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Dispositional Optimism as a Predictor of Health Changes among Cardiac Patients

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We examined in a longitudinal study whether dispositional optimism (as measured by the Life Orientation Test) predicts success in making health changes associated with lower risk of coronary heart disease. Subjects were 22 patients participating in an 18 week cardiac rehabilitation program. As part of the program all patients were assigned goals (e.g., reduce weight by 20 lbs) designed to decrease the risk of a cardiac event. Optimism measured at the outset of the program was associated with greater success in achieving lower levels of saturated fat, body fat, and global coronary risk, and with greater success in increasing aerobic capacity by the end of the program. Moreover, these effects were significant after controlling for the magnitude of the goal, the number of health changes, and negative affect.

According to the Bureau of Census, diseases of the cardiovascular system are the most prevalent cause of death in the United States, annually afflicting 4 of every 1,000 people (Masbacher, 1990). Close to 60 billion dollars is

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spent annually on medical expenses related to myocardial infarctions alone (Krantz & Blumenthal, 1987). Yet cardiovascular diseases do not strike randomly. Medical researchers have identified a variety of factors that place individuals at increased risk of heart disease. These cardiac risk factors include smoking, a diet high in cholesterol and saturated fat, high levels of body fat, high blood levels of cholesterol and low density lipoproteins, hypertension, a sedentary lifestyle, a family history of heart disease, and being overweight (McArdle, Katch, & Katch, 1981). Awareness of these risk factors has resulted in remarkable changes in the lifestyles of Americans over the past 20 years (Higgins & Luepker, 1988), ranging from increased exercise to modification of diet (i.e., decreased fat intake and increased fiber intake). These lifestyle changes likely contributed to the decline in the mortality rate associated with coronary heart disease (CHD) observed since 1968 (Higgins & Luepker, 1988).

The identification of cardiac risk factors has also led to the development of behavioral rehabilitation programs designed to assist individuals who have suffered or are at risk to suffer a cardiac event (e.g., myocardial infarction or coronary artery bypass surgery) make health changes that reduce their future risk. There is evidence that these rehabilitation programs are effective in assisting individuals in making health-related lifestyle changes (Lovibond, Birrell, & Langeluddecke, 1986). Nevertheless, not all participants in cardiac rehabilitation programs respond favorably. Some exhibit substantial health changes at the end of the treatment program whereas others do not. Although there are many reasons for individual differences in response to an intervention program, the present study examined whether changes in health outcomes associated with lower risk of CHD (e.g., lower cholesterol, less body fat, greater aerobic capacity) are related to individual differences in dispositional optimism. Specifically, we examined whether people who are high in dispositional optimism are more successful than people low in dispositional optimism at making changes in health outcomes associated with lower risk for CHD.

Dispositional Optimism and Successful Health Changes

Dispositional optimism refers to the belief that one's outcomes will be positive rather than negative (Scheier & Carver, 1985). Optimists are more likely than pessimists to believe that good outcomes are attainable and bad outcomes are avoidable. As a result optimists exert greater effort toward attaining desired outcomes, whereas pessimists reduce or withdraw effort and eventually abandon desired goals (Carver & Scheier, 1981; Scheier & Carver, 1988). Thus, optimists are more successful at attaining desired outcomes than are pessimists.

Several studies have demonstrated that having positive outcome expectan-

cies, i.e., being an optimist, confers important benefits to individuals undergoing hardships or facing adversities. For example, in a prospective study of college undergraduates, optimism measured midsemester correlated negatively with report of physical symptoms of illness four weeks later, just prior to final exams (Scheier & Carver, 1985). Other research reveals that optimists are more successful than pessimists at completing an inpatient aftercare program for alcoholism (Carver & Blaney, 1987). Finally, a study of pregnant women revealed that optimism measured during the third trimester was negatively correlated with postpartum depression (Carver & Gaines, 1987).

Most pertinent to the present research is a study examining the relationship between optimism and recovery from coronary artery bypass surgery (Scheier, Matthews, Owens, *et al.*, 1989). In this study, optimists were more likely than pessimists to take an active role in their recovery from coronary bypass surgery. Optimists also demonstrated quicker physical recovery during hospitalization and a faster rate of return to their normal daily routine following discharge. Finally, optimism measured prior to surgery correlated positively with life satisfaction and happiness six months later.

Taken together, this research provides compelling evidence that optimists recover more quickly and more successfully from health problems than do pessimists. Yet, for coronary patients, the recovery process often involves more than returning to one's daily routine or feeling happy or satisfied with life. It often involves significant changes in risk factors, including substantial changes in diet and activity that reduce the risk of future coronary events. Given that optimists are more likely to believe that desired outcomes are attainable and, consequently, to exert greater effort than pessimists toward achieving desired outcomes, optimists should be more successful than pessimists at making the health changes associated with reduced risk of CHD.

