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A Model for Integrating a Mind/Body Approach to Cardiac Rehabilitation

OUTCOMES AND CORRELATORS

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■ **PURPOSE:** Although cardiac rehabilitation programs have been shown to decrease cardiovascular risk, morbidity, and mortality, few programs have integrated a balanced mind/body approach in which patients are taught the relaxation response and utilize cognitive behavior skills for stress management, along with diet and exercise. We examined the medical and psychological outcomes of patients treated in such a cardiac rehabilitation program in a general hospital setting.

■ **METHODS:** From 1997 to 2005, outcomes were measured in 637 patients with coronary artery disease at baseline and after a 3-month program. Components of the intervention included smoking cessation, moderate aerobic exercise, nutrition counseling, relaxation response training, and cognitive/behavioral skills.

■ **RESULTS:** Men and women improved significantly with respect to medical outcomes (blood pressure, lipids, weight, exercise conditioning, frequency of symptoms of chest pain and shortness of breath) and psychological outcomes (general severity index, depression, anxiety, and hostility) ($P < .0001$). Patients considered "at higher risk" for cardiac events due to high baseline measures improved their measures to a less than "at higher risk" level. Data indicate that specific components of the intervention, that is, increased relaxation response practice and exercise, significantly contributed to these improvements ($P < .05$). Furthermore, age and gender differences, particularly for psychological measures, were found; younger patients and female patients had greater improvements than older patients and male patients.

■ **CONCLUSIONS:** This study provides preliminary data for a subsequent randomized control trial to test mind/body-based interventions to determine the most effective outcomes at an affordable cost.

KEY WORDS

cardiac rehabilitation

mind/body approach

outcomes

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Coronary artery disease (CAD) is the leading cause of death in the United States, with estimates for 2006 of 1.2 million new or recurrent coronary events and associated healthcare costs estimated at \$142.5 billion.¹ Suboptimal diet and physical inactivity increase the risk of cardiac events in patients with CAD.² In addition, psychological risk factors play an independent role in

the pathogenesis of CAD.³⁻⁸ A large meta-analysis by Linden et al⁴ demonstrated that psychological interventions, offered in addition to usual care, reduced mortality by 54% for at least 2 years ($P = .002$).

The American Heart Association and the American Association of Cardiovascular and Pulmonary Rehabilitation have recognized the importance of

psychological interventions as a core component of cardiac rehabilitation (CR).⁹ Programs that provide both one-to-one and group meetings, employing healthcare professionals to assess levels of psychological distress and to teach specific stress management skills, have been shown to be beneficial for CAD patients.¹⁰⁻¹⁴ However, it appears that most CR programs offer only limited approaches in this regard.

Medical outcomes from CR programs have been widely studied and reported; however, fewer studies report psychological outcomes. The long-term collection of medical and psychological outcomes data should provide a unique opportunity to evaluate psychological as well as the more commonly assessed medical outcomes. To determine the role of outpatient CR to integrate psychosocial interventions, we conducted a long-term outcome study to evaluate the effectiveness of CR in treating CAD patients in a general hospital setting. Correlations between demographic (age and gender) and intervention variables (exercise and stress management), to program outcome effectiveness, were examined.

METHODS

All participants were CAD outpatients who were referred to and completed a 13-week CR program between 1997 and 2005. Medical conditions motivating referral for treatment included stable angina (38%), myocardial infarction (26%), percutaneous coronary intervention (9%), coronary bypass surgery (20%), and other conditions such as cardiomyopathy and congestive heart failure (7%). The study was approved by the Beth Israel Deaconess Medical Center (Boston, Massachusetts) Committee for Clinical Investigations for retrospective review of data collected from medical records.

