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Depressive Symptoms, Depressive Symptom Types, and Coping Strategies Among Cardiac Rehabilitation Participants

Jennifer Jones Cameron
University of Alabama at Birmingham

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DEPRESSIVE SYMPTOMS, DEPRESSIVE SYMPTOM TYPES, AND COPING
STRATEGIES AMONG CARDIAC REHABILITATION PARTICIPANTS

by

JENNIFER JONES CAMERON

MICHELLE MARTIN, COMMITTEE CO-CHAIR
BONNIE SANDERSON, COMMITTEE CO-CHAIR
VICKI DILILLO
KRISTINE LOKKEN
SHARINA PERSON

A DISSERTATION

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DEPRESSIVE SYMPTOMS, DEPRESSIVE SYMPTOM TYPES,
AND COPING STRATEGIES AMONG CARDIAC REHABILITATION
PARTICIPANTS

JENNIFER JONES CAMERON

MEDICAL (CLINICAL) PSYCHOLOGY

ABSTRACT

Cardiac rehabilitation is an outpatient intervention for coronary heart disease (CHD), the leading cause of death among adults in the United States. Depressive symptoms, common among cardiac rehabilitation participants, are associated with poor outcomes, including death. Many depressive symptoms and CHD symptoms overlap, so separating mental health concerns from physical problems is difficult. However, identifying separate factors could improve the predictability of outcomes, because they could be tested separately as predictors. The aim of Study 1 was to delineate depressive symptom types through a retrospective exploratory factor analysis of the Beck Depression Inventory-II (BDI-II) scores of 783 participants in a university-based cardiac rehabilitation program. Based on prior analyses of the BDI-II, it was assumed that somatic and cognitive factors would emerge. The analysis revealed a two-factor solution: cognitive and somatic-affective symptoms. The solution is consistent with a cognitive-behavioral model of depression.

Coping strategies are also emerging as an important psychological variable among cardiac rehabilitation participants, but existing studies of coping among cardiac patients yield conflicting results about the benefits and detriments of approach and avoidance coping. The purpose of Study 2 was to examine approach and avoidance coping among university-based cardiac rehabilitation program participants in relation to depressive

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symptoms, depressive symptom types, discharge status (completed program vs. failure to complete program), and attendance rate (percent of sessions attended). Eighty-four participants were enrolled in the prospective study. Approach coping was found to have no relationship with depressive symptoms or depressive symptom types. Avoidance coping was positively correlated with total depressive symptoms and cognitive symptoms of depression, but it was inversely correlated with somatic-affective symptoms of depression. There was no association between coping strategies and discharge status or attendance rate. A step-wise logistic regression analysis including psychosocial, demographic, and medical variables revealed that only one medical variable, obesity, was associated with failure to complete the rehabilitation program.

These findings enhance the understanding of important psychological variables among cardiac rehabilitation participants. Given the prognostic power of psychological variables for cardiac rehabilitation participants, these results add to the literature, which may be used to improve medical and psychosocial outcomes in this population.

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LIST OF ABBREVIATIONS

AACVPR	American Association of Cardiovascular and Pulmonary Rehabilitation
AHA	American Heart Association
BDI-II	Beck Depression Inventory-II
Brief COPE	Brief Coping Orientations to Problems Experienced Inventory
CABG	coronary artery bypass surgery
CDC	Centers for Disease Control and Prevention
CHF	congestive heart failure
CHD	coronary heart disease
CR	cardiac rehabilitation
FHS	Framingham Heart Study
MI	myocardial infarction
NCHS	National Center for Health Statistics
NHLBI	National Heart, Lung, and Blood Institute
PCI	percutaneous interventions
VIF	variance inflation factor

INTRODUCTION

Coronary heart disease (CHD) is a prevalent and costly condition that is associated adversely with mental and physical health. Cardiac rehabilitation (CR) programs provide an opportunity to counteract the impact heart disease has on patients, their families, and the economy. Indeed, studies indicate that patients with CHD who participate in a CR program can experience physical, psychosocial, and economic benefits. However, many patients who enroll in CR fail to complete the prescribed sessions, which may prevent them from achieving the desired benefits. One factor associated with poor CR attendance is the presence of depressive symptoms and disorders. Furthermore, certain clusters, or types, of depressive symptoms (identified by factor analyses in non-CR populations) have been stronger predictors of cardiac outcomes than other depressive symptom types, but depressive symptom types have not been clearly delineated in a CR population.

Like depressive symptoms, coping strategies have been associated with health outcomes. Associations between depressive symptoms and coping strategies have also been demonstrated in cardiac patients. However, several questions about coping strategies among CR participants remain. Understanding how coping strategies are related to depressive symptoms and depressive symptom types, as well as understanding the role that coping strategies play in patients failing to complete CR, can help guide psychosocial intervention development.

In this project a factor analysis of depressive symptoms was conducted to delineate depressive symptom types in CR. Additionally, the following questions were addressed: (a) Are depressive symptoms associated with coping strategies?, (b) Are depressive symptom *types* associated with coping strategies? and (c) Do depressive symptom types and coping strategies predict attendance rate and failure to complete CR?

Coronary Heart Disease

According to the American Heart Association (AHA, 2008), CHD includes acute myocardial infarction (MI) or heart attack, other acute ischemic coronary heart disease, angina pectoris, atherosclerotic cardiovascular disease, and all other forms of chronic ischemic heart disease (ICD-10 codes I20-I25; World Health Organization, 2006). CHD is the leading cause of death for men and women in the United States (Vital Statistics of the United States, National Center for Health Statistics [NCHS], as cited in AHA, 2008). Sixteen million Americans are diagnosed with CHD, 8.1 million have a history of an MI, and 9.1 million bear angina pectoris (National Health and Nutrition Examination Survey 1999-2004], Centers for Disease Control and Prevention/National Center for Health Statistics (CDC/NCHS) as cited in AHA, 2008). Additionally, almost 7 million Americans underwent a cardiovascular interventional procedure in 2005 (CDC/NCHS, as cited in AHA, 2008). The estimated total cost of CHD from both direct costs (such as medical care) and indirect costs (such as lost productivity, morbidity, and premature mortality) for 2008 is $156.4 billion (AHA, 2008). Clearly, the prevalence, mortality, and cost of CHD are burdens to the United States.

In addition to the high public health cost, CHD is associated with psychosocial consequences, including disability, reduced quality of life, and risk for further cardiac illness. CHD is the foremost cause of premature, permanent disability (Framingham Heart Study [FHS], National Heart, Lung, and Blood Institute [NHLBI] as cited in AHA, 2003), and approximately 22% of MI patients younger than 65 years of age are unable to return to their previous work (FHS, NHLBI as cited in AHA, 2003). Cardiac patients also perceive a reduced quality of life (Stewart et al., 1989) and struggle with depression and anxiety (Grace et al., 2002). Finally, the risk for further cardiac illness and death is 1.5 to 15 times higher for MI patients compared to the general population, and it varies depending on gender or other clinical variables (Thom, Kannel, Silbershatz, & D'Agostino, 2001). These data demonstrate the need to intervene on factors that can positively affect cardiac and psychosocial health outcomes among patients with CHD, including effective coping strategies. Although patients with CHD face many challenges, CR programs offer an opportunity for such interventions to improve health, quality of life, and psychosocial functioning.