Perhaps optimists are more successful than pessimists at making health changes because optimists use more effective coping styles when confronting problems. Several studies reveal that optimists are more likely to employ coping strategies that involve making plans and taking direct steps toward finding a solution, whereas pessimists are inclined to use coping strategies that involve mentally or behaviorally withdrawing from the situation (Carver, Scheier, & Weintraub, 1989; Scheier, Weintraub, & Carver, 1986). There also is evidence that the different coping strategies are associated with long term health outcomes, with problem-focused strategies linked to better health outcomes and with withdrawal-based strategies linked to poorer health outcomes (Scheier *et al.*, 1989; Suls & Fletcher, 1985). Given this previous research, we anticipated that optimism and pessimism would be associated with different coping styles and that these coping styles, in turn, would be differentially associated with success in making health and lifestyle changes associated with reduced risk of CHD.

Overview and Hypotheses

The present study examined the relationship of dispositional optimism to success at making health changes associated with lower risk of CHD. The progress of patients participating in an 18 week cardiac rehabilitation program was monitored by a team of cardiologists, nurses, exercise specialists, a psychologist, physical and occupational therapists, and a nutritionist. Status on a variety of risk factors (cholesterol level, body fat, saturated fat in diet, activity level, smoking status, aerobic capacity, etc.) was assessed at the outset and completion of the program. During the program, patients attended exercise sessions three times a week and met weekly to monthly with a cardiac rehabilitation nurse who assisted patients in setting exercise and dietary goals and who supervised patients' progress throughout the program.

We predicted that optimists would be more successful than pessimists at making health changes associated with lower risk of CHD. Specifically, at the end of the treatment program, we predicted that optimists would be more successful at achieving their health goals for body fat, saturated fat in the diet, cholesterol level, levels of high and low density lipoproteins (HDL and LDL), weight loss, aerobic capacity, and global coronary risk. We also predicted that dispositional optimism would be positively associated with the use of problem-focused coping strategies and negatively associated with the use of withdrawal-based coping strategies. Finally, we predicted that problem focused strategies would be positively associated with making health changes, whereas withdrawal-based coping would be negatively associated with making health changes.

METHODS

Participants and Setting

Participants were new patients admitted to an 18 week, phase 3, cardiac rehabilitation program at the Center for Health and Fitness at the University of Massachusetts Medical Center between October 1989 and April 1990. The program targets people who have recently had a heart attack, heart surgery, angina pectoris, or have been diagnosed as having cardiovascular disease, high cholesterol, or high blood pressure. All patients were referred to the program by a physician and gave signed consent to participate in the study. Of the 25 eligible patients in the program during the study period, three withdrew early because of insurance payment problems. Thus, data were available from 22 patients (18 male, 4 female). Two of the male patients were Asian. All other patients were white. Of the remaining 22 patients, 13 were recovering from a myocardial infarction (MI), 6 were recovering from coronary artery bypass surgery, and 3 were experiencing angina. The MI and angina diagnoses were made by the referring physician and not the rehabilitation staff. Participants ranged in age from 40 to 80 ($M = 61$).

Instruments and Materials

At the beginning of the rehabilitation program, participants completed measures of dispositional optimism, coping strategies, depressive symptoms, and health and lifestyle history.

Dispositional Optimism. We assessed dispositional optimism using the Life Orientation Test (LOT; Carver & Scheier, 1985), an 8-item, 4-step Likert-type instrument (1 = strongly disagree, 4 = strongly agree) measuring the favorability of a person's generalized outcome expectancies. Previous research suggests that the LOT is both internally consistent and stable over time (Carver & Scheier, 1985). In the present sample, the mean optimism score was 26.18 (SD = 5.46).

Coping Strategies. We assessed coping strategies using portions of the multidimensional coping inventory scale (COPE; Carver *et al.,* 1989). The COPE has two formats, one assessing dispositional styles and the other assessing situational use of the strategies. We focused on the dispositional styles format. Although the COPE measures a variety of coping strategies, we concentrated on four: two that are problem-focused (active coping and planning) and two that are focused on withdrawal (mental disengagement and behavioral disengagement). Active coping involves taking steps toward removing or alleviating a stressor or its effects, whereas planning involves devising plans or strategies for dealing with the problem. Behavioral disengagement is the reduction of effort in response to a stressor or the abandonment of goals that are impeded by the stressor. Mental disengagement is the process of cognitively distancing oneself from a stressor through distracting oneself or ignoring or ''forgetting'' the problem.