Cardiac Rehabilitation Program

The CR program consisted of an initial evaluation by the physician and the clinical nurse specialist, 13 weekly 3-hour group sessions, and a discharge appointment. Sessions were billed under CR codes. Each weekly group had an average of 12 patients and each weekly session consisted of initial data collection (weight, heart rate, and blood pressure), 45 minutes of supervised exercise, a 45-minute relaxation session, a 20-minute snack/meal, and a 45- to 60-minute group discussion. Patients learned a variety of techniques to elicit the relaxation response, including yoga, breath focus, meditation, mindfulness, and visualization. Patients were provided with 2 CD-ROMs of guided relaxation exercises to develop a

regular practice at home. Clinical nurse specialists, specifically trained in mind/body interventions, led the relaxation session and group discussion. Seven of the 13 group discussion sessions were related to stress management that addressed how to recognize stress warning signs and manage stress by using cognitive restructuring skills to challenge negative thinking patterns. Patients applied these skills at home by completing a weekly cognitive journal. Additional skills included effective communication, journaling, and how to deal with the emotional impact of CAD.

Other group discussion topics included nutrition for heart health, healthy cooking, and exercise for health. The Mediterranean diet, 50% to 55% carbohydrates, with an emphasis on fruits, vegetables, and whole grains; 20% to 30% fat, with emphasis on monounsaturated and polyunsaturated fats; and 15% to 20% protein, was recommended to patients. Patients were encouraged to keep a weekly diary log documenting their home practice (exercise, stress management, and nutrition). Each week, the interdisciplinary team reviewed each patient diary and provided recommendations.

Study Measures

All patients referred to the program completed a comprehensive, preintervention clinical assessment of health behaviors, psychological distress, and activity levels; a physiologic assessment of cardiac risk factors; and determination of use of antihypertensive and lipid-lowering medications. After CR completion, a similar postintervention assessment was administered. Study variables were derived from data collected during the pre- and postintervention assessments.

Medical outcome measures

Medical outcome measures were blood pressure, lipids, anthropometrics, and exercise capacity obtained as part of the standard clinical assessments. Three blood pressure measurements were obtained while the patient remained seated as part of the pre- and postintervention assessments. Levels of total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides were also assessed. Anthropometrics measured weight in pounds (same scale, without shoes), waist circumference in inches, and body mass index (BMI). Body mass index was determined using the following formula: weight (kg)/height (m²). Because of cost-containment practices of third-party payers, most patients did not have a symptom-limited exercise stress test pre- and postintervention. Accordingly, to determine changes in physical conditioning, we examined submaximal exercise rate pressure products (RPPs).

Patients “at higher risk” for cardiac events were identified by baseline measures of blood pressure, lipid, waist circumference, and BMI. Patients with a systolic blood pressure (SBP) of 140 mmHg or higher or diastolic blood pressure (DBP) of 90 mmHg or higher, total cholesterol 200 mg/dL or higher, waist circumference more than 40 in in men and more than 35 in in women, or BMI 30 or higher were considered at higher risk.¹⁵

Cardiac symptom ratings

The frequency of chest pain and shortness of breath, which are prevalent among CAD patients, was measured by a modified medical symptom checklist developed by Leserman and Dorrington.¹⁶ Patients rated the frequency of each symptom with a Likert-type scale ranging from 0 (never or almost never) to 8 (constantly).

Psychological outcome measures

Psychological outcomes were measured with the Symptom Checklist-90-Revised (SCL-90-R).¹⁷ The SCL-90-R is a standardized self-report questionnaire assessing psychological distress and is frequently used with medical populations. Its reliability and validity have been demonstrated previously.¹⁸ Each item is rated on a 5-point scale of distress, ranging from “not at all” to “extremely.” The 90 items comprise 9 subscales and an overall global severity index (GSI). The GSI and depression, anxiety, and hostility subscales were also evaluated. Patients with a score above 62 were considered at risk for cardiac events.¹⁸

Exercise and relaxation response practice time

During the pre- and postassessments, patients were asked to complete a questionnaire that included a “yes/no” question about whether they regularly performed aerobic exercise (walking, swimming, and biking) and practiced the relaxation response/meditation. Those who answered “yes” were subsequently asked to answer questions about how many sessions per week and how many minutes per session. Total minutes per week of exercise and relaxation response/meditation time at pre- and postinterventions were then calculated.

