with CR initiation. The magnitude of the association between perceived health competence and CR initiation was notable when compared with the other psychosocial instruments. Each one-point increase in the PHCS-2 scale (range: 2-10) was associated with a 15% higher odds of initiating CR. For context, the only other psychological covariable with a sizable association with CR initiation was quality of life (as measured by the modified PROMIS Global-10). Each one-point increase on the modified PROMIS Global-10 score was associated with 26% higher odds of initiating CR though this instrument has a smaller range (1-5). A comparison of the PHCS-2 effect size on CR initiation with the other psychosocial instruments suggests that the increase in CR initiation associated with higher PHCS-2 scores is clinically meaningful.

Other clinical and social covariables associated with CR initiation included insurance status, income, home status, length of stay, and the absence of concomitant HF or smoking status. These findings are consistent with prior studies characterizing predictors of CR participation. Current smoking has been associated with lower odds of CR par-

Table 2
Association of Perceived Health Competence With Cardiac Rehabilitation Initiation in Patients Hospitalized With Acute Coronary Syndrome (N = 1809)

Characteristic	OR ^a	95% CI	P Value
Demographic			
Age/yr	1.01	1.00-1.03	.10
Female	1.16	0.85-1.58	.34
Non-White	0.93	0.58-1.49	.75
Home status			
Unmarried, living with someone vs married	1.58	1.06-2.37	.026
Unmarried, living alone vs married	1.42	0.94-2.15	.09
Education/yr	1.02	0.96-1.08	.46
Income/1 strata increase	1.15	1.06-1.26	.001
Insurance			
Commercial vs Medicare	1.63	1.13-2.34	.009
Medicaid vs Medicare	1.08	0.44-2.63	.864
Other vs Medicare	1.75	0.83-3.71	.14
No insurance vs Medicare	0.53	0.20-1.40	.20
Clinical			
Heart failure	0.31	0.16-0.60	<.001
Body mass index/1 kg/m ²	1.01	0.99-1.03	.48
Diabetes	1.14	0.86-1.51	.37
Length of stay/d	1.07	1.03-1.10	<.001
Current smoker	0.64	0.43-0.96	.030
Psychosocial			
PHCS-2/1-point increase	1.15	1.06-1.26	.001
ARMS-7/1-point increase	1.00	0.94-1.07	.99
BHLS/1-point increase	0.99	0.93-1.04	.61
BRCS/1-point increase	0.98	0.91-1.05	.50
ESSI-6/1-point increase	1.00	0.96-1.04	.97
HCSD/1-point increase	1.02	1.00-1.05	.038
Modified PROMIS Global-10/1-point increase	1.26	1.02-1.57	.034
PHQ-8 (per 1-point increase)	1.00	0.97-1.04	.86
SNS/1-point increase	1.06	0.93-1.21	.36
SPMSQ/1-point increase	0.97	0.83-1.14	.74

Abbreviations: ARMS-7, 7-item Adherence to Refills and Medication Scale; BHLS, Brief Health Literacy Screen; BRCS, Brief Resilient Coping Scale; ESSI-6, 6-item ENRICH Social Support Instrument; HCSD, Health Care System Distrust Scale; PHCS-2, 2-item Perceived Health Competence Scale; PHQ-8, Patient Health Questionnaire-8; PROMIS, Patient-Reported Outcomes Measurement Information System; SNS, Subjective Numeracy Scale; SPMSQ, Short Portable Mental Status Questionnaire.

^aOdds ratios were obtained from a single multiple logistic regression model fitted with CR as the outcome and the PHCS-2 as the predictor variable, adjusted for all other variables in the Table (21 covariates, 25 degrees of freedom total [df]). The variables above each had 1 df except for home status (2 df) and insurance (4 df).

ticipation in multiple prior studies,^{30,31} as in our analysis. Baseline health status as measured by the SF-36 Physical Component Scale was associated with CR initiation in prior studies,³² similar to our findings with the modified