Coronary Heart Disease and Cardiac Rehabilitation

According to the United States Agency for Health Care Policy and Research Clinical Practice Guidelines for CR Programs (Wenger et al., 1995), CR is designed to provide comprehensive, long-term services, including medical evaluations, exercise prescriptions, cardiac risk factor modification, education, and counseling for the purpose of limiting the physiological and psychological effects of cardiac illness, lowering the risk of reinfarction and sudden death, managing cardiac symptoms, stabilizing or reversing

the atherosclerotic process, and improving patient psychosocial and vocational status. Candidates include patients with a history of MI, stable angina pectoris, stable chronic heart failure, peripheral arterial disease with claudication, other forms of cardiovascular disease, coronary artery bypass surgery (CABG), percutaneous interventions (PCI), and heart transplantation (Leon et al., 2005). Beneficial outcomes are achieved through exercise training and behavioral interventions such as physical activity counseling, nutritional counseling, risk factor management (lipids, blood pressure, weight, diabetes, and smoking), and psychosocial management (Balady et al., 2007). Patient care providers include physicians (primary care, cardiologists, and cardiovascular surgeons), nurses, exercise physiologists, dietitians, behavioral medicine specialists, psychologists, and physical and occupational therapists (Wenger et al., 1995). Following an initial assessment of medical, nutritional, psychosocial, educational, and vocational status, individualized goals are set and plans are made to assist participants in reaching those goals (Wenger et al., 1995). Outpatient CR programs seek to reduce risk factors and improve outcomes through exercise training, education, and counseling.

Benefits of attending CR are apparent. Compared to cardiac patients who do not attend a CR program, CR participants experience physical benefits, including higher survival rates (Sundararajan, Bunker, Begg, Marshall, & McBurney, 2004; Witt et al., 2004), lower recurrence of MI (Kavanagh, Shephard, Chisholm, Qureshi, & Kennedy, 1979; Witt et al., 2004), better physical functioning (Lindsay, Hanlon, Smith, & Belcher, 2003), and, with rare exceptions (Glazer, Emery, Frid, & Banyasz, 2002), better exercise capacity (DeBusk, Houston, Haskell, Fry, & Parker, 1979; Haskell et al., 1994; Waites, Watt, & Fletcher, 1983). Also of great importance, CR programs have demonstrated

marked improvements in psychosocial functioning, including reduced depressive

symptoms (Lavie & Milani, 1997; Lavie, Milani, Cassidy, & Gilliland, 1999; Milani,

Lavie, & Cassidy, 1996).

STUDY 1: FACTOR ANALYSIS OF THE BECK DEPRESSION INVENTORY IN CARDIAC REHABILITATION PARTICIPANTS

Background

Coronary Heart Disease and Depression

CHD and psychosocial well-being appear to have a bi-directional relationship; psychosocial well-being is related to the development of CHD, and it can be affected by the onset of CHD (Graves & Miller, 2003). Furthermore, psychosocial well-being is associated with CHD prognosis and, consequently, improving psychosocial well-being is an important CR goal (Graves & Miller, 2003; Wenger et al., 1995). One of the most prominent psychosocial factors related to CHD is depression. The prevalence of major depressive disorder in cardiac patients is estimated to be between 16% and 20% (Connerney, Shapiro, McLaughlin, Bagiella, & Sloan, 2001; Frasure-Smith, Lespérance, & Talajic, 1993; Schleifer et al., 1989), a figure that is three to four times higher than in similarly aged community-based samples (Blazer, Landerman, Hays, Simonsick, & Saunders, 1998).

The consequences of both major depressive disorders and depressive symptoms are severe and include mortality (Frasure-Smith & Lespérance, 2003; Lespérance, Frasure-Smith, Juneau, and Théroux, 2000), greater medical morbidity (Ladwig, Röll, Breithardt, Budde, & Borggrefe, 1994; Schleifer et al., 1989), increased cardiac disease severity (Connerney et al., 2001; Frasure-Smith, Lespérance Juneau, Talajic, & Bourassa, 1999), greater health care utilization, longer hospital stays, more complex surgical

procedures, a greater recurrence of cardiac severity (Connerney et al., 2001), similar or greater functional impairment than other major chronic medical illnesses (Wells et al., 1989), and decreased overall quality of life (Katon, 1996; Wells et al., 1989). In a recent study, depressive symptoms were the best psychosocial predictor of cardiac-related mortality 5 years following MI, even after adjusting for cardiac disease severity (Frasure-Smith & Lespérance, 2003). These data indicate the importance of understanding depression in cardiac patients and the necessity of further investigating the relationship between depression and cardiac health.

Depression and Cardiac Rehabilitation

Prevalence rates of depressive disorders in CR participants are similar to those of CHD patients, ranging between 15.5% and 30% (Lavie, Milani, & Littman, 1993; Milani, Lavie, & Cassidy, 1996; Todaro, Shen, Niaura, & Tilkemeier, 2005). Not only is psychosocial well-being a main CR outcome unto itself (Wenger et al., 1995), the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) recommends depression screening during CR intake because of the strong and important associations between depression and adverse clinical events (Herridge, Stimler, Southard, & King, 2005). Depressive symptoms have also demonstrated an inverse relationship with CR attendance and positive relationship with failing to complete CR (Glazer et al., 2002; Sanderson & Bittner, 2005; Shen, Wachowiak, & Brooks, 2005; Turner, Bethell, Evans, Goddard, & Mullee, 2002) in all but a few studies (Dorn, Naughton, Imamura, & Trevisan, 2001; Whitmarsh, Koutanji, & Sidell, 2003).

Depression includes several physical or somatic symptoms such as sleep difficulties, changes in appetite, psychomotor retardation, and fatigue, but CR participants may also experience these symptoms as a result of their illness or treatment (Silverstone, 1990; Sørensen et al., 2005). Therefore, distinguishing true symptoms of depression from medical sequelae can be difficult. To that point, Södeman & Lisspers (1997) found a 5-item physical factor in their factor analysis of the Beck Depression Inventory-I (BDI-I) in a sample of patients with CHD, patients with chronic pain, unemployed individuals, and a control group. They found that the two patient groups scored higher than the nonpatient groups on the physical factor, as one would expect (Södeman & Lisspers). Separating somatic and nonsomatic depressive symptoms allows researchers to better understand the relationship between depression and medical outcomes. For example, Lespérance, Frasure-Smith, and Talajic (1996) removed sleep and appetite disturbances from the diagnostic criteria for depression in a sample of MI patients because those symptoms occurred equally as common in depressed and nondepressed patients. After removing those two symptoms, these authors found that depression improved as a predictor of mortality (Lespérance et al., 1996). Therefore, separating somatic symptoms from other depressive symptoms may present a clearer picture of the relationships between depression and important CR outcomes. At present, it is not clear which depressive symptoms represent a somatic symptom factor among CR participants.