Medication use

During the postintervention assessment, patients were asked about whether they changed the use of antihypertensive and lipid-lowering medications using 6 choices: discontinued, started during the program, dose increased, dose decreased, changed type of medication, or never on medications. This medication information was used as a controlling variable in the regression analysis that included all study patients. For the subgroup analysis on patients who

were at higher risk, we included only those patients who did not change antihypertensive and lipid-lowering medications during the program to eliminate possible effects due to changes in medications.

Statistical Analysis

Analyses of changes in outcomes from pre- to postintervention were determined with a paired *t* test for continuous variables and McNemar’s test for binary variables.¹⁹ These tests were used to account for the correlations between the pre- and postintervention data collected from the same patients. A regression analysis was then conducted to estimate the association of outcome changes with age and gender, and with changes in number of minutes of exercise and relaxation response/meditation time from pre- to postintervention, controlling for baseline (preintervention) outcome measures and use of antihypertensive and lipid-lowering medication. To account for missing data in exercise and relaxation response/meditation time, a missing data indicator variable was included in the regression model and replaced the missing data with the mean values.¹⁹

RESULTS

The study population was composed of 637 CAD patients with mean age of 63.3 ± 10.5 years (range = 27–92 years), of which 72% were male, 90% were white, and 41% had higher than a college education. Tables 1 and 2 describe outcome variables at pre- and postinterventions as well as the changes from pre- to postintervention for men and women. Statistically significant ($P < .01$) decreases (indicating improvement) were observed in blood pressure (both SBP and DBP), lipids (total cholesterol, LDL, and triglycerides), anthropometric measures (body weight, waist circumference, and BMI), psychological measures (depression, anxiety, hostility, and GSI), and exercise response (RPP) for both men and women. These improvements were also considered to be clinically significant, particularly for SBP and LDL.^{20,21} Both male and female patients had an approximately 7 mmHg decrease in SBP and a 9 mg/dL reduction in LDL.

Improvements were more evident among those considered “at higher risk” at baseline (Table 3). Among 131 CAD patients with SBP of 140 mmHg or higher or DBP of 90 mmHg or higher (defined as *hypertension*)²² at baseline and who had never taken antihypertensive medications or did not change antihypertensive medications during CR, the average SBP was reduced from 153.3 to 138.7 mmHg ($P < .0001$). Among the subset of CAD patients who had total cholesterol level of 200 mg/dL or higher at baseline

Table 1 • MEDICAL AND PSYCHOLOGICAL OUTCOMES IN MEN

Outcome measures	n ^a	Preintervention		Postintervention		Difference from pre- to postintervention	
		Mean	SD	Mean	SD	Mean	SD
Blood pressure, mmHg							
Systolic	420	132.06	20.40	125.49	17.79	-6.57 ^b	16.17
Diastolic	420	72.92	9.72	70.39	9.53	-2.52 ^b	8.91
Lipids, mg/dL							
Cholesterol	407	167.49	35.59	157.92	33.53	-9.57 ^b	32.21
Low-density lipoprotein	362	95.61	30.65	86.89	27.10	-8.72 ^b	27.14
High-density lipoprotein	397	41.77	10.37	43.33	11.09	1.56 ^b	7.40
Triglycerides	378	157.69	107.27	139.19	94.34	-18.49 ^b	76.91
Anthropometrics							
Weight, lb	448	193.19	34.00	189.44	32.53	-3.75 ^b	6.91
Waist circumference, in	426	40.65	4.97	39.58	4.77	-1.07 ^b	1.30
Body mass index	448	29.49	5.06	28.92	4.86	-0.57 ^b	1.05
Psychological measures (Symptom Checklist-90-Revised)							
Depression	419	59.49	10.63	56.39	10.42	-3.10 ^b	8.85
Anxiety	419	55.29	11.49	53.17	10.79	-2.12 ^b	9.77
Hostility	419	52.63	9.49	51.67	9.49	-0.96 ^c	8.89
Global	419	57.75	10.65	55.12	10.60	-2.63 ^b	8.30
Exercise capacity							
Submaximal exercise rate pressure product	414	14,034.14	3,361.95	12,182.05	2,807.06	-1,852.09 ^b	2,173.31

^aThe number of patients included in the analysis of each outcome measure varied because of missing data.

^b $P < .0001$.

^c $P < .05$.