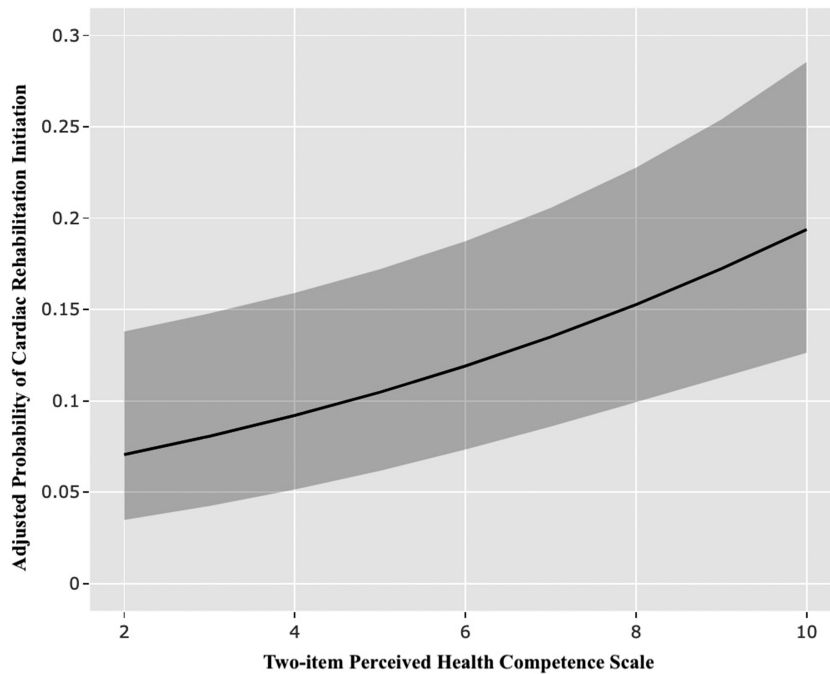


Figure 3. Model-estimated relationship of perceived health competence with probability of cardiac rehabilitation initiation in patients hospitalized with acute coronary syndrome (N = 1809). Shaded areas represent 95% CI. The model was adjusted for age, sex, education, income, home status, insurance status, heart failure, body mass index, diabetes, length of stay during the index hospitalization, and psychosocial instruments including the ARMS-7, BHLS, BRCS, ESSI-6, HCSD, modified PROMIS Global-10, PHQ-8, SNS, and SPMSQ.

PROMIS Global-10. Medicare patients eligible for Medicaid (“dual-eligible” patients) are less likely to participate in CR programs,⁵ consistent with our findings that patients with private insurance had the highest odds of CR initiation. For comparison, a one-point increase in the PHCS-2 has a similar increase in the odds of CR initiation (15%) as a one-level increase in income strata (15% out of nine income strata), underlying the importance of perceived health competence in predicting CR initiation.

To our knowledge, no other studies have examined perceived health competence in the context of CR. The closest psychological construct to perceived health competence that has been evaluated in prior CR work is self-efficacy. Self-efficacy for exercise is likely the most relevant form of self-efficacy for CR. This construct has been studied as both a predictor and an outcome for CR programs³³ on the premise that patients with high exercise self-efficacy are more likely to initiate CR and those who increase exercise self-efficacy during CR are more likely to continue to exercise after concluding the program. Numerous studies have demonstrated that CR participation is positively associated with increased exercise self-efficacy.^{33,34} In contrast, prior work investigating exercise self-efficacy as a predictor of CR participation has yielded mixed results, with some studies finding that exercise self-efficacy was not associated with adherence to CR programs^{35,36} and others identifying an association with CR attendance.³⁴ The strong association between the PHCS-2 and CR initiation seen in our results is novel in light of prior work.

Of note, there was no significant interaction between sex and the association of the PHCS-2 with CR initiation. This is in contrast to prior work that identified effect modification by sex in the relationship of perceived health competence with physical activity (PA), finding that the association of the PHCS-2 with PA was stronger in women than in men in a group of outpatients with coronary heart disease.¹² Women generally have lower self-efficacy for various

types of PA,³⁷ and thus it is plausible that higher levels of perceived health competence would be especially beneficial in promoting PA in this patient population. Initiating CR requires self-efficacy for a variety of tasks and barriers as opposed to merely PA, however, perhaps negating the greater influence of perceived health competence among women in our cohort.

Taken together, our results raise the possibility that interventions designed to improve perceived health competence could potentially improve CR initiation rates. Motivational interviewing, for example, is a behavioral counseling technique that can increase self-efficacy for a variety of behaviors and is likely effective at improving perceived health competence as well.³⁸⁻⁴¹ Inpatient CR programs incorporate a variety of counseling methods for exercise, smoking cessation, and medication adherence.⁴² Inpatient CR can be readily adapted to incorporate interventions to improve perceived health competence in the interest of ensuring that patients participate in outpatient CR after discharge. Evaluation of perceived health competence might also help clinicians identify patients at highest risk of CR nonattendance. At some institutions, the capacity of inpatient CR teams is limited and CR staff are not able to see all patients who are eligible for outpatient CR programs. Characterization of perceived health competence or self-efficacy for activities related to CR (such as exercise) could help ensure that counseling resources are deployed efficiently.

Our study has several limitations. First, we have no data on whether VICS participants were referred to CR programs by their providers. Referral to CR is generally necessary for CR initiation and is an important factor in studying CR utilization but unfortunately cannot be readily ascertained by patient interviews or administrative claims. Second, CR initiation was self-reported by patients during a telephone call as opposed to verification of attendance at CR centers. Given the numerous CR centers at which patients could potentially enroll, it would not be feasible to

verify attendance at each of the individual facilities. Third, the study population was predominantly White, so it was not possible to test interactions with race and ethnicity. However, the VICS study instruments have been validated in diverse age ranges and racial/ethnic backgrounds.¹³ Fourth, the PHCS-2 was administered once during the hospitalization and perceived health competence could potentially change during an inpatient stay and after discharge. However, this is a theoretical concern, and more data are necessary to understand how perceived health competence might change over time. Finally, we used the two-item Perceived Health Competence Scale (PHCS-2) instead of the full eight-item version to reduce overall response burden. However, the PHCS-2 has been associated with health behaviors⁴³ and PA¹² in other studies, suggesting convergent validity with the eight-item PHCS.

In conclusion, we found that perceived health competence was strongly associated with self-reported CR initiation in patients hospitalized for ACS after adjusting for demographic, clinical, and psychosocial factors. These results add to current data regarding psychosocial predictors of and barriers to CR participation. Our findings invite further study of addressing low perceived health competence as a way of increasing participation in this widely underutilized therapy.

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