A commonly used depressive symptom inventory, the BDI-II (Beck, Steer, & Brown, 1996), has been factor analyzed in several populations, with each sample yielding

differing factor structures. For example, factors labeled cognitive-affective and somatic-vegetative were observed among college students (Dozois, Dobson, & Ahnberg, 1998), and factors labeled as somatic-affective and cognitive were found among psychiatric outpatients (Beck et al., 1996) and among medical outpatients (Viljoen, Iverson, Griffiths, & Woodward, 2003). Although the factors in the last two studies were given the same labels, several symptoms that loaded on a factor in one study loaded on the other factor in the other study. For example, sadness loaded on the cognitive factor and crying loaded on the somatic-affective factor among psychiatric outpatients (Beck et al., 1996) and these symptoms loaded on the opposite factor among medical outpatients (Viljoen et al., 2003). Furthermore, indecisiveness loaded onto the somatic-affective factor among psychiatric outpatients (Beck et al., 1996), but loaded on both factors among medical outpatients (Viljoen et al., 2003). Finally, one study assessed cardiac patients. Campbell, Burgess, and Finch (1984) performed a principal components analysis of the BDI-I in a group of men who had been hospitalized for cardiac problems. The participants were assessed within 4 weeks of hospital discharge when they entered a rehabilitation unit. These authors found three principal components of BDI-I scores: (a) sadness and hopelessness, (b) negative self-attitudes, and (c) vegetative and somatic symptoms. Although helpful, this study included only male participants, and an updated version of the BDI is now available. Having clearly delineated depressive symptom types may improve the predictive utility of depressive symptoms.

Summary, Study Questions, and Hypotheses

CHD is a major health concern in the United States not only because it is the leading cause of death, but because individuals with CHD suffer medical, psychological, and economic difficulties. Although CR is an effective intervention, many CR participants experience depression, which adds to the difficulties of a person with CHD. Symptoms of CHD and depression have common characteristics, so it is unclear when CR participants are experiencing a psychological problem or simply the expected physical sequelae of their illness. The purpose of the present study was to delineate depressive symptom types employing a commonly used depressive symptom inventory. It was expected that two factors representing cognitive and somatic symptom types would emerge, and symptoms considered as affective would load on either of those factors. The answer to this question will improve the understanding of how CR participants experience depression, which will help guide the development of interventions.

Method

Protection of Human Subjects and Approvals

Expedited Institutional Review Board approval for the protection of human subjects was obtained prior to data collection and accessing the existing database (Appendix A). During CR enrollment, participants provided informed consent for individual data to be used for clinical and research purposes. Data for each participant were coded with an identification number to assure confidentiality. No personal identifying information is included in the study database, and the database is password protected.

Participants

Participants entered a university-based CR program between 1998 and 2006 with a referring diagnosis of CHD, intervention for CHD, or congestive heart failure (CHF) with a CHD component. All participants with appropriate data were included in the study.

Protocol

The University of Alabama at Birmingham CR program is a university hospital-based clinical service. Participants are referred from both inpatient and outpatient providers. They often enroll shortly following a hospital stay, but some participants enroll years after they learn of their CHD diagnosis. A multidisciplinary team provides care for participants. This team includes the medical director, clinical care coordinator, nurse coordinator, clinical exercise physiologist, and others who serve as needed (e.g., respiratory therapist, occupational therapist, dietitian, pharmacist, social worker, clinical psychiatrist, clinical psychologist, home health care provider, and vocational rehabilitation counselor; Sin, 2001).

The case manager (registered nurse or exercise physiologist) provides an initial orientation and assessment session during which an individualized exercise plan and education goals are agreed upon (Sanderson, Phillips, Gerald, DiLillo, & Bittner, 2003). Cost, coverage provided by the participant's health care plan, and projected time for completion are also discussed with participants. Some participants may be eligible for financial aid based upon need (Sanderson et al.). The Surgeon General's Report and American College of Sports Medicine Guidelines (ACSM, 2006) is used to guide the

number of exercise sessions prescribed (Sin, 2001), which typically includes 24 to 36 sessions at a rate of 2 to 3 sessions per week (Sanderson et al., 2003). Attempts are made to accommodate work and personal schedules as much as possible (Sanderson et al.). Monthly group educational sessions on the following subjects are also offered: diet, medication, disease, relaxation, and self-monitoring education (Sin).

Data from the UAB Cardiopulmonary Rehabilitation program are maintained in a database called Cardiopulmonary Outcomes: Prospective Evaluation. Upon CR entry, participants provide demographic information and complete measures of psychological, social, and physical functioning, and answer questions regarding current health behaviors. These data, along with clinical and outcome data, are included in the database. The database is managed by CR personnel, who are trained in managing specific aspects of the database. For example, demographic data are entered by the office associate upon patient referral, which is later verified by the clinical case manager upon patient enrollment. The case manager also enters all clinical data from medical records, rehabilitation assessment forms, and questionnaires.

A resource manual is available for consultation when needed. It includes definitions of terms, criteria for data entry, data-collection guidelines for forms and questionnaires, written protocols for patient outcome measures, and trouble-shooting suggestions for potential database problems (Sin, 2001). Data are reviewed systematically and regularly to ensure accuracy. The database is screened for missing values and values that are inappropriate for the variable. Additionally, case managers review individual patient reports for data-entry errors, and the nurse manager repeats this process for group

reports on a monthly basis. Finally, the nurse manager and data programmer meet biweekly to ensure accuracy of the data (Sin).

Instrument: Beck Depression Inventory-II

The Beck Depression Inventory-II (BDI-II; Appendix B) measures the severity of depressive symptoms in adults (Beck et al., 1996). It is a well-known and utilized 21-item self-report instrument. Participants were asked to choose one of four answer options for each item. Each answer choice corresponds to a score of 0 to 3, indicating symptom severity. Total scores range from 0 to 63 with higher scores denoting greater severity (Beck et al.).

McGee, Hevey, and Horgan (1999) concluded that the BDI-I, the precursor to the BDI-II, was one of the psychosocial measures that was most responsive to CR intervention. Because the BDI-II is very similar to the BDI-I, the same can be expected for the BDI-II. The BDI-II has also demonstrated high internal consistency (Dozois et al., 1998), convergent validity, construct validity, divergent validity (Osman et al., 1997), and test-retest reliability (Sprinkle et al., 2002). Finally, its brief questionnaire format allows for quick administration to CR participants.

