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Impact of Home- and Hospital-Based Exercise in Cardiac Rehabilitation on Hopelessness in Patients With Coronary Heart Disease

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Abstract
Hopelessness is associated with increased adverse events and decreased survival in patients with coronary heart disease (CHD). The purpose of this research was to examine the effect of regular home- and hospital-based cardiac rehabilitation (CR) exercise on hopelessness levels in patients with CHD, hypothesizing that increased exercise in either setting would lead to decreased state hopelessness.

Keywords
cardiac rehabilitation, home-based exercise, hopelessness, hospital-based exercise

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■ **PURPOSE:** Hopelessness is associated with increased adverse events and decreased survival in patients with coronary heart disease (CHD). The purpose of this research was to examine the effect of regular home- and hospital-based cardiac rehabilitation (CR) exercise on hopelessness levels in patients with CHD, hypothesizing that increased exercise in either setting would lead to decreased state hopelessness.

■ **METHODS:** A descriptive longitudinal design was used at a large teaching hospital in Michigan. A total of 324 patients provided data during hospitalization and at least 1 followup time point (3, 8, and 12 months).

■ **RESULTS:** The patients had persistent, modest levels of state and trait hopelessness across all time points. Among home exercisers with moderate to severe state hopelessness at baseline, both mean state ($P = .002$) and trait ($P = .02$) hopelessness were reduced at later time points compared with those who quit or did not start exercise. Multivariable models showed that when individuals had moderate to severe baseline state hopelessness, home exercise remained associated with decreases in state hopelessness compared with no exercise, even after adjusting for hospital exercise, depression, and demographic variables.

■ **CONCLUSIONS:** Exercise may be effective in reducing moderate to severe hopelessness in patients with CHD. Moderate to severe baseline state hopelessness was a predictor of attrition in this cohort, especially for home exercisers, but this was mediated in hospital-based programs. Further research is needed to determine how hopeless individuals can be encouraged to exercise and whether home- or a hospital-based CR exercise is superior in impacting hopelessness.

K E Y W O R D S

cardiac rehabilitation

home-based exercise

hopelessness

hospital-based exercise

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The authors have no conflicts of interest to disclose. Dr. Dunn was on faculty at Hope College when this study was completed.

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Cardiovascular disease is the leading cause of death and disability in the United States.[1,2] Coronary heart disease (CHD) and depression are recognized comorbid health conditions, and a recent American Heart Association (AHA) Scientific Statement recommended that depression be regarded as a risk factor for adverse outcomes in patients with CHD.[3] Hopelessness is another important psychological factor associated with the development and progression of CHD independent of depression.[4,5] Hopelessness has been identified in 27% to 52% of patients with CHD[4,6,7] and is predictive of decreased survival[8] and increased adverse clinical events.[4]

Hopelessness is defined as a negative outlook and sense of helplessness toward the future.[9] Hopelessness, as a temporary response to new events, may represent a state.[9] Hopelessness may also reflect a habitual outlook toward life, denoting a trait.[9] The differentiation between state and trait hopelessness is important because state hopelessness may be more responsive to short-term interventions. Few studies have examined how hopelessness may be successfully treated in this population. Cognitive behavior therapy has been effective in decreasing hopelessness in patients after coronary artery bypass surgery[10]; however, research is lacking related to other potential interventions for hopelessness in patients with CHD.

A growing amount of evidence suggests that physical inactivity is largely responsible for increased cardiovascular events and death associated with depression, a psychological factor related to hopelessness. Physical inactivity has accounted for 25% of increased risk for cardiovascular mortality[11] and a 30% higher rate of adverse cardiovascular events[12] because of depression. The REGARDS study found a higher risk of myocardial infarction or death in patients with known CHD and depressive symptoms, with physical inactivity accounting for 20% of the increased risk.[13] Although there is evidence that physical activity impacts the association between depression and adverse events in patients with CHD, no similar research has been done with hopelessness. A study examining college students established that those who engaged in 20 to 30 minutes of aerobic activity at least 1 (males) to 3 (females) times per week demonstrated a reduced risk of hopelessness.[14] A cohort study of healthy men found that moderate to vigorous physical activity of ≥2.5 hours per week and increased respiratory fitness predicted decreased hopelessness, independent of depression.[15]