Participants respond to items on the COPE using a four-step scale (1 = I usually don't do this at all, 4 = I usually do this a lot). Of the four coping strategies, only mental disengagement suffers from low internal consistency (Cronbach's alpha = .45), perhaps attributable to the scale representing a multiple-act criterion (see Carver *et al.,* 1989). The test–retest reliability coefficients for the four strategies range from .42 to .69 (Carver *et al.,* 1989), suggesting that the scales are relatively stable but also may be situation-specific.

Given the conceptual similarity between active coping and planning and between behavioral and mental disengagement, we combined items from the four scales to form two instruments; one representing problem-focused coping and one representing withdrawal-based coping. In our sample, the mean score for the measure of problem-focused coping was 24.45 (SD = 5.44); the mean score for the measure of withdrawal-based coping was 12.32 (SD = 3.39).

Depressive symptoms. We measured depressive symptoms using the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). Because the patients had just undergone a life threatening event and were facing a variety of major life changes, scores on the BDI were high (M = 18.82, SD = 5.83; Range 10–32).

Outcome Measures

Our primary interest was in the temporal change of eight coronary risk factors (global coronary risk, aerobic capacity, percent body fat, weight, percent saturated fat, cholesterol, HDL, and LDL levels). Consequently, we examined participants' status on each of the eight coronary risk factors both at the beginning and at the end of the 18 week rehabilitation program.

Global Coronary Risk. Overall coronary risk was assessed using the Heart Chec Plus Questionnaire (Wellsource Inc., 1987), a self-report screening instrument that identifies health and lifestyle history related to coronary risk. This questionnaire assesses family and personal history of related diseases, symptoms related to coronary disease, medications, aerobic capacity, stress level, smoking status, and alcohol consumption. Also included are items assessing diet and nutrition. These data, along with several diagnostic screening tests (e.g., blood pressure, cholesterol, high density lipoproteins, blood glucose levels, and height/weight ratios), are combined to form a coronary risk score that reflects the person's susceptibility to developing coronary heart disease. Responses to the questionnaire are used in designing programs that assist patients in making lifestyle changes necessary to reduce their coronary risk.

Aerobic Capacity. Each patient underwent a supervised submaximal treadmill test using the Bruce Protocol (Bruce, 1972) to determine aerobic capacity. This protocol systematically increases both the percent grade of the treadmill and the speed of the treadmill (mph) in 3-min

intervals. Aerobic capacity is a measure of the level of cardiopulmonary endurance. Exercise increases aerobic capacity and may decrease the risk of developing CHD.

Percent Body Fat. Percent body fat was measured using a skinfold caliper or by measuring circumference (the latter for significantly overweight patients). The skinfold caliper provides a measure of the ratio of fat to lean body mass.

Other Risk Factors. Information regarding patients' weight, percent of total dietary fat in diet that is saturated fat, blood cholesterol level, and levels of high density lipoproteins (HDL) and low density lipoproteins (LDL) were obtained based on laboratory tests conducted both at the beginning and at the end of the 18 week program. Finally, information regarding patients' smoking history was recorded. However, too few patients were smokers ($n = 3$) to allow us to examine the effect of smoking on success at making health changes.

Procedures

On entry into the cardiac rehabilitation program, patients completed a battery of questionnaires including the LOT, the abridged COPE, and the Heart Chec Plus Questionnaire. Next, patients underwent a variety of tests to determine their status on several cardiac risk factors. These tests assessed patients' weight, percent body fat, blood cholesterol, HDL and LDL levels, and aerobic capacity.

Patients then met individually with a cardiac rehabilitation nurse who assisted them in setting specific goals for each of their relevant cardiac risk factors, including the eight outcome measures. The goals were established by mutual consent, but were based in part on the exercise prescription established by the American College of Sports Medicine (1986) and on the nurse's estimate of what was a reasonably achievable four month goal for the patient. That is, the cardiac rehabilitation nurse reviewed the medical and psychosocial/health behavior data and made recommendations to the patient as to the goals which would improve health. These recommendations were then discussed with the participant and goals were negotiated based on the participant's preference. The nurse was blind to patients' optimism score and blind to the purpose of the study.

Because patients differed in their initial levels on the various risk factors and in the magnitude of the goals that were set, we focused primarily on the degree to which patients reached each of the goals set for them. The degree to which patients reached each goal was determined by dividing the magnitude of change achieved for a particular variable (e.g., initial body fat minus body fat at end of the program) by the magnitude of the recommended goal relative to the patients' initial status (e.g., initial body fat minus body fat goal). The degree to which patients reached their goals (i.e., the percent of each goal attained) on the eight outcome measures at the end of the treatment program served as the primary dependent measures.