Data Analysis

Extant data from the database were used for this retrospective study. Before the data were analyzed, descriptive statistics, including mean scores for each symptom, were calculated. Missing data were left blank. Data for baseline BDI-II scores were factor analyzed using exploratory factor analysis. Factors were rotated with an oblique, promax

rotation. Oblique rotations allow factors to be correlated with one another. The oblique rotation was used because it was anticipated that depressive symptom types would be correlated. In addition, using the promax rotation maximizes the simple structure of the model by elucidating which variables correlate with each factor and which variables do not (Tabachnick & Fidell, 2001).

Only factor loadings greater than or equal to .32 were interpreted, as suggested by Comrey and Lee (1992). These authors suggested that factor loadings equaling .71 or more are thought to be "excellent" measures of the factor and have 50% overlapping variance with the other loadings for that factor. Factor loadings between .63 and .70 are thought to be "very good" and have 40% overlapping variance. Factor loadings between .55 and .62 have 30% overlapping variance and are "good." Factor loadings between .45 and .54 have 20% overlapping variance and are considered "fair." Finally, factor loadings less than .32 have only 10% overlapping variance with the other loadings within the factor and are considered to be "poor" measures of the factor.

Results

Participants

Participants were 783 men (68%) and women (32%) who entered a university-based CR program between 1998 and 2006. The participant pool of this retrospective analysis is predominantly Caucasian (67%; 29% African American; 3% other, 1% Asian American), with an average age of 60.9 years (*SD = 11.18;* 21 – 90 years), and a CR referring diagnosis of CHD. Data describing participants are further displayed in Tables 1 to 4.

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Table 1

Demographic Data for Study 1

Variable	*Mean (SD)/ n* (%)
Age	
Mean	60.9 (11.18)
Minimum	21
Maximum	90
Gender	
Male	534 (68%)
Female	249 (32%)
Race	
White	523 (67%)
Black	230 (29%)
Other	26 (3%)
Asian	4 (1%)
Employment Status	
Fulltime	264 (34%)
Retired	312 (40%)
Disabled	121 (15%)
Part-time	40 (5%)
Unemployed	41 (5%)
Missing	5 (< 1%)

Note. Values may add up to slightly more or less than 100% due to rounding.

Table 2

Social Support Data for Study 1

Variable	*n* (%)
Marital Status	
Married	555 (71%)
Divorced	68 (9%)
Single	81 (10%)
Widowed	56 (7%)
Other	12 (2%)
Missing	11 (1%)
Living Status	
Not Alone	692 (88%)
Alone	91 (12%)

Note. Values may add up to slightly more or less than 100% due to rounding.

Table 3

Medical Data for Study 1—Continuous Variables

Specific Risk Factors	*Mean (SD)*
Diet Score	34.40 (28.43)
MET Hours	6.0 (10.55)
6-Min. Walk Distance (meters)	1257 (397.1)

Note. Diet Score is "fair." MET Hour goal = 10.

Table 4

Medical Data for Study 1—Categorical Variables

Variable	n (%)
Diagnosis	
MI	249 (32%)
Post-intervention procedure	250 (32%)
CHD	4 (<1%)
Stable angina	247 (32%)
CHF with Ischemia	28 (3.5%)
Other	5 (<1%)
Risk Stratification	
High	335 (43%)
Intermediate	291 (37%)
Low	156 (20%)
Specific Risk Factors	
Hypertension	619 (79%)
High Cholesterol	711 (91%)
Low Physical Activity	554 (71%)
Obesity	368 (47%)
Diabetes	297 (40%)
Smoke tobacco	154 (20%)
Antidepressant Medication	167 (21%)
Antianxiety Medication	56 (7%)

Note. Values may add up to slightly more or less than 100% due to rounding.

Descriptive Data

BDI-II scores ranged from 0 to 47 (possible score range = 0 to 63), and the mean BDI-II score was 10.36 (*SD* = 8.77), which suggested minimal depressive symptoms (Beck et al., 1996). The three depressive symptoms with the highest means (possible range, 0 to 3) were Loss of Energy (*M* = 1.15, *SD* = 0.72), Tiredness or Fatigue (*M* = 1.13, *SD* = 0.86), and Changes in Sleeping Pattern (*M* = 1.07, *SD* = 1.00). The items with the lowest mean scores were Worthlessness (*M* = 0.26, *SD* = 0.56), Punishment Feelings (*M* = 0.17, *SD* = 0.61), and Suicidal Thoughts or Wishes (*M* = 0.08, *SD* = 0.29).

Factor Analysis

A scree plot revealed that two factors were a good fit for the factor analysis. The squared multiple correlations (a measure of the variance accounted for by the factors) of the variables for each factor demonstrated internal consistency (0.91, 0.86 for cognitive and somatic-affective, respectively). The two factors were positively correlated, *r* = 0.64.

The results of the two factors are displayed in Table 5. Loadings on the cognitive factor ranged from 0.41 – 0.73, and included guilty feelings, past failure, self-criticalness, punishment feelings, self-dislike, worthlessness, sadness, suicidal thoughts/wishes, pessimism, indecisiveness, and crying. Somatic-affective loadings ranged from 0.39 – 0.76. Tiredness or fatigue, loss of energy, changes in sleep pattern, loss of interest in sex, changes in appetite, irritability, concentration difficulty, and agitation loaded on this factor. Two items, loss of pleasure and loss of interest, loaded ambiguously on each factor. Cognitive symptoms of depression accounted for 61.52% of the variance in the solution, and somatic-affective symptoms of depression accounted for 38.48% of the variance in

Table 5

Factor Analysis of the BDI-II in Cardiac Rehabilitation

BDI-II Item	Cognitive	Somatic-Affective
Guilty Feelings	**0.73**	-0.07
Past Failure	**0.72**	-0.03
Self-criticalness	**0.72**	-0.03
Punishment Feelings	**0.70**	-0.14
Self-dislike	**0.70**	0.06
Worthlessness	**0.65**	0.11
Sadness	**0.58**	0.16
Suicidal Thoughts/Wishes	**0.54**	-0.06
Pessimism	**0.50**	0.20
Indecisiveness	**0.49**	0.27
Crying	**0.41**	0.21
Tiredness or Fatigue	-0.10	**0.76**
Loss of Energy	-0.07	**0.75**
Changes in Sleep Pattern	-0.06	**0.55**
Loss of Interest in Sex	0.00	**0.45**
Changes in Appetite	0.01	**0.44**
Irritability	0.26	**0.44**
Concentration Difficulty	0.31	**0.42**
Agitation	0.19	**0.39**
Loss of Pleasure	0.36	0.43
Loss of Interest	0.40	0.42

Note. Bold factor loadings distinguish the factor onto which they load.

the solution. The average (*SD*) of the cognitive symptoms of depression was 3.93 (4.91), and the average (*SD*) of somatic-affective symptoms was 6.26 (4.03).