(defined as *higher risk*) and who were never on lipid-lowering medications or did not change lipid-lowering medications during CR, there was a strong statistical and clinical reduction in lipid measures (total cholesterol: -34.0 mg/dL; LDL: -26.1 mg/dL; and triglycerides: -44.1 mg/dL). Those who had an SCL-90-R *t* score above 62 (considered as "distressed") at baseline dropped to below or near 62 on average (Table 3).

Age and Gender Differences on Outcome Changes

To examine the effects of age and gender differences on outcome changes, baseline measures were taken into account. After controlling for baseline measures, age was not significantly associated with SBP changes ($P > .5$); however, older age was associated with greater decreases in DBP ($\beta = -.11$, $P = .0004$). Age was not associated with changes in any lipid measures or anthropometric measures ($P > .5$). For psychological measurements, younger age was associated with greater improvements in depression ($\beta = .09$, $P = .005$) and GSI ($\beta = .10$, $P = .001$) after adjusting for their baseline scores.

For medical outcomes measures, men generally had lower, more favorable values than women at baseline (SBP: 132 mmHg vs 136 mmHg, $P = .07$;

cholesterol: 167 mg/dL vs 186 mg/dL, $P < .0001$; and LDL: 96 mg/dL vs 103 mg/dL, $P = .02$). After controlling for baseline measures, there was no gender difference in either SBP or DBP changes. However, men had a greater decrease in total cholesterol ($\beta = -6.58$, $P = .015$). As shown in Tables 1 and 2, both men and women had significant increases (indicating improvement) in HDL (1.6 and 2.1 mg/dL, respectively). After adjusting for the baseline value, men had significantly less increases in HDL measures than women ($\beta = -2.4$, $P = .005$). In contrast, for psychological measures, women started with lower (better) baseline psychological scores than men in all 4 subscales of SCL-90-R (Tables 1 and 2; $P < .05$) and had greater improvements even after adjusting for baseline measures ($P < .01$).

Effect of Individual Intervention Component on Outcome Changes

We examined the independent effects of 2 important components of the CR program, exercise time and relaxation response/meditation practices.

Exercise time

Among the 586 patients who had complete pre- and postintervention data on the yes/no question about

Table 2 • MEDICAL AND PSYCHOLOGICAL OUTCOMES IN WOMEN

Outcome measures	n ^a	Preintervention		Postintervention		Difference from pre- to postintervention	
		Mean	SD	Mean	SD	Mean	SD
Blood pressure, mmHg							
Systolic	156	135.59	20.43	128.92	16.69	-6.68 ^b	15.52
Diastolic	156	71.54	9.16	69.26	8.03	-2.28 ^c	9.26
Lipids, mg/dL							
Cholesterol	145	186.24	38.92	174.06	30.91	-12.18 ^b	33.09
Low-density lipoprotein	133	103.12	34.00	93.58	28.14	-9.54 ^d	30.50
High-density lipoprotein	139	51.27	13.49	53.41	14.96	2.14 ^e	10.99
Triglycerides	136	158.17	91.72	129.84	67.02	-28.33 ^b	64.96
Anthropometrics							
Weight, lb	168	165.40	38.56	162.36	36.73	-3.05 ^b	6.43
Waist circumference, in	157	36.41	6.21	35.50	6.07	-0.91 ^b	1.32
Body mass index	168	29.40	6.44	28.87	6.18	-0.53 ^b	1.14
Psychological measures (Symptom Checklist-90-Revised)							
Depression	155	56.48	9.14	52.44	9.29	-4.05 ^b	7.90
Anxiety	155	53.12	10.23	48.91	8.78	-4.21 ^b	9.03
Hostility	155	51.00	9.62	48.48	8.36	-2.52 ^d	8.71
Global	155	56.12	9.22	51.81	9.26	-4.30 ^b	7.84
Exercise capacity							
Submaximal exercise rate pressure product	154	14,306.09	3,485.75	12,524.86	2,783.43	-1,781.23 ^b	2,243.28

^aThe number of patients included in the analysis of each outcome measure varied because of missing data.^b $P < .0001$.^c $P < .01$.^d $P < .001$.^e $P < .05$.

exercise, 41% initiated an exercise program after joining CR, 55% were exercising before joining CR and continued to exercise until the end of CR, and 4% were not exercising at the end of CR. On average, there was a 95-min/wk increase (94–189 minutes) in exercise time from pre- to postintervention ($n = 565$).