Worthy of note is that not all patients were at risk on all of the outcome measures. For example, three of the 22 patients were not at risk in their dietary intake of saturated fat, and eight of the 22 patients did not have high cholesterol. In such cases, patients were instructed that their goal was to maintain their current level or status on that risk factor and the data for these patients on that risk factor were excluded from analyses.

Over the next 18 weeks, the staff of the Center for Health and Fitness recorded patient progress. Patients attended educational sessions and participated in a cardiovascular conditioning program that concentrated on increasing aerobic capacity. Finally, patients continued to meet individually with their cardiac rehabilitation nurse who monitored their weight, diet, and activity levels, and discussed strategies for making the recommended health changes and reaching the agreed upon health-related goals. The strategies typically involved changing diet and increasing activity levels and, for the three smokers, ways to reduce smoking. At the end of the cardiac rehabilitation program, the program staff again assessed patient status on the eight outcome measures. Throughout, the staff were blind to patients' optimism scores.

TABLE 1
Change in Outcome Measures across Time

Variable	Time 1		Time 2		Mean health change recommended			
	Mean	*SD*	Mean	*SD*	Mean	*SD*	*t*	*p*
Weight (lbs)	175.45	31.59	168.27	26.82	16.39	13.33	5.24	.0001
Percent body fat	27.48	6.68	25.52	5.93	7.06	4.52	5.83	.0001
Cholesterol (mg/dl of blood)	207.68	28.36	196.91	27.60	23.64	15.49	5.75	.0001
Percent of total dietary fat that is saturated fat	51.73	13.12	49.36	9.03	14.75	11.07	3.72	.002
High density lipoproteins (mg/dl of blood)	38.00	12.04	40.73	10.99	10.10	5.97	5.04	.0001
Low density lipoproteins (mg/dl of blood)	137.05	22.59	134.09	8.76	21.93	18.48	4.32	.0008
Aerobic capacity (METS)	22.36	6.46	24.82	6.80	4.59	3.02	6.65	.0001
Global coronary risk (questionnaire score)	61.82	4.44	55.95	6.39	11.81	6.22	6.03	.0001

Note. Each variable is reported in the metric associated with that variable (e.g., weight is reported in terms of pounds). The final two columns present the statistical comparison of responses at the beginning (Time 1) and end (Time 2) of the rehabilitation program.

RESULTS

We first examined whether participants improved their status on the outcome measures at the end of the 18 week rehabilitation program. Table 1 presents the means and standard deviations for the eight outcome measures at the beginning and end of the program. Also presented in Table 1 are the mean and standard deviation of the magnitude of the health goal for each of the outcome measures. Participants significantly decreased their weight, body fat, blood cholesterol, saturated fat, LDL, and global coronary risk, and significantly increased their levels of HDL and aerobic capacity at the end of the rehabilitation program compared to the beginning of the program.

We next examined whether optimism predicted the extent to which participants were successful in reaching their outcome goals. This occurred in two stages: selecting predictors and conducting regression analyses. In the first stage, we examined the suitability of five different predictors for inclusion in regression analyses: age, sex, the magnitude of the goal (e.g., lose 30 pounds), the level of the criterion at the beginning of the program (e.g., the patient's initial weight), and dispositional optimism. The zero-order correlations (see Table 2) between the five potential predictors and the outcome measures revealed that sex and the level of the criterion at the outset of the program were not (with one exception) significantly correlated with any of

TABLE 2
Zero-Order Correlations between Potential Predictors and the Percent Change in Health Outcomes at the End of the Program

Predictors	Percent body fat	Percent saturated fat	Percent cholesterol	Percent weight
Age	−.51[b]	.05	.17	−.38
Sex	.09	.18	.01	.04
Magnitude of the goal	−.06	.09	−.57[b]	.16
Initial status on criterion measures	.04	.15	−.49[a]	.25
Optimism	.81[c]	.66[c]	.30	.36
	Percent high density lipids	Percent low density lipids	Percent aerobic capacity	Percent global coronary risk
Age	.03	.06	.14	.00
Sex	.32	.11	.35	−.10
Magnitude of the goal	.42[a]	−.25	.25	.32
Initial status on criterion measures	.27	−.25	−.06	.10
Optimism	.43[a]	.48[a]	.45[b]	.43[b]

[a] $p < .10$.
[b] $p < .05$.
[c] $p < .01$.

the outcome measures. The exception was a significant correlation between initial cholesterol level and the percent of the cholesterol goal reached. However, the correlation between initial cholesterol level and the magnitude of the cholesterol goal was so high ($r = .91$) as to make these predictors virtually redundant. The redundancy threatened to bias the least-squares estimates. Consequently, initial cholesterol level was omitted as a predictor. In the end, the regression analyses were conducted using only three predictors: age, the magnitude of the goal, and dispositional optimism.