There is ample evidence of the beneficial effects of exercise for patients with CHD, including decreased depression,[16-19] decreased nonfatal reinfarction and increased survival,[16] and improved quality of life.[18] The AHA recommends at least 30 minutes of moderate to intense aerobic activity at least 5 days per week for secondary prevention and risk reduction in patients with CHD.[20] Despite clear guidelines and known benefits, most individuals with CHD do not meet current exercise recommendations. A study examining the use of phase 2 (outpatient monitored) cardiac rehabilitation (CR) found that, of all eligible patients, only 18.7% participated in at least 1 CR exercise session.[21] Another study found that even with a physician referral for CR, only 34% enrolled in the program.[22] For those who do begin a CR program, predictors of not completing include increased baseline depression[23] and hopelessness.[24]

As a supplement or alternative to phase 2 CR, home-based exercise prescriptions promote physical activity and improve exercise capacity in patients with CHD,[25] and have been found as effective as phase 2 CR in improving exercise capacity, risk factor control, and health-related quality of life.[26] A meta-analysis of 12 studies showed no differences in either short- or long-term outcomes between patients with stable CHD participating in home- or hospital-based CR.[27]

The purpose of this research was to examine the effect of regular home- and hospital-based CR exercise on levels of state and trait hopelessness in patients with CHD. It was hypothesized that, over a 1-year period, increased exercise in either setting would lead to decreased state hopelessness levels and that neither type of exercise would significantly impact trait hopelessness.

METHODS

A descriptive longitudinal design was used examining patients participating in hospital-based CR or home exercise. Data were collected over 4 time points (baseline, 3, 8, and 12 months). Time points were chosen on the basis of standard completion of phase 2 CR within 3 months and use of 8- and 12-month followup in prior research.[24] Inpatients were enrolled at a large teaching hospital in Michigan from November 2010 to September 2011. Patients completed baseline measures while hospitalized, and followup data were collected by mail. The human subject review boards of Hope College and the hospital approved the project.

Sample

Patients were eligible if they were 21 years or older and had a diagnosis of myocardial infarction, angina pectoris, acute coronary syndrome, or underwent coronary artery angioplasty, stent, or bypass surgery. Patients were excluded if they were unable to speak

or read English, unable to provide consent or complete an interview, or had a planned discharge to an institutional setting. Of the 520 patients who completed baseline data, 324 (62.3%) responded to at least 1 of the remaining followup time points. Patients who only completed baseline data were more likely to be younger, unmarried, less educated, on Medicaid or lacking insurance, and had higher hopelessness and depression levels. There were no significant differences between patients who completed only baseline data and those who responded to at least 1 remaining time point on other variables. Mortality (n = 6) was not a major contributor to attrition.

Patients self-selected whether they participated in home or phase 2 CR exercise. Patients who completed phase 2 CR received 12 weeks of monitored exercise and were encouraged to exercise at home on nonattendance days. The phase 2 program included group educational sessions focused on exercise, nutrition, smoking cessation, and stress reduction, but did not include group or individual emotional/mental health counseling.

Patients were considered as exercising regularly if they reported walking or biking on average 3 days per week or more for both the home and phase 2 exercise programs. Home exercisers were categorized as (1) currently participating (exercising at home), (2) quit (no longer exercising at home, but had previously done so), or (3) did not start. Patients' participation in phase 2 CR was categorized as (1) participating (currently attending or had completed a 12-week phase 2 program), (2) quit (began phase 2 but stopped before it was completed), or (3) did not start. The number of home or phase 2 CR exercise quitters was small (n = 14-27 [10-20%], depending on the time point) relative to the number of individuals who never started; therefore, those who quit or did not start (nonexercisers) were grouped in all analyses.

Measures

Demographic characteristics, clinical history, cardiac diagnoses and procedures, hopelessness, depression, and exercise participation were measured. Demographics and clinical history were collected at baseline using a self-report questionnaire. Cardiac diagnoses and procedures were collected using medical chart review.