To estimate the effect of self-reported exercise time on the study outcomes, we adjusted for the baseline measures. There was a strong association between increases in exercise time and decreases in weight ($P = .008$), waist circumference ($P = .01$), BMI ($P = .004$), and submaximal exercise RPP ($P = .007$). Similar results were obtained after further adjusting for age, gender, lipid and hypertension medication usage, and missing data (Table 4). However, exercise time was not found to be associated with improvements in psychological measures.

Relaxation response/meditation time

Among 583 patients who had complete data on the yes/no question about relaxation response practice, 76% started to meditate after joining CR, 11% were meditating before joining CR and continued to meditate until the end CR, and 13% were not meditating by the end of CR. On average, there was an increase of 72 min/wk (12–84 minutes) in relaxation response

time from pre- to postintervention ($n = 540$). Women had a greater increase in relaxation response time than men (85 minutes vs 66 minutes, $P = .005$); however, age was not associated with changes in relaxation response time.

The increase in relaxation response time from pre- to postintervention was significantly associated with greater improvements in depression ($P = .01$) after adjusting for baseline measures. After further adjusting for age, gender, lipid and hypertension medication usages, and missing data, similar results remained (see Table 4). However, relaxation response time was not found to be associated with changes in blood pressure, anthropometric measures, or lipid measures.

Medical Symptoms

We examined 2 common medical symptoms reported among CAD patients. There were significant improvements in symptoms of chest pain and shortness of breath (McNemar test, $P = .0016$ and $P = .0001$, respectively). Approximately half of the patients (270/566) reported symptoms of chest pain at the preintervention assessment. Thirty-six percent (96/270) of these patients reported no chest pain at

Table 3 • MEDICAL AND PSYCHOLOGICAL OUTCOMES IN PATIENTS WITH CORONARY ARTERY DISEASE WHO WERE AT HIGHER RISK

Outcome measures	n	Preintervention		Postintervention		Difference from pre- to postintervention	
		Mean	SD	Mean	SD	Mean	SD
Blood pressure, ^a mmHg							
Systolic	131	153.31	13.30	138.65	13.70	-14.66 ^b	14.69
Diastolic	131	77.73	9.60	72.35	9.12	-5.38 ^b	7.92
Lipids, ^c mg/dL							
Cholesterol	88	220.61	22.90	186.66	30.33	-33.95 ^b	29.66
Low-density lipoprotein	74	136.27	25.07	110.22	29.39	-26.05 ^b	30.70
High-density lipoprotein	83	47.25	14.38	47.45	14.05	0.19	7.97
Triglycerides	81	201.49	112.25	157.37	86.74	-44.12 ^b	78.97
Anthropometrics ^d							
Weight, lb							
Male	236	213.49	32.00	208.42	31.08	-5.07 ^b	7.54
Female	89	191.48	33.52	187.48	31.55	-4.00 ^b	7.81
Waist, in							
Male	223	44.06	4.20	42.75	4.16	-1.31 ^b	1.38
Female	85	40.96	4.52	39.82	4.73	-1.14 ^b	1.44
Body mass index	325	33.16	4.75	32.41	4.62	-0.75 ^b	1.22
Psychological measures ^e							
(Symptom Checklist-90-Revised)							
Depression	198	69.72	5.63	62.78	9.46	-6.94 ^b	8.69
Anxiety	134	69.66	5.81	61.51	9.59	-8.15 ^b	8.97
Hostility	94	67.56	5.12	59.51	10.06	-8.05 ^b	9.54
Global	170	69.18	5.27	62.87	9.10	-6.31 ^b	8.46

^aPatients included in the analysis of blood pressure outcomes were those who had baseline SBP of 140 mmHg or more or baseline DBP of 90 mmHg or more and also never took antihypertensive medications nor changed their antihypertensive medications during cardiac rehabilitation.

^b $P < .0001$.