Discussion

This study provides insight into how CR participants experience depressive symptoms. Results suggest that depressive symptoms in CR participants are represented by two factors, cognitive and somatic-affective, and the model is consistent with the cognitive-behavioral framework. The clear demarcation between the symptom types is a gateway to enhancing research and interventions.

The cognitive factor included the following items: guilty feelings, past failure, self-criticalness, punishment feelings, self-dislike, worthlessness, sadness, suicidal thoughts/wishes, pessimism, indecisiveness, and crying. This factor was termed cognitive symptoms of depression because it is thought that symptoms on this factor are the result of thoughts, or cognitions. Although some BDI-II items in this factor are labeled as feelings (e.g., punishment feelings), they can be thought of as results of cognitions as defined by the cognitive-behavioral model (Beck, 1995). In the cognitive-behavioral model, feelings are the results of cognitions; therefore, punishment feelings would be the result of a thought such as "I am being penalized for not taking care of myself." Each of the following items can be directly related to cognitions: guilty feelings, past failure, self-criticalness, punishment feelings, self-dislike, worthlessness, suicidal thoughts/wishes, and pessimism. Indecisiveness may also be related to self-doubting thoughts, given that it co-varies with these highly cognitive symptoms. For example, a person may feel incapable of making a decision when thinking about past failures. Beck and others (1996) found that

affective symptoms such as sadness and crying were items that were most likely to co-vary with cognitive or somatic symptoms, depending upon the sample. In this sample, these symptoms are likely to result from self-deprecating thoughts. For example, one would expect that a person would feel sad if he or she thought of one's self as worthless.

The somatic-affective factor includes the following somatic symptoms: tiredness or fatigue, loss of energy, changes in sleep pattern, and changes in appetite. These symptoms can be directly related to bodily feelings. As with the cognitive factor, two affective items (irritability and agitation) load onto this factor, which is likely a result of the other items on the factor. That is, it is expected that a person who feels tired and is not sleeping well may feel irritable and agitated. Similarly, loss of interest in sex and concentration difficulty may result from cognitions (like the feeling items on the cognitive factor), but it is also reasonable to surmise that these feelings may also result from the somatic symptoms on the second factor.

One of two symptoms of depression is required to diagnose depression, sadness, or loss of interest in previously enjoyed activities (American Psychiatric Association, 2000). The loading of these cardinal symptoms directed the interpretation of the factors. Sadness loaded onto the cognitive factor, and loss of pleasure and loss of interest loaded ambiguously on both factors. This suggests that the cognitive factor may represent psychological concerns, and loss of interest and pleasure are related to both cognitive and somatic-affective symptoms of depression for CR participants.

Results of this study are similar to those of related populations in terms of medical status (primary care patients, many of whom likely have chronic medical conditions; Viljoen et al., 2003), age (geriatric psychiatric inpatients; Steer, Rissmiller, & Beck, 2000),

and severity of depression (psychiatric outpatients; Beck et al., 1996). Viljoen and others (2003) also found a 2-factor solution and termed their factors cognitive and somatic-affective. The items loaded onto the same factors in the present study, with the exception of four items (81% match). One major difference between their study and the present study is that the somatic-affective factor explained a greater proportion of the variance in the model for primary care patients, while the cognitive factor explained more of the variance for CR participants. In addition, the cardinal depressive symptoms loaded onto the somatic-affective for Viljoen and colleagues, but loaded ambiguously or on the cognitive factor in the present study.

Steer and colleagues (2000) found "cognitive" and "noncognitive" factors among depressed geriatric inpatients. Although the severity of the depression for their population compared to the present population differs (moderate vs. minimal), the age range is similar. Each factor in their analysis represented a similar percentage of the total variance in the solution (18.8% vs. 18.4%). These factors are similar to those of the present study, matching on all but five items (76% match). In their study, the cardinal symptoms of depression loaded onto the noncognitive factor; in the present study these items loaded onto the cognitive factor, or they were ambiguous. The factor loadings in the present study are similar to those of geriatric inpatients, but one important difference is that depression seems to be represented equally by somatic, affective, and cognitive symptoms of depression for geriatric inpatients. Meanwhile, cognitive symptoms of depression, rather than somatic-affective symptoms, explain more of the variance in the model for CR participants.

Finally, Beck and others (1996) reported cognitive and somatic-affective factors for psychiatric outpatients, as well. There factor loadings differed from the present study by four items (81% match). Similar to Viljoen et al. (2003), the somatic-affective factor explained the greatest percent of the variance. Loss of interest and loss of pleasure also loaded onto the somatic-affective factor. However, sadness loaded onto the cognitive factor, and in this way, it is the sample which is most similar to the CR sample in the present study. Taken together, CR is the only population of these four for which cognitive depressive symptoms are prominent in terms of explaining a greater proportion of the variance, and the presence of a cardinal depressive symptom in the factor. For this reason, it appears that even though somatic-affective depressive symptoms are common among CR participants, cognitive depressive symptoms are of special importance in this population.

This study has several strengths. The large sample size and diverse patient population enhances the generalizability of the study. However, the present study has several limitations. First, this is a convenience sample of CR participants. Second, some participants may have been reluctant to admit to their depressive symptoms.

The present study lays the groundwork for future studies in which the two factors can be compared as predictors of important CR outcomes. For example, depressive symptoms have been reliably related to poor CR attendance (Glazer et al., 2002; Sanderson & Bittner, 2005; Shen et al., 2005; Turner et al., 2002), and it may be that one symptom type is a better predictor of poor attendance, and even discharge status. If that is the case, interventions may be tailored to target the symptoms that seem to have the greatest impact on success in the program. To illustrate, participants in the present study

reported greater somatic-affective than cognitive symptoms, and they may need to be addressed regularly within CR. Changes in sleep pattern were the third most commonly reported depressive symptom in this study. While tiredness and fatigue may resolve as an effect of exercise, sleep problems may need to be addressed directly. Additionally, understanding which symptoms are most responsive to CR treatment will also be helpful. For example, participants may feel empowered by their progress in the program, which may reduce cognitive symptoms. Meanwhile, they may feel more energized from the exercise. Knowing how well symptom types respond to other interventions, like antidepressants, may also be helpful in guiding treatment planning. There are many avenues for exploring the potential utility of the delineated depressive symptom types.

This study is the first to delineate depressive symptoms types among a diverse group of CR participants. Although the factor structure is similar to that of previous studies of related populations, distinguishing differences in the factor structure of the BDI-II emerged. These findings set the stage for future studies of depressive symptoms in CR participants, which may improve patient care and CR completion rates.