Hopelessness was measured using the State-Trait Hopelessness Scale (STHS). The STHS is a 23-item (10-state, 13-trait) instrument measured on a 4-point Likert-type scale (1 = strongly disagree through 4 = strongly agree). The STHS was developed using key components of the Theory of Hopelessness Depression.[9] Reliability and validity of the STHS are established in patients with CHD.[28] Earlier factor analysis identified a state hopelessness factor (6 of 10 state items) and a trait hopelessness factor (8 of 13 trait items).[28] For this study, only hopelessness factor items (6 state and 8 trait items) were analyzed because the aim was to determine differences in hopelessness between exercise groups. Adding the item scores and dividing by the number of items provides a total score for each factor. A mean score of $\leq$1.5 was categorized as minimal to no hopelessness, 1.6 to 2.0 as mild hopelessness, and $>$2.0 as moderate to severe hopelessness. These cut-off scores were based on established benchmarked scores for the Beck Hopelessness Scale, which has a cut-off score of 9 on a 20-item scale.[29] In the current study, the Cronbach α for the hopelessness factor was high for the 6-item state (0.84-0.87 at all time points) and 8-item trait (0.85-0.89 at all time points) scales. In addition, nearly all the values of α for each item in the state and trait scales decreased when an item was removed, indicating that virtually all items contribute positively to the overall reliability of the scales. Lastly, item-total correlations were moderately strong, varying between 0.42 and 0.77 for the state and 0.64 and 0.79 for the trait scales across all time points.

Depression was measured with the Patient Health Questionnaire-9, a 9-item measure of depression severity. Items are scored from 0 (not at all) to 3 (nearly every day), providing a score range of 0 to 27. Internal consistency reliability[30] and criterion and construct validity[31] have been confirmed in prior research. Separate cognitive and somatic depressive symptom dimensions have been validated in patients with CHD.[32,33] The reliability of the scale (α = 0.85) and 2 dimensions (somatic: α = 0.70, cognitive: α = 0.82) were adequate in our study.

Home- and hospital-based CR exercise participation was measured at 3, 8, and 12 months using the Cardiac Rehabilitation Exercise Participation Tool (CREPT). The CREPT is a 20-item self-report questionnaire assessing a patient's referral and participation in home and CR exercise. The CREPT was developed and tested in an earlier study and deemed to have adequate reliability and content validity.[24]

Statistical Analysis

Data were entered into SPSS software, version 20.0 (IBM, Inc, Chicago, Illinois), with double data entry used to ensure data quality. SPSS and R[34,35] software were used for data analysis. Generalized linear mixed models were used to evaluate predictors of state or trait hopelessness scores at each time point after baseline. Selected covariates included baseline hopelessness levels, cognitive and somatic depressive symptom dimensions, and key demographic variables (age, sex, and marital status). Depression and marital status have shown significant association with hopelessness in earlier research with patients with CHD,[6,24]whereas age[15] and sex[14] have had a significant impact on

hopelessness levels in the general population. As in previous hopelessness research,[24] we pooled data across the 3 postbaseline time points to account for attrition, varying numbers of cases over time, within- and between-subject effects, and time-independent and time-dependent predictors. Two-sided tests and $\alpha = .05$ were used to determine significance.

RESULTS

Sample Characteristics

Table 1 summarizes the sample characteristics (n = 324). A total of 166 patients responded to all 3 followup time points. Despite some fluctuation in responses across time, the sample's demographic and clinical characteristics remained similar at all time points.

Hopelessness and Exercise Over Time

The sample had persistent, modest levels of both state and trait hopelessness across all time points, with no statistically significant change in levels at any time (Table 2). At any of the 3 time points, approximately one-half of the sample reported recent participation in regular home exercise, compared with slightly less than one-third that reported recent participation or completion of a hospital-based CR program (Table 3). The associations between hopelessness and home- or hospital-based exercise are shown in Table 4. Individuals who quit or did not start an exercise program had higher levels of state and trait hopelessness at 3, 8, and 12 months compared with those who did exercise, with the differences in most cases being statistically significant ($P < .05$). Differences in state hopelessness levels ranged between 0.13 and 0.24 points higher among nonexercisers than exercisers, whereas trait hopelessness differences ranged between 0.10 and 0.31 points higher among nonexercisers.

We used a general linear mixed model predicting hopelessness scores by exercise type, time point (3, 8, or 12 months), and an interaction term (exercise type and time point) to test for evidence of differential effects of exercise across time. None of the 4 combinations of exercise type (home or hospital) and hopelessness type (state or trait) showed significant differences on the effect of exercise across time (*P* values from .62 to .87; details not reported). Thus, in further analyses, we pooled data across the postbaseline time points.