^cPatients included in the analysis of lipid outcomes were those who had baseline cholesterol levels of 200 mg/dL or more and also never took lipid-lowering medications nor changed their lipid-lowering medications during cardiac rehabilitation.

^dPatients included in the analysis of anthropometric outcomes were those men who had baseline waist circumference of more than 40 in or baseline BMI of 30 or more and those women who had baseline waist circumference of more than 35 in or baseline BMI of 30 or more.

^ePatients included in the analysis of each subscale of the psychological outcomes were those who had the baseline score of more than 62 within each subscale.

the postintervention assessment. Forty percent of patients ($n = 220$) reported having symptoms of shortness of breath at the preintervention assessment, but at the postintervention, 104 of these 220 (47%) reported no shortness of breath.

DISCUSSION

The study showed both statistical and clinical improvements in medical and psychological outcomes for both male and female CAD patients, and particularly for those who were considered "at higher risk" at baseline. Observed reductions of 6.6 mmHg in SBP is greater than the reported reduction of 3.5 mmHg by exercise alone and the effect of a reduction of 5.5 mmHg from the Dietary Approaches to Stop Hypertension Diet.^{23,24} In addition, observed reductions in lipid and blood pressure levels at 3

months were comparable with the findings from other major lifestyle intervention studies with similar intervention components.^{10-12,25,26} A downward shift of 3 mmHg in SBP has been shown to decrease mortality from stroke by 8% and from CAD by 5%²⁰ and a simultaneous 5 mmHg reduction in SBP and DBP conferred a 5-year cardiovascular risk reduction of 19.7%.²⁷ Furthermore, for every 1% reduction in LDL cholesterol level, a 1% reduction in risk of major CAD has been demonstrated.²⁸ The improvement observed in the medical outcomes of male and female patients who completed the program demonstrated great clinical potential for reducing mortality and morbidity. Our findings of age and gender differences in the improvement from program participation may have significant clinical implications for CR. For example, to achieve a similar degree of improvement as in younger patients, a longer duration of intervention may be needed for older patients. Program facilitators

Table 4 • REGRESSION ANALYSIS RESULTS FOR PREDICTING MEDICAL AND PSYCHOLOGICAL OUTCOME CHANGES BY EXERCISE AND RELAXATION RESPONSE/MEDITATION PRACTICE TIME^a

Predictor	Blood pressure				Lipids				Anthropometrics				Exercise							
	SBP		DBP		TC		LDL		HDL		Trig		Weight		WC		BMI		RPP	
	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Age, y	.040	0.057	−.11 ^b	0.031	.10	0.11	−0.029	0.099	.0078	.035	.21	0.27	−.0029	0.026	.0045	0.0051	.0028	0.0040	−6.34	7.47
Gender, male	−1.28	1.26	.25	0.73	−6.85 ^c	2.61	−3.96	2.30	−2.37 ^c	.88	9.96	6.22	1.00	0.62	.12	0.13	−.025	0.093	−249.82	170.05
Exercise time (per 10-min increase/wk)	−.074	0.048	−.023	0.028	−.11	0.096	−.11	0.088	−.0020	.031	−.37	0.24	−.058 ^d	0.023	−.011 ^d	0.0045	−.010 ^e	0.0036	−18.74 ^e	6.52
R ²	.33		.29		.38		.39		.07		.33		.14		.10		.12		.35	

Predictor	Psychological measures (SCL-90-R)							
	Depression		Anxiety		Hostility		Global	
	β	SE	β	SE	β	SE	β	SE
Age, y	.10 ^c	0.031	.046	0.033	.062 ^d	0.031	.11 ^b	0.030
Gender, male	1.91 ^c	0.74	3.15 ^e	0.78	2.25 ^c	0.73	2.15 ^c	0.71
Relaxation response/meditation time (per 10-min increase/wk)	−.12 ^d	0.049	−.043	0.052	−.070	0.048	−.067	0.047
R ²	.23		.30		.27		.20	