Including the magnitude of the goal as a predictor controlled for the fact that some patients faced more formidable health change goals than did other patients. For example, a patient instructed to lose 50 lbs has a more difficult goal than a patient instructed to lose 10 lbs. Of note, optimism and the magnitude of the goal were uncorrelated with the exception of a near significant correlation between optimism and the magnitude of the goal for cholesterol ($r = -.46$, $p < .10$).

Table 3 presents the zero order correlations between age, dispositional optimism, and the magnitude of the goal associated with each of the eight

TABLE 3
Zero-Order Correlations of Age, Optimism, and the Magnitude of the Health Change Goals

Predictors	Magnitude of body fat goal	Magnitude of saturated fat goal	Magnitude of cholesterol goal	Magnitude of weight goal
Optimism	.00	.16	−.46[a]	.12
Age	−.26	−.24	−.10	−.36
	Magnitude of high density lipids goal	Magnitude of low density lipids goal	Magnitude of aerobic capacity goal	Magnitude of global coronary risk goal
Optimism	.24	−.38	−.29	−.25
Age	.30	.29	.42[b]	.52[b]

[a] $p < .10$.
[b] $p < .05$.
The correlation of age and optimism was $r = -.25$.

criteria. In general, the predictors were uncorrelated with three exceptions. First, optimism correlated marginally with the magnitude of the cholesterol goal. Second, age correlated significantly with the magnitude of the aerobic capacity goal and the magnitude of the global coronary risk goal.

In the second stage, each of the eight outcome measures was examined separately using a simultaneous multiple regression analysis. In this analysis, all predictors were entered simultaneously into a regression model, permitting an examination of the unique variance associated with each predictor. The standardized regression coefficients and the unique variance associated with each predictor are presented in Table 4. As predicted, dispositional optimism uniquely absorbed a significant and substantial proportion of the variance associated with reaching the goals for body fat, saturated fat, aerobic capacity, and global coronary risk. Indeed, optimism was by far the strongest predictor, absorbing more variance than the remaining two predictors combined for six of the eight outcome measures. For all outcome measures, the valence of the regression coefficients reveals that optimists were more successful than pessimists at reaching their health goals.

Although optimism did not uniquely predict a significant proportion of the variance associated with reaching the health goals for HDL and LDL, the zero-order correlations between optimism and these outcomes were strong. Optimism was correlated with the proportion of the HDL goal reached and with the proportion of the LDL goal reached (see Table 2). The discrepancy between the zero-order correlations and the findings emerging from the regression analyses suggests that optimism predicted the extent to which pa-

TABLE 4
Results from Regression Analyses

Predictors	Body fat (n = 16)		Saturated fat (n = 20)		Cholesterol (n = 14)		Weight (n = 18)	
	B	R^2	B	R^2	B	R^2	B	R^2
Age	−.345[a]	.10	.246	.00	.117	.02	−.302	.08
Magnitude of the goal	−.153	.02	.040	.00	−.527	.22	.016	.00
Dispositional optimism	.705[b]	.45	.719[b]	.48	.062	.01	.275	.07
Total variance explained		.79		.49		.34		.22

Predictors	High density lipoproteins (n = 21)		Low density lipoproteins (n = 14)		Aerobic capacity (n = 22)		Global coronary risk (n = 22)	
	B	R^2	B	R^2	B	R^2	B	R^2
Age	.080	.00	.070	.01	.134	.01	−.141	.01
Magnitude of the goal	.304	.08	−.099	.01	.362	.06	.527[a]	.10
Dispositional optimism	.384	.11	.440	.16	.587[b]	.31	.533[b]	.26
Total variance explained		.30		.24		.37		.40

Note. R^2 = the unique variance predicted by each predictor.
[a] $p < .05$.
[b] $p < .01$.

tients successfully changed their levels of HDL and LDL, but did not do so uniquely.[1]

Table 4 also reveals that age explained a significant proportion of the variance associated with reaching the body fat goal (younger patients were more successful than older patients). Likewise, the magnitude of the goal explained a significant proportion of the variance associated with reaching the global coronary risk goal and a marginally significant proportion of the variance associated with reaching the cholesterol goal.[2]

[1] There is some evidence that it is the ratio of HDL to LDL in the blood that places an individual at risk for heart disease, and not cholesterol, HDL, or LDL levels per se. However, additional analyses involving the ratio of HDL to LDL did not yield a significant effect of optimism nor significant effects for the other two predictors.