Effect of Exercise and Hopelessness Severity

State hopelessness at 3, 8, and 12 months was not significantly different between exercisers and nonexercisers for individuals who reported minimal to no (≤ 1.5) or mild (1.6-2.0) state hopelessness at baseline (Table 5). However, among individuals with moderate to severe hopelessness at baseline (> 2.0), there was a 0.26-point lower mean state hopelessness score for home exercisers and a 0.24-point lower state hopelessness score for hospital (participation/completion) exercisers at the later pooled time points compared with nonexercisers (Table 5).

Table 5 shows a similar pattern for trait hopelessness, with the group with moderate to severe trait hopelessness at baseline showing significantly less hopelessness for home exercisers (0.23 lower), but no significant difference for the minimal to no and mild baseline

Table 1• Demographic and Clinical Characteristics (n = 324)[a]

	All Patients
Age, y	66 ± 9.8
Range, y	31-91
Sex	
Male	218 (67.3)
Female	106 (32.7)
Race[b]	
White	301 (92.9)
Other	22 (6.8)
Marital status	
Not married	85 (26.2)
Married	239 (73.8)
Employment status	
Not employed	218 (67.3)
Employed	106 (32.7)
Education[b]	
High school or less	130 (40.1)
Greater than high school	193 (59.6)
Insurance[b]	
Medicaid/no insurance	41 (12.6)
Other insurance	282 (87.3)
Prior diagnoses of heart condition[b]	
Yes	161 (49.7)
No	162 (50.2)
Type of cardiac procedure	
Coronary bypass surgery	117 (36.1)
PTCA-stent	162 (50.0)
None	45 (13.9)

Abbreviation: PTCA, percutaneous transluminal coronary angioplasty.
[a]Continuous data reported as mean ± standard deviation and categorical data reported as number (%).
[b]Data were missing for 1 patient.

Table 2• Hopelessness Levels Over Time[a,b]

	Baseline (n = 324)	3 mo (n = 251)	8 mo (n = 230)	12 mo (n = 258)
State[c]	1.68 ± 0.51	1.72 ± 0.54	1.68 ± 0.54	1.66 ± 0.53
Trait[c]	1.81 ± 0.54	1.80 ± 0.55	1.75 ± 0.54	1.80 ± 0.59

[a]All data reported as mean ± standard deviation.
[b]Possible range 1 to 4.
[c]There was no significant change in either state or trait hopelessness levels between any of pairs of time points (all paired *t* test *P* values > .05).

hopelessness groups (0.00 and 0.19 lower, respectively). Hospital exercise (participation/completion) was not associated with significant changes in trait hopelessness for any of the 3 baseline hopelessness groups.

We examined data from patients who were doing both home- and hospital-based exercise and found that combined exercise was no more beneficial in reducing state or trait hopelessness levels than just exercising at home (results not reported).

Multivariable Models

Because of the association between baseline hopelessness and the effects of exercise on subsequent hopelessness levels, we created separate multivariable models for the 3 baseline hopelessness levels (Table 6). For individuals with minimal to no or mild state hopelessness, neither home- nor hospital-based exercise was significant in either the unadjusted or adjusted models. However, when individuals had moderate to severe baseline hopelessness, home exercise remained significantly associated with lower state hopelessness levels even after adjusting for hospital-based CR exercise, cognitive and somatic depressive symptom dimensions, and key demographic variables (age, sex, and marital status). Thus, these potential confounding variables did not account for the relationship between state hopelessness and home exercise. Neither home nor hospital exercise was associated with lower trait hopelessness in any of the 3 baseline hopelessness groups after adjusting for exercise types, depression dimensions, and demographics (Table 6).

Table 3. Exercise Participation Over Time[a,b]

	3 mo n (%)	8 mo n (%)	12 mo n (%)
Home[c]	119/251 (47.4)	113/230 (49.1)	124/258 (48.1)
Hospital-based cardiac rehabilitation[d]	79/251 (31.5)	68/230 (29.6)	72/258 (27.9)

[a]Participation rates are given as the percentage of participants for whom data were available at each of the 3 time points.
[b]Walking or biking ≥3 days a week.
[c]Currently exercising at home.
[d]Currently exercising in a hospital-based phase 2 cardiac rehabilitation program or completed a 12-week phase 2 cardiac rehabilitation program.