STUDY 2: COPING STRATEGIES AMONG CARDIAC
REHABILITATION PARTICIPANTS

Background

Coping Strategies

Coping is another important psychological variable among CR participants.

While it is possible that a CR participant may not experience depression, each participant

employs coping strategies. In fact, creating a coping strategy has been conceptualized as a

stage through which cardiac patients pass following diagnosis (Sotile, 2003). Coping has

been defined as "ongoing cognitive and behavioral efforts to manage specific external

and/or internal demands that are appraised as taxing or exceeding the resources of the

person," and includes "cognitive and behavioral efforts to manage psychological stress"

(Lazarus, 1993, p. 237). Lazarus recognized that coping strategies are not static across

situations. For example, in populations with a chronic medical illness, coping strategies

are likely to vary depending upon the stage of their illness and the broader context in

which they experience their illness. Two major coping paradigms have emerged:

problem-focused versus emotion-focused coping, and approach versus avoidance coping

(Epping-Jordan et al., 1999; Lazarus). Lazarus stated that problem-focused coping is used

to alter the self or the environment when faced with difficulty, whereas emotion-focused

coping is used to either approach or avoid the situation, or modify one's appraisal of the

event to reduce stress. However, this paradigm does not effectively predict outcomes

(Lazarus). The approach-avoidance coping paradigm, sometimes termed engagement

and disengagement coping or active and passive coping by Compas and colleagues (e.g., Luecken & Compas, 2002), has been a better predictor of health outcomes in other medical populations. For example, in their review, Luecken and Compas reported that approach coping was associated with more favorable values of several immune system functioning markers, and avoidance coping was associated with less favorable immune system functioning in populations such as surgical candidates, HIV positive men, and cancer patients. The evident value of the approach-avoidance paradigm in predicting medical outcomes in other medical populations suggests that this paradigm will also be useful within the CHD population in general, and the CR population specifically.

Coronary Heart Disease and Coping

Coping strategies have been associated with cardiac health, but few studies have characterized coping among cardiac patients, especially among CR patient populations. Crumlish (1998) asked patients who underwent nonemergent cardiopulmonary bypass surgery to indicate which coping strategies they used to deal with the cardiac surgical experience. Coping was measured 1 day before surgery and 5 days after surgery using a self-report questionnaire that divided the coping strategies into five categories: seeking social support, problem-focused coping, avoidance, wishful thinking, and self-blame. Both before and after surgery, problem-focused coping and seeking social support (emotional and informational) were the most used coping strategies, while avoidance, wishful thinking, and self-blaming were used less. It is unknown if CR participants may favor similar approach coping strategies.

Another study compared coping strategies of emergency cardiac patients (stable angina or MI) and noncardiac emergency patients (acute trauma). Pignalberi, Patti, Chimenti, Pasceri, and Maseri (1998) administered the same instrument used by Crumlish (1998) to these two patient groups 4 to 10 days following hospital admission. Even though cardiac patients may use approach coping (i.e., problem-focused coping and seeking social support) more than other coping strategies (Crumlish), it was reported that emergency cardiac patients used avoidance and self-blame (a form of avoidance coping) more than noncardiac emergency patients (Pignalberi et al.). As previously illustrated, avoidance coping and self-blame may have important implications for cardiac patients' psychosocial well-being. These avoidance coping strategies may also be directly or indirectly associated with cardiac health because they have been associated with depression (Shen, McCreary, & Myers, 2004), and depression has been associated with cardiac health (e.g., Frasure-Smith & Lespérance, 2003).

In contrast to the findings of Shen et al. (2004) and Van Elderen et al. (1999) that avoidance coping may be initially harmful or neutral to psychological health, the data on coping in cardiac patients who experienced an MI, underwent CABG, or both, suggest that denial (a form of avoidance coping) may be medically beneficial immediately after the event (Levenson, Kay, Monteferrante, & Herman, 1984; Levine et al., 1987), but detrimental to future health status (Levine et al.). Levenson et al. conducted a semistructured interview designed to assess denial with MI patients within 48 hr after hospital admission. Patients with lower denial scores ($\leq$ 15) were hospitalized for longer periods of time before they became medically stable (pain-free for 36 hr) than patients with higher denial scores ($\geq$ 16). There were no differences between patients with lower

or higher denial scores regarding anginal episodes per day, medication use, blood pressure, or heart rate. Similar findings were reported by Levine et al., who conducted semistructured interviews with male MI and CABG patients on average of 10 days after their event or surgery. They found that, during hospitalization, denial scores were inversely correlated with the number of days spent in intensive care and cardiac dysfunction. However, 1 year after patients were discharged, denial scores were positively correlated with the number of days spent in the hospital within that year, and the patients were less adherent to medical recommendations. These studies suggest that the avoidance coping strategy of denial may be temporarily beneficial when recovering from a cardiac event, but that its usefulness diminishes within a year following the event or surgery, which is the time period within which the patients would begin CR.

Although avoidance coping strategies are reportedly used less often than approach coping strategies among patients recovering from nonemergent cardiac surgery, patients who have undergone emergent cardiac surgery reported greater use of avoidance coping strategies than patients who have been hospitalized for other reasons (Crumlish, 1998; Pignalberi et al., 1998). Avoidance coping may be beneficial for MI and CABG patients immediately after an event (Levenson et al., 1984; Levine et al., 1987); however, it appears to be detrimental to long-term cardiac health among MI and CABG patients (Levenson et al.; Levine et al.). Furthermore, little is known about how approach and avoidance coping strategies are related to CR outcomes, especially CR attendance.

Depressive symptoms are associated with unfavorable CR outcomes and are also associated with coping strategies. For example, Shen et al. (2004) reported no association between approach coping (e.g., active coping) and depressive symptoms, but found that avoidance coping (e.g., negative coping) was positively associated with depressive symptoms among CR participants who had undergone cardiac intervention procedure approximately 12 weeks before study enrollment. However, a different relationship was observed between coping strategies and depressive symptoms over time by Van Elderen et al. (1999). Within 1 month of the event, these authors investigated coping and depressive symptoms in CHD patients who experienced a cardiac event. They re-assessed these patients 3 months and 12 months later. At each time point, approach coping was positively associated with concurrent depressive symptoms. However, baseline approach coping scores were inversely related to depression at 3 and 12 months post-baseline. Avoidance at any time point was not associated with depressive symptoms at any time point. Thus, approach coping was a better predictor of later depressive symptoms than avoidance coping. Furthermore, although approach coping was positively associated with concurrent depressive symptoms, within 3 to 12 months after a cardiac event it appeared to be especially important for experiencing lower depressive symptomatology at later time points.