[2] For exploratory purposes, we repeated the regression analyses after substituting the absolute amount of change associated with each outcome measure for the percent change associated with each outcome measure. The results were quite similar, with optimism absorbing a significant proportion of unique variance associated with absolute changes in body fat, saturated fat, aerobic capacity, and global coronary risk. In addition, optimism absorbed a significant proportion of unique variance associated with weight change (t = 3.48, $p < .01$, R^2 = .17). Specifically, optimists were more successful than pessimists at losing weight.

An additional, important finding emerges when the values in Tables 2 and 4 are viewed together. The zero-order correlations in Table 2 reveal that optimism correlates .66 with the proportion of saturated fat goal reached, .45 with the proportion of aerobic capacity goal reached, and .43 with the proportion of global coronary risk goal reached. These correlations suggest that optimism by itself was associated respectively with 44, 20, and 19% of the variation in these three outcome measures. Yet, as evident in Table 4, the unique variance in these outcome measures explained by optimism was 48% for saturated fat, 31% for aerobic capacity level, and 26% for global coronary risk. The additional unique variance attributable to optimism and emerging when age and the magnitude of the goal were included in the regression model, although not a significant increase, suggests the presence of a suppressor effect (Wiggins, 1973). Further examination revealed that the suppressor variable was the magnitude of the goal. Apparently, including the magnitude of the goal as a predictor in the regression model increased the predictive capacity of optimism by removing (i.e., suppressing) a portion of the variance in optimism that was irrelevant to the prediction of the outcome measure. Supporting the conclusion that the magnitude of the goal is suppressing unreliability in optimism (rather than the reverse) are the valences of the regression coefficients for the magnitude of the goals (see Table 4). The valences are consistently in a direction opposite of what would be expected. That is, the positive regression coefficients suggest that having a smaller goal is associated with *less* success in making the recommended health changes.

An obvious limitation in the present study is the small sample size. Due to financial constraints, collection of data relevant to several of the predictor and outcome measures was discontinued, making it impossible to continue data collection. A small sample can increase the risk of a Type-II error, resulting in erroneous support of a false null hypothesis. Yet we found that dispositional optimism significantly predicted health changes despite the small sample. This makes the present findings all the more impressive. Although a small sample does not increase the probability of a Type-I error (Zuckerman, Hodgins, Zuckerman, & Rosenthal, 1993), it may result in findings that are attributable entirely to one or two extreme responses. As a result, researchers may be misled into believing that a predictor has a consistent effect on the responses of all participants, when in fact it had no effect for most participants, yet an extreme effect for a few.

To examine whether the effects for dispositional optimism were attributable to one or two extreme responses, we plotted participants' optimism scores against the values representing the extent to which participants were successful at reaching their health goals (i.e., the percent of the goal achieved by the end of the program). Plots of the four outcome measures for which

optimism significantly and uniquely predicted revealed that in no case were the optimism effects attributable to one or two extreme scores.

Testing Alternative Hypotheses

Patients differed in the absolute number of health changes they needed to make. Some patients were expected to make health changes in all eight categories, whereas others were not. It is possible that the greater success observed among optimists in achieving the health goals is attributable to optimists having fewer health changes to make. Contrary to this explanation was the finding that optimism did not correlate with the total number of changes recommended for each patient ($r = .14$). Moreover, optimism continued to predict a significant proportion of unique variance associated with achieving the recommended goals for body fat, saturated fat, aerobic capacity, and global coronary risk even after the total number of changes recommended was included in the regression models as a predictor. In no case did the total number of changes recommended predict a significant proportion of unique variance. Thus, the effectiveness of optimism in predicting health outcomes does not appear attributable to optimists having fewer health changes to make.

Alternatively, it is possible that the success of optimism in predicting health changes is actually attributable to individual differences in negative affect (Costa, 1988). This explanation challenges the psychometric purity of the LOT and suggests that the predictive success of the dispositional optimism results from its correlation with negative affect. Fortunately, the rehabilitation staff routinely measures depressive symptoms using the Beck Depression Inventory (Beck *et al.,* 1961) at the beginning of the rehabilitation program. Depressive symptoms can serve as proxy for negative affect (Watson & Clark, 1984). In the present study, optimism correlated significantly with depression ($r = .43$, $p < .05$). To test whether the effects found for optimism are actually attributable to negative affect, we reanalyzed the outcome data using simultaneous regression analyses with BDI scores included as a covariate. The regression analyses revealed that negative affect had no appreciable impact on the predictive ability of optimism. Optimism continued to predict a significant proportion of unique variance associated with achieving the recommended goals for body fat, saturated fat, aerobic capacity, and global coronary risk even with BDI scores entered into the regression model.