DISCUSSION

The key finding of this study was that regular exercise might be an effective strategy in reducing moderate to severe state hopelessness in patients with established CHD. The hypothesis that participation in exercise would lead to decreased state hopelessness was partially supported in that home exercise remained significantly associated with lower state hopelessness levels, but only for patients who reported moderate to severe hopelessness at baseline. Current participation or successful completion of a hospital-based phase 2 CR program was related to lower state hopelessness in unadjusted analyses, but was not significant after adjusting for covariates. As hypothesized, neither type of exercise was significantly associated with lower trait hopelessness levels.

The beneficial relationship between home exercise and state hopelessness is similar to that in research showing decreased hopelessness levels with exercise in healthy individuals.[14,15] The association between exercise and lower state hopelessness levels in our study was stronger in patients who expressed more severe hopelessness at baseline. Therefore, it is important to assess the presence and severity of hopelessness levels before hospital discharge and to intervene early in the recovery period. All patients should be encouraged to participate in a regular exercise program. Special encouragement is needed for those patients who are moderately to severely hopeless, as they may be the most vulnerable and least likely to exercise yet benefit the most.

An unanticipated finding was that home-based exercise had a significant association with state hopelessness levels, whereas hospital-based phase 2 CR exercise with its associated group educational classes did not. This could be explained by the independent nature of home exercise, thus decreasing a patient's sense of helplessness toward improving future health and prognosis. This finding supports earlier research that shows home exercise is at least as equally effective as hospital-based CR in improving health-related quality of life.[27] Further research is needed to examine the possible mechanism unique to home exercise that is

Table 4• State and Trait Hopelessness by Time Point and Exercise Status

	3 mo (n = 251) Mean ± SD	8 mo (n = 230) Mean ± SD	12 mo (n = 258) Mean ± SD
State hopelessness			
Home			
Quit/did not start	1.80 ± 0.56	1.76 ± 0.59	1.75 ± 0.57
Attending	1.63 ± 0.51	1.58 ± 0.46	1.57 ± 0.47
Difference	0.17 (P = .01)	0.18 (P = .01)	0.18 (P = .01)
Hospital-based			
Quit/did not start	1.78 ± 0.55	1.75 ± 0.52	1.70 ± 0.55
Attending/completed	1.59 ± 0.51	1.51 ± 0.51	1.57 ± 0.47
Difference	0.19 (P = .01)	0.24 (P = .005)	0.13 (P = .07)
Trait hopelessness			
Home			
Quit/did not start	1.85 ± 0.57	1.82 ± 0.56	1.89 ± 0.61
Attending	1.75 ± 0.54	1.66 ± 0.50	1.69 ± 0.54
Difference	0.10 (P = .16)	0.16 (P = .02)	0.20 (P = 0.01)
Hospital-based			
Quit/did not start	1.88 ± 0.57	1.82 ± 0.53	1.82 ± 0.60
Attending/completed	1.64 ± 0.50	1.51 ± 0.44	1.71 ± 0.54
Difference	0.24 (P = .001)	0.31 (P < .001)	0.11 (P = .13)

Abbreviation: SD, standard deviation.

beneficially related to hopelessness levels, as well as to explicitly characterize the relationship between quantity of exercise (ie, dose response) and impact on hopelessness levels. We also found that state hopelessness levels were generally lower than trait hopelessness levels across time points. Further research is needed to explore the clinical implications of this finding.

The finding that moderate to severe state hopelessness decreased in participants who continued to exercise compared with those who quit or did not start exercise is important. This confirms an expectation that moderate to severe state hopelessness at baseline is an independent predictor of attrition in exercise programs, especially for home-based programs, but this effect is mediated in hospital-based programs. Therefore, it is possible that hospital-based programs might better address the effect of moderate to severe baseline hopelessness compared with home-based exercise programs.

Limitations

The sample was from 1 hospital and was homogeneous, thereby limiting generalizability. The sample was not randomized and self-selection could have biased findings. We could not determine whether either home- or hospital-based CR exercise was superior because we were unable to randomize patients to groups. Consistent with previous research,[24] there was a high attrition rate, with some of the most hopeless individuals lost, suggesting that effect sizes were smaller due to the relatively low levels of reported hopelessness. We treated the effects of exercise on hopelessness as a constant across time points because there was no strong evidence of differences; however, a larger sample with more variation in hopelessness scores is needed to further investigate this hypothesis.