Predictor	Psychological measures (SCL-90-R)							
	Depression		Anxiety		Hostility		Global	
	β	SE	β	SE	β	SE	β	SE
Age, y	.10 ^c	0.031	.046	0.033	.062 ^d	0.031	.11 ^b	0.030
Gender, male	1.91 ^c	0.74	3.15 ^e	0.78	2.25 ^c	0.73	2.15 ^c	0.71
Relaxation response/meditation time (per 10-min increase/wk)	−.12 ^d	0.049	−.043	0.052	−.070	0.048	−.067	0.047
R ²	.23		.30		.27		.20	

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; HDL, high-density lipoprotein; LDL, low-density lipoprotein; RPP, submaximal exercise rate pressure product; SBP, systolic blood pressure; SCL-90-R, Symptom Checklist-90-Revised; TC, total cholesterol; Trig, triglycerides; WC, waist circumference; β, slope.

^aThe regression analysis controlled for baseline measure, hypertension and lipid medications, and missing data indicator.

^b*p* < .001.

^c*p* < .01.

^d*p* < .05.

^e*p* < .0001.

might want to encourage male patients to engage in more relaxation practices to result in greater improvements in psychological outcomes.

Recent studies provide convincing evidence that psychosocial risk factors play a significant and independent role in the pathogenesis of CAD.^{4-6,29,30} The CR program in this study successfully decreased the psychological distress of those patients who were at higher risk for cardiac mortality and morbidity to levels below the higher risk criterion. Relaxation response practice was found to be associated with these improvements in psychological outcomes, particularly in measures of depression. Indeed, 75% of patients reported that they practiced the relaxation response after joining the program. The success of the CR program in engaging patients to practice relaxation response, which is associated with improvement in psychological outcomes, demonstrates the value of including mind/body psychological interventions in CR.

This study has several limitations. As an observational study that used data collected from a real-world clinical setting, this analysis did not include a control group for comparison. Therefore, we cannot attribute all the observed improvements to the interventions provided in the CR program. However, our data provide some evidence of real-world effectiveness and found that 2 main components of the intervention, the relaxation response and exercise, contributed to specific improvements. Another limitation is that the data were obtained from a single clinic that serves mainly white and highly educated patients. Future studies should include patients with a variety of races and education levels to increase the generalizability of our findings.

In conclusion, our data demonstrate the success and effectiveness of a mind/body CR program in reducing medical and psychological risks in men and women with CAD. Future randomized trials are needed to further investigate the effect of integrating mind/body interventions into CR.