Coping Strategies as a Mediator

One goal of this study was to examine whether dispositional optimism was associated with the use of particular coping strategies. Coping strategies

were assessed at the beginning of the rehabilitation program, at the same time optimism was assessed. Consistent with previous research (Scheier *et al.*, 1986, 1989), optimism correlated positively and substantially with the use of problem-focused coping strategies ($r = .84$, $p < .0001$) such that optimists were more likely than pessimists to report that they coped with problems by making plans and taking steps to find a solution. In addition, optimism correlated negatively and substantially with the use of withdrawal-based coping strategies ($r = -.80$, $p < .0001$) such that optimists were less likely than pessimists to report that they coped with problems by mentally or physically withdrawing. Given the high correlations between optimism and the two styles of coping, it was not surprising to find that, as predicted, the coping strategies correlated significantly with the same outcome measures that correlated with optimism (correlations ranged from .38 to .76 for problem-focused coping and from −.36 to −.72 for withdrawal-based coping).

We proposed and cited evidence earlier that optimists may be more successful than pessimists at making changes in health outcomes because optimists use more effective, problem-focused coping styles such as active coping and planning. To examine whether the effect of dispositional optimism on health outcome changes results from the coping strategies they use, we conducted a series of mediation analyses using multiple regression. Specifically, we reanalyzed the four health outcomes presented in Table 4 that dispositional optimism significantly predicted. However, in addition to entering age, magnitude of the health goal, and dispositional optimism as predictors in the regression model, we included problem focused coping.[3] If the effects of dispositional optimism are mediated by the degree to which the participants used problem-focused coping strategies, then the significant effect for optimism that emerged in the analyses reported in Table 4 should be substantially diminished.

The results from the mediation analyses consistently revealed that the effects of optimism were mediated by participant's coping style. Specifically, when participants' score on the measure of problem focused coping was entered in the regression model, the significant effect of optimism on the outcome measures was reduced. For body fat the effect for optimism was reduced from $t(1, 12) = 4.70$, $p < .001$ to $t(1, 11) = 2.08$, $p < .07$. For percent saturated fat, the effect for optimism was reduced from $t(1, 16) = 3.88$, $p < .002$ to $t(1, 15) = 1.21$, $p > .20$. For aerobic capacity, the effect for optimism was reduced from $t(1, 18) = 2.98$, $p < .01$ to $t(1, 17) < 1$.

[3] Analyses using withdrawal-based coping instead of problem-focused coping yielded identical results, not surprisingly, given that optimism was correlated quite highly with both coping styles and the two styles were themselves highly correlated ($r = -.73$).

Finally, for global coronary risk, the effect for optimism was reduced from $t(1, 18) = 2.80$, $p < .02$ to $t(1, 17) < 1$.

DISCUSSION

Before discussing the findings, several limitations of the study should be noted. First, our findings are based on a sample of only 22 patients. As noted earlier, the small sample increases the probability of a Type-II error, severely curtailing our ability to uncover effects. Thus, our findings must be viewed cautiously. On the other hand, the fact that optimism predicted a significant and dramatic proportion of the variance associated with several of the outcome measures despite the small sample suggests that the effects are robust. Moreover, the effects for optimism were not attributable to one or two extreme observations but instead resulted from the responses of all participants in the sample. A second limitation is that our findings are based on a sample of coronary patients participating in a behavioral rehabilitation program. It is unknown whether our findings would generalize to coronary patients not undergoing such a program. The explicit goals set by the cardiac rehabilitation nurse combined with weekly monitoring and encouragement provided by the rehabilitation staff may have enhanced the effects of optimism on health changes. Of course, the goal of this study was to test a theoretical relationship between dispositional optimism and success in making changes in health outcomes, not to generalize our findings to other cardiac patients. In this regard, several findings deserve attention.

Effects of Dispositional Optimism

The primary goal of this study was to examine whether dispositional optimism is associated with greater success among cardiac patients in making a variety of health changes indicative of lower risk for CHD. Our findings provide compelling evidence that it is. By the end of the 18-week treatment program, optimists were more successful than pessimists at reducing the proportion of saturated fat in their diet, their body fat, and their global coronary risk to recommended levels. In addition, at the end of the program optimists were more successful than pessimists at increasing their aerobic capacity.

Importantly, optimism significantly predicted success in making health changes while controlling for the effects of traditional predictors such as age, sex, and magnitude of the goal. In addition, the greater success of optimists in making health changes was not attributable to differences between optimists and pessimists at the outset of the program. Specifically, optimists did not have fewer or smaller health changes to make than did pessimists. Moreover, optimism continued to predict a significant proportion of the unique variance associated with reaching goals for body fat, saturated fat, aerobic capacity, and global coronary risk even after the effects of the magnitude of health change associated with each of health outcome were removed. Taken to-

gether, these findings suggest that optimism plays a unique and important role in recovery among high risk cardiac patients.