Implications

Our study has made progress in identifying hopelessness in individuals with CHD, state and trait components, and associations with exercise. Previous work by 1 of the investigators identified increased hopelessness as predictive of decreased exercise in a phase 2 CR program.[24] Interrupting the harmful cycle of sedentary behavior and hopelessness would be an excellent goal for health care professionals. However, many questions remain unanswered, including what

Table 5• Posthospitalization State and Trait Hopelessness Levels by Exercise Status and Baseline Hopelessness

	Baseline (In-Hospital) State Hopelessness Group		
	Minimal to None (≤1.5) Mean ± SD (n)[a]	Mild (1.6-2.0) Mean ± SD (n)[a]	Moderate to Severe (>2.0) Mean ± SD (n)[a]
Posthospitalization state hopelessness			
Home			
Quit/did not start	1.55 ± 0.46 (116)	1.72 ± 0.46 (90)	2.17 ± 0.57 (148)
Attending	1.49 ± 0.46 (155)	1.80 ± 0.48 (63)	1.91 ± 0.54 (131)
Difference	0.06 (P = .77)	-0.08 (P = .66)	0.26 (P = .002)[b,c]
Hospital-based			
Quit/did not start	1.56 ± 0.49 (176)	1.78 ± 0.45 (115)	2.12 ± 0.57 (206)
Attending/completed	1.42 ± 0.39 (92)	1.68 ± 0.52 (41)	1.88 ± 0.52 (81)
Difference	0.14 (P = .15)	0.10 (P = .54)	0.24 (P = .04)
Posthospitalization trait hopelessness			
Home			
Quit/did not start	1.41 ± 0.43 (112)	1.73 ± 0.48 (71)	2.02 ± 0.56 (177)
Attending	1.41 ± 0.40 (134)	1.54 ± 0.47 (78)	1.79 ± 0.49 (142)
Difference	0.00 (P = .39)	0.19 (P = .28)	0.23 (P = .02)[b,c]
Hospital-based			
Quit/did not start	1.47 ± 0.42 (151)	1.65 ± 0.51 (114)	1.96 ± 0.55 (241)
Attending/completed	1.31 ± 0.37 (91)	1.57 ± 0.38 (42)	1.84 ± 0.51 (83)
Difference	0.16 (P = .33)	0.08 (P = .27)	0.12 (P = .18)

Abbreviation: SD, standard deviation.
[a]The reported number of patients is the number of people-time point combinations. We controlled for obtaining multiple people-time point combinations from the same individual through the use of a mixed-effects model.
[b]$P < .05$; for example, among individuals in the moderate-severe baseline hopelessness group, posthospitalization hopelessness levels were significantly lower among individuals who had exercised at home (1.91) compared with those who had not (2.17).
[c]P value for a 3×2 interaction of baseline hopelessness group by exercise type: trait hopelessness × home exercise (0.00 vs 0.19 vs 0.23; P = .01); trait hopelessness × hospital-based exercise (0.16 vs 0.08 vs 0.12; P = .98).

interventions are effective in reducing hopelessness and how to best encourage hopeless individuals to change their exercise behaviors. There have been surprisingly few studies to determine how hopelessness might be successfully treated. This study suggests that regular exercise may be an effective strategy in reducing moderate to severe state hopelessness, yet reducing a sense of hopelessness may also lead to increased exercise. Randomized controlled trials are needed to establish causation and determine whether home or hospital-based exercise is superior.

The AHA 2020 Impact Goals include a new definition of cardiovascular health that incorporates physical activity.[36] Ideal cardiovascular health is defined as at least 150 minutes per week of moderate physical activity or at least 75 minutes per week of vigorous activity.[2] Despite the known benefits, limited risks, and established guidelines recommending CR exercise programs, referral and participation rates remain unacceptably low. Those patients with moderate to severe baseline state hopelessness are at high risk for lack of participation or continuation in exercise and warrant special attention.