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References

1. American Heart Association. *Heart and Stroke Statistical Update*. Dallas, TX: American Heart Association; 2006.
2. Elmer PJ, Obarzanek E, Vollmer WM, et al. Effects of comprehensive lifestyle modification on diet, weight, physical fitness, and blood pressure control: 18-month results of a randomized trial. *Ann Intern Med*. 2006;144:485-495.
3. Schuler G, Hambrecht R, Schlierf G, et al. Regular physical exercise and low-fat diet: effects on progression of coronary artery disease. *Circulation*. 1992;86:1-11.
4. Linden W, Phillips M, Leclerc J. Psychological treatment of cardiac patients: a meta-analysis. *Eur Heart J*. 2007;28:2972-2984.
5. Trigo M, Silva D, Rocha E. Psychosocial risk factors in coronary heart disease: beyond type A behavior. *Rev Port Cardiol*. 2005;24:261-281.
6. Kubzansky LD, Davidson KW, Rozanski A. The clinical impact of negative psychological states: expanding the spectrum of risk for coronary artery disease. *Psychosom Med*. 2005;67(suppl 1):S10-S14.
7. Rozanski A, Blumenthal JA, Kaplan J. Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. *Circulation*. 1999;99:2192-2214.
8. Blumenthal JA, Jiang W, Babyak MA, et al. Stress management and exercise training in cardiac patients with myocardial ischemia. Effects on prognosis and evaluation of mechanisms. *Arch Intern Med*. 1997;157:2213-2223.
9. Balady GJ, Williams M, Ades P, et al. Core components of cardiac rehabilitation (secondary prevention programs): 2007 update. A scientific statement from the American Heart Association and the American Association of Cardiovascular and Pulmonary Rehabilitation. *Circulation*. 2007;115:2675-2682.
10. Daubenmier JJ, Weidner G, Sumner MD, et al. The contribution of changes in diet, exercise, and stress management to changes in coronary risk in women and men in the multisite cardiac lifestyle intervention program. *Ann Behav Med*. 2007;33:57-68.
11. Jatuporn S, Sangwatanaroj S, Saengsiri AO, et al. Short-term effects of an intensive lifestyle modification program on lipid peroxidation and antioxidant systems in patients with coronary artery disease. *Clin Hemorheol Microcirc*. 2003;29:429-436.
12. Sundin O, Lisspers J, Hofman-Bang C, et al. Comparing multifactorial lifestyle interventions and stress management in coronary risk reduction. *Int J Behav Med*. 2003;10:191-204.
13. Linden W, Stossel C, Maurice J. Psychosocial interventions for patients with coronary artery disease: a meta-analysis. *Arch Intern Med*. 1996;156:745-752.
14. van Dixhoorn JJ, Duivenvoorden HJ. Effect of relaxation therapy on cardiac events after myocardial infarction: a 5-year follow-up study. *J Cardiopulm Rehabil*. 1999;19:178-185.
15. Smith SC Jr, Allen J, Blair SN, et al. AHA/ACC guidelines for secondary prevention for patients with coronary and other atherosclerotic vascular disease: 2006 update: endorsed by the National Heart, Lung, and Blood Institute. *Circulation*. 2006;113:2363-2372.
16. Borensynko J. *Mind the Body, Mending the Mind*. New York: Addison-Wesley; 1987.
17. Derogatis LR. *The SCL-90-R: Administration, Scoring and Procedures Manual II*. Baltimore: Clinical Psychometric Research; 1992.
18. Allison TG, Williams DE, Miller TD, et al. Medical and economic costs of psychologic distress in patients with coronary artery disease. *Mayo Clin Proc*. 1995;70:734-742.
19. Cohen J, Cohen P. *Applied Multiple Regression/Correlation Analysis for Behavioral Science*. 3rd ed. Hillsdale, NJ: Erlbaum; 1983.
20. The fifth report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (JNC V). *Arch Intern Med*. 1993;153:154-183.
21. Pasternak RC, Grundy SM, Levy D, et al. 27th Bethesda Conference: matching the intensity of risk factor management

- with the hazard for coronary disease events. Task Force 3. Spectrum of risk factors for coronary heart disease. *J Am Coll Cardiol*. 1996;27:978-990.
22. Chobanian AV, Bakris GL, Black HR, et al. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA*. 2003;289:2560-2572.
23. Bacon SL, Sherwood A, Hinderliter A, Blumenthal JA. Effects of exercise, diet and weight loss on high blood pressure. *Sports Med*. 2004;34:307-316.
24. Appel L, Moore T, Obarzanek E, et al. A clinical trial of the effects of dietary patterns on blood pressure. *New Engl J Med*. 1997;336:1117-1124.
25. Law MR, Wald NJ, Rudnicka AR. Quantifying effect of statins on low density lipoprotein cholesterol, ischaemic heart disease, and stroke: systematic review and meta-analysis. *BMJ*. 2003;326:1423.
26. Ornish D, Brown SE, Scherwitz LW, et al. Can lifestyle changes reverse coronary heart disease? The Lifestyle Heart Trial. *Lancet*. 1990;336:129-133.
27. Glynn RJ, L'Italien GJ, Sesso HD, et al. Development of predictive models for long-term cardiovascular risk associated with systolic and diastolic blood pressure. *Hypertension*. 2002;39:105-110.
28. Grundy SM, Cleeman JI, Merz CN, et al. Implications of recent clinical trials for the National Cholesterol Education Program Adult Treatment Panel III guidelines. *Arterioscler Thromb Vasc Biol*. 2004;24:e149-e161.
29. Parashar S, Rumsfeld JS, Spertus JA, et al. Time course of depression and outcome of myocardial infarction. *Arch Intern Med*. 2006;166:2035-2043.
30. Frasure-Smith N, Lesperance F, Gravel G, et al. Social support, depression, and mortality during the first year after myocardial infarction. *Circulation*. 2000;101:1919-1924.

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