It is worth noting that optimism did not uniquely predict a significant proportion of the variance associated with the goals for levels of HDL, LDL, blood cholesterol, and weight. There are several possible explanations for the null findings for these four risk factors. First, regarding the first three risk factors, some of the patients with elevated cholesterol levels received cholesterol reducing medications. These medications may have obscured any cholesterol, HDL, or LDL improvements associated with individual differences in optimism. Second, there is an unavoidable degree of unreliability associated with these measures in that laboratories differ substantially in their readings of cholesterol, HDL, and LDL levels. Although attempts were made to receive pre- and post-rehabilitation readings from the same lab, this was not always possible. Compounding the problem of reliability between labs is the problem of reliability within labs, where a 10–15% error in the reading is not uncommon. Thus, unreliability may have contributed to our inability to find an effect. A third explanation for our null findings has a genetic basis. Cholesterol, HDL, and LDL levels (as well as weight) are, to some extent, genetically determined. As a result, cardiac patients with a family history of high cholesterol, HDL, and LDL may have difficulty reducing these risk factors regardless of their level of optimism. A final contributor to our null findings is undoubtedly the weak statistical power resulting from having a small sample.

In considering the absence of an effect of optimism for changes in weight, one should remember that being overweight and its correlates (e.g., high body fat and high levels of saturated fat in the diet) rather than weight per se places a person at risk to coronary disease. Although the optimists were no more successful at losing weight, they may have been more successful at converting their weight from fat to muscle through exercise and diet. Corroborating this supposition is the finding that optimists were more successful than pessimists at attaining their goals of lower saturated fat, lower body fat, and greater aerobic capacity.

Addressing Alternative Interpretations

The research on optimism has been criticized by researchers who argue that the predictive success of the LOT is attributable to factors such as neuroticism or negative affect that correlate with optimism (Costa, 1988; Smith, Pope, Rhodewalt, & Poulton, 1989). In defense of the LOT, Scheier and his colleagues (Scheier *et al.,* 1989) have noted that much of the research uncovering a relationship between neuroticism and health is limited to self-reported health status (Costa & McCrae, 1987). When alternate, non-self-reported indices of health are examined, the relationship between neuroticism and health disappears. We did not include a measure of neuroticism

in our study, thus we are unable to state unequivocally that our findings for optimism are not attributable to neuroticism. However, because most of our health measures were not self-reported, it seems unlikely that our findings are attributable to differences in neuroticism.

Regarding negative affect, there is evidence that negative affect correlates with self-reports of angina and chest pains but is unrelated to the experience of actual cardiac events (Watson & Pennebaker, 1989). In light of this research and the fact that most of our health measures were not self-reported, we feel that it is unlikely that our findings for optimism are attributable to differences in negative affect. Nevertheless, we conducted additional analyses using scores on the BDI as a proxy for negative affect. Although depression does not reflect the entire spectrum of negative affect, it correlates strongly with traditional measures of negativity affect (Watson & Clark, 1984). Analyses revealed that optimism continued to predict a significant proportion of the variance associated with decreased body fat, decreased saturated fat in the diet, and increased aerobic capacity level, and decreased global coronary risk even after controlling for the effects of negative affect. Apparently, dispositional optimism in the present study predicts successful changes in health outcomes independent of negative affect.

Implications and Applications

The results of this research suggest a means by which health care professionals can identify patients undertaking lifestyle changes who require special attention. Greater attention should be devoted to patients scoring high in pessimism. The pessimists in our study were the least successful in making health changes associated with decreased risk of CHD, and thus would require the greatest intervention from health professionals.

Although our results are based on a sample of cardiac patients, one might speculate about the generality of our findings to individuals facing other traumatic events or health problems. Might dispositional optimism predict successful recovery from traumas such as rape, paralysis, severe burns, or mastectomy? Perhaps the outcome expectancies of these individuals would significantly impact the success with which they adjust following their traumas or health status change. For example, optimism might predict the speed with which individuals with spinal cord injuries are able to adapt to using a wheelchair, learning how to operate an automobile without the use of legs, and returning to work or learning a new trade. As such, dispositional optimism again would provide a means of identifying individuals who might have difficulties in making necessary health changes in the process of recovery. Our results indicate that dispositional optimism is an important component in the process of making health changes. Health professionals would benefit from being aware of patient expectations regarding the recovery process.

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