Further research is needed to evaluate how patients with CHD with moderate to severe hopelessness can be encouraged to participate in regular home- and hospital-based exercise and how this may reduce the increased morbidity and mortality associated with hopelessness. The AHA supports interventions to promote physical activity, with an emphasis on the use of cognitive-behavioral strategies for promoting behavior change.[36] With limited primary care

Table 6• Covariate Adjusted Models of Posthospitalization State and Trait Hopelessness

	Baseline (In-Hospital) Hopelessness Group					
	Minimal to None (≤1.5)		Mild (1.6-2.0)		Moderate to Severe (>2.0)	
	Unadjusted[a] Beta (95% CI)[c]	Adjusted[b] Beta (95% CI)[c]	Unadjusted[a] Beta (95% CI)[c]	Adjusted[b] Beta (95% CI)[c]	Unadjusted[a] Beta (95% CI)[c]	Adjusted[b] Beta (95% CI)[c]
Posthospitalization state hopelessness						
Home exercise						
Attending	0.01 (−0.08 to 0.11)	0.01 (−0.07 to 0.09)	−0.03 (−0.17 to 0.11)	0.01 (−0.12 to 0.14)	−0.21[d] (−0.34 to −0.08)[e]	−0.11 (−0.22 to −0.01)[d]
Hospital exercise						
Attending/completed	−0.11 (−0.25 to 0.04)	−0.02 (−0.14 to 0.11)	−0.06 (−0.27 to 0.14)	−0.01 (−0.20 to 0.18)	−0.14 (−0.28 to 0.005)[d]	−0.07 (−0.18 to 0.05)
Somatic depression	0.07 (0.04 to 0.10)[e]	0.05 (0.02 to 0.08)[e]	0.05 (0.01 to 0.09)[d]	0.02 (−0.03 to 0.06)	0.10 (0.07 to 0.12)[f]	0.01 (−0.02 to 0.03)
Cognitive depression	0.09 (0.03 to 0.15)[e]	0.06 (0.00 to 0.12)	0.07 (0.01 to 0.13)[d]	0.06 (−0.00 to 0.12)	0.12 (0.10 to 0.13)[f]	0.10 (0.07 to 0.12)[f]
Posthospitalization trait hopelessness						
Home exercise						
Attending	0.05 (−0.07 to 0.17)	0.01 (−0.09 to 0.12)	−0.06 (−0.17 to 0.05)	−0.03 (−0.14 to 0.08)	−0.14 (−0.26 to 0.02)[d]	−0.05 (−0.15 to 0.05)
Hospital exercise						
Attending/completed	−0.06 (−0.19 to 0.06)	−0.03 (−0.14 to 0.08)	−0.07 (−0.20 to 0.06)	−0.03 (−0.16 to 0.10)	−0.09 (−0.23 to 0.04)	0.01 (−0.11 to 0.14)
Somatic depression	0.06 (0.03 to 0.09)[f]	0.06 (0.2 to 0.10)[e]	0.02 (−0.01 to 0.06)	−0.02 (−0.06 to 0.01)	0.10 (0.08 to 0.12)[f]	0.02 (−0.01 to 0.05)
Cognitive depression	0.07 (0.03 to 0.11)[f]	0.03 (−0.03 to 0.08)	0.09 (0.05 to 0.12)[f]	0.10 (0.05 to 0.15)[f]	0.11 (0.09 to 0.13)[f]	0.06 (0.04 to 0.09)[f]

[a]Unadjusted models show the association between exercise or depression with hopelessness levels. Separate models are fit for each of the 3 baseline groups.
[b]Adjusted models include home- and hospital-based exercise, cognitive and somatic depressive dimensions, age, sex, and marital status and baseline state or trait hopelessness value. Separate adjusted models are fit for each of the 3 baseline groups.
[c]Beta is the coefficient in the general linear mixed models and can be interpreted as the adjusted or unadjusted effect of exercise or depression. For example, home exercisers on average had 0.11 lower posthospitalization state hopelessness levels compared with nonhome exercisers among those who were most severely hopeless at baseline, after adjusting for other covariates. Thus, after adjusting for demographic and other mental health covariates, home exercise showed a significant association with state hopelessness levels, whereas hospital exercise did not. Furthermore, neither home nor hospital exercise showed significant association with trait hopelessness after adjusting for other variables.
[d]$P < .05$.
[e]$P < .01$.
[f]$P < .001$.

provider resources for patient followup, an individual-focused intervention may be effective in meeting particular health care needs. Strategies recommended by the AHA that could be used as part of an individual-based intervention include motivational interviewing, goal setting, self-monitoring, self-efficacy enhancement, assessment of barriers to change, and regular followup with a health care provider.[36] Future studies should consider a combination of these strategies. Because many patients lack access, time, or insurance to attend a hospital-based program, or do not feel comfortable exercising in a group, home exercise is reasonable alternative. Further examination of home exercise, including potential barriers and outcomes, is necessary.

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