Taken together, the limited data regarding the relationship between coping and depressive symptoms among cardiac patients are inconsistent. Some data indicate that avoidance coping is more strongly, and positively, related to concurrent depressive symptoms (Shen et al., 2004) than approach coping, and some data indicate the opposite

relationship (Van Elderen et al., 1999). Additionally, longitudinal data addressing the relationship between coping strategies and depressive symptoms among cardiac populations are rare (e.g., Van Elderen et al.). Furthermore, only two studies have addressed coping among CR participants (Shen et al., 2004), and their results are limited because the sample was restricted to a Veterans Administration hospital patient population, 97% were male, and MI or angina participants were not represented in the study. Because depression is an important predictor of CR outcomes, and studies suggest an association between depression and coping (Shen et al., 2004; Van Elderen et al.), further investigation into how depressive symptoms and coping are related among CR participants is clearly warranted.

Coping and Cardiac Rehabilitation Discharge Status and Attendance

Of great importance to cardiac patients, coping has been associated with CR attendance. Referral rates and participant enrollment do not reflect the need for CR services. That is, only a fraction of cardiac patients who could benefit from CR are referred to and participate in a CR program (Wenger et al., 1995). Unfortunately, even following enrollment in a CR program, attendance is often poor (Wenger et al.), which puts individuals with CHD at greater risk for morbidity and mortality compared to their peers who complete a CR program (Carlson, Johnson, Franklin, & VanderLaan, 2000). Only a few studies have addressed this relationship. Two studies found that coping strategies were related to CR enrollment, and two studies found that coping strategies were related to CR attendance. In an early study, Ades, Waldman, McCann, & Weaver (1992) concluded that MI patients who denied the severity of their cardiac illness (as rated

by a nurse in a guided interview before entering CR) did not enroll in CR. Denial predicted nonenrollment even when medical factors, including cardiac diagnosis and left ventricular ejection fraction, did not. Of note, CR participants were also significantly younger, had shorter commute time, had more education, and fewer chronic medical conditions.

In another structured interview study (Wyer, Earll, Joseph, & Harrison, 2001), MI patients were contacted 2 months following hospitalization and, similar to Ades et al. (1992), an avoidance coping strategy was associated with not enrolling in CR. Furthermore, nonattenders overtly expressed that they did not want to know information about their health for fear that it would cause them to worry. In contrast, CR attenders who used an approach coping strategy (information-seeking) saw themselves in control of recovery and felt that CR was a way to take responsibility for their health more than nonattenders did.

At least two studies have addressed coping and CR attendance. Whitmarsh et al. (2003) addressed coping in relation to the percent of attended/prescribed CR sessions among MI patients. These authors found that CR attenders (attended >50% of prescribed sessions) used more approach coping strategies (including problem-focused and emotion-focused strategies) than non-/poor-attenders (attended $\leq$ 50% of prescribed sessions). There was no difference between groups on avoidance coping strategies (termed maladaptive coping in that study), but in a logistic regression model, problem-focused approach coping predicted attendance and avoidance coping predicted non-/poor attendance. Finally, among participants in a Veterans Administration CR program, avoidance coping (called maladaptive/detrimental coping in that study) was associated

with failure to complete (19.8% attrition; Shen et al., 2004). However, the difference between attenders and the failure to complete group became nonsignificant after applying the Bonferroni adjustment for Type I error inflation.

Collectively, these studies suggest that avoidance coping is associated with patients not enrolling in CR, as well as failing to complete the program if they did enroll in CR. Approach coping may also be positively associated with CR participation. However, the previous studies did have limitations. First, while objective ratings and structured interviews potentially provide unbiased information (Ades et al., 1992, Wyer et al., 2001), and gathering qualitative data provides a helpful description of coping strategies among CHD patients (Wyer et al.), using paper-and-pencil measures may reduce social desirability bias and increase standardization. Second, some studies use a long questionnaire (60 items) to assess coping (Whitmarsh et al., 2003). Using a shorter questionnaire (i.e., 20 items) can provide useful information while reducing participant burden. Third, while several of these studies measured what are considered approach coping strategies, they are imbedded in the problem-focused and emotion-focused paradigm (Whitmarsh et al.). Investigating these strategies within the approach-avoidance paradigm may be more predictive of CR outcomes, including attendance. Fourth, while Wyer et al. used the approach-avoidance paradigm, their sample size was limited *(n =* 21). Increasing the sample size allows for more reliable results. Finally, some studies did not include a diverse patient population. Shen and others' (2004) sample was less than .003% women, and Whitmarsh and colleague's sample was 100% Caucasian. While their results suggest relationships between coping and CR attendance, data that includes a

more diverse sample may be more representative of the CR population and increase the generalizability of results.

Summary, Study Questions, and Hypotheses

CHD is the leading cause of death among U.S. adults and contributes to major health care costs. CR programs are helpful in attenuating the impact of CHD on patients, but failure to complete the program is common and also associated with depressive symptoms and coping strategies. Coping strategies are associated with depressive symptoms and CR attendance, but the existing literature leaves several areas of interest to be studied. The following questions were addressed: (a) Are coping strategies associated with total depressive symptoms in CR participants? (b) Is avoidance coping more strongly related to cognitive symptoms of depression than somatic symptoms? and (c) Does avoidance coping predict failure to complete CR, and does approach coping predict CR attendance?

The following hypotheses were made: (a) approach coping strategies would be inversely related to total depressive symptoms, and avoidance coping strategies would be positively related to total depressive symptoms, (b) avoidance coping would be positively correlated with cognitive depressive symptoms, and it would be more strongly related to cognitive symptoms of depression than somatic symptoms of depression, and (c) avoidance coping would predict failure to complete CR and would be inversely related to attendance rate, while approach coping would predict program completion and be positively associated with attendance rate.

If either coping strategy is a better predictor of depression, discharge status, or attendance rates CR, interventions may need to focus on helping patients learn more positive coping skills. Because CR attendance is necessary to achieve the expected benefits of CR, knowing more about the predictors of failure to complete CR will inform the development of interventions that can empower participants to achieve the full benefits of CR.

Method

Protection of Human Subjects and Approvals

As with Study 1, Expedited Institutional Review Board approval for the protection of human subjects was obtained prior to data collection and accessing the existing database (Appendix A). In addition to obtaining informed consent for the data usually collected upon enrollment, participants were verbally consented prior to their participation in Study 2. Data for each participant were coded with an identification number to assure confidentiality. No personal identifying information is included in the study database and the database is password protected.

Participants

Participants for this prospective study were recruited from the University of Alabama at Birmingham CR program between March 2006 and March 2007. They must have had a diagnosis of CHD to be included in the study, and they must have been able to complete the questionnaire. Additionally, participants were eligible to enroll in the study if they had not yet reached their sixth CR session. Based on preliminary data, the

majority of participants were prescribed 36 sessions at a rate of 3 sessions per week. It was

decided that data collected after 2 weeks of enrollment in CR would no longer count as

baseline data. Elapsed time from enrollment was calculated to test if coping strategies

were associated with that time frame.

Protocol

In addition to the previously described CR protocol, CR participants were

interviewed by a behavioral health specialist within their first few weeks of CR

participation, as part of routine care. Participants were asked if they would be willing to

complete an additional short questionnaire following that interview. If patients could not

be scheduled for the behavioral health interview before their sixth session, they were

asked if they were interested in the study before that time. Verbal consent was obtained

from interested participants (Appendix C). Instructions were provided verbally, as well

(Appendix D).

Another part of routine the protocol, participants were asked to inform the case

manager if they could not attend a scheduled session. Upon discharge (whether or not the

participant completed the program), case managers recorded their discharge status in the

most appropriate category: medical condition, move from the area or transfer to another

program, no transportation, financial issue, personal reason, or other. Discharge status for

the present study was defined as follows. Patients who completed their prescribed number

of sessions achieved their exercise and education goals ahead of schedule, transferred to

another program, or completed the program without final data were categorized as

"complete." A participant's discharge status was counted as "failure to complete" if they

discontinued participation for a medical reason, personal decision, schedule conflict, financial issue, or no specified reason. Attendance rate was defined as the number of sessions attended divided by the number of sessions prescribed.

Instruments

   Beck Depression Inventory-II. The BDI-II, as described above, was used for this study. As in Study I, participants completed the questionnaire during their initial CR assessment.

   Brief Coping Orientations to Problems Experienced Inventory (Brief COPE). The Brief COPE is a 28-item shortened version of the longer COPE Inventory (60 items; Carver, 1997). The 28 items of the Brief COPE represent 14 subscales with 2 questions per subscale. Items for the shorter instrument were chosen based upon research that indicated the significance of certain subscales in health-related research (e.g., acceptance and behavioral disengagement). Other subscales from the original COPE were eliminated because studies demonstrated that they were not useful, or they were redundant with other scales (Carver). Each item is scored 0 to 3, with higher scores indicating that the coping strategy is used with greater frequency.

   The Brief COPE was factor analyzed in CR by Shen et al. (2004). In their analysis, two factors emerged, maladaptive/detrimental coping and proactive/salutary coping. Four subscales loaded on both factors. For the purpose of the present study, only the 10 subscales that clearly loaded on one of the factors found by Shen et al. (2004) were used, resulting in a 20-item questionnaire (Appendix E). The factors were labeled

approach coping (proactive/salutary) and avoidance coping (maladaptive/detrimental) in this study (Table 6), because these terms describe the behavior without making assumptions about the outcomes with which they may be correlated. Alpha reliabilities from baseline, 6-month, and 12-month follow-up data for the subscales used in the present study ranged from .54 to .90 in Carver's (1997) study of individuals who had been greatly affected by a hurricane. These reliabilities may seem low at .54, but as Lazarus (1993) points out, coping strategies often change over time as the situation evolves. Convergent and discriminate validity were also demonstrated by Carver, Scheier, and Weintraub (1989). Shen and others (2004) used the Brief COPE in CR, as stated previously, and Whitmarsh and others (2003) used the longer COPE in CR. The results of both studies indicated that coping was related to important CR outcomes.

Data Analysis

The presence of outliers was investigated with leverage and influence diagnostic test. Leverage is a measure of how far a data point is away from the centroid of all other cases (Tabachnick & Fidell, 2001). Cases with leverage greater than 0.107 based on the formula $h_{ii} = 3(k+1)/n$, where k is the number of predictors and n is the sample size, were examined further as potential outliers (Mun, 2003). Influence measures the change in the regression coefficient when the case is deleted from the analysis, and cases with influence statistics greater than one are potential outliers (Tabachnick & Fidell).

Before conducting analyses to answer study questions related to coping, the data were described in terms of frequency of coping strategies reported, depressive symptom

Table 6

Approach and Avoidance Coping Strategies From a Factor Analysis of the Brief COPE in CR by
Shen et al. (2004)

Approach Coping

    Active Coping

    Planning

    Positive Reframing

    Acceptance

    Using Emotional Support

    Using Instrumental Support

Avoidance Coping

    Denial

    Substance Abuse

    Behavioral Disengagement

    Self-blame

reporting, failure to complete rates, and differences between participants who completed

the questionnaire before or after their interview with the behavioral health specialist.

      Regression analyses were used to determine if coping strategies were associated

with total depressive symptoms. A power analysis based on a two-tailed regression test

with $\rho = 0$ and $\alpha = .05$ revealed that 80 participants were necessary to detect a regression

coefficient of 0.30 with 80% power. Before performing analyses, the assumptions of the F-

test were assessed. The first assumption, that errors in the dependent variables are

normally distributed, was tested with the Shapiro-Wilk's W statistic. Second, homogeneity

of the error variance for the dependent variable regressed on the independent variable

was assessed with White's test for heteroscedasticity. Third, the Durbin-Watson statistic was used to test the independent errors assumption. Fourth, the assumption that coping strategies (the independent variable) and depressive symptoms (the dependent variable) were linearly related was tested by plotting residual tested against residual BDI-II scores as a function of the predicted BDI-II scores (Tabachnick & Fidell, 2001). When data are linearly related, points around the zero on the Y-axis will show a straight, linear (as opposed to curved) pattern in a scatter plot (Tabachnick & Fidell). Finally, mean scores for approach and avoidance coping were entered together into the regression model with total BDI-II score as the dependent variable.

Determining if coping strategies were differentially associated with depressive symptom types was assessed with Pearson's *r c*orrelations in four separate analyses: (a) Avoidance Coping correlated with Cognitive Depressive Symptoms, (b) Avoidance Coping correlated with Somatic-Affective Depressive Symptoms, (c) Approach Coping correlated with Cognitive Depressive Symptoms, and (d) Approach Coping correlated with Somatic-Affective Depressive Symptoms. A Bonferroni correction was applied to adjust for multiple analyses. As a result, correlations must be significant at the .0125 level.

Logistic regression was used to evaluate the relationship between coping strategies and discharge status. First, three logistic regression assumptions were tested. The Durbin-Watson statistic was used to test that the cases were independent. Multicollinearity of independent variables was assessed with the variance inflation factor (VIF). The Wald statistic was used to test for the linearity of the logit. Avoidance Coping and Approach Coping were then entered into the model predicting discharge status. Following that

analysis, it was planned to add covariates (depression, employment, obesity, smoking status, clinical risk, gender, 6-minute walk distance, and diabetes status) into the model.

In a final analysis, psychosocial, demographic, and medical variables were entered into a step-wise logistical regression model. The following psychosocial variables were entered into Step 1: Approach Coping, Avoidance Coping, BDI-II score, and the Physical Component and Mental Component Scores from the Short-Form-36-Health-Survey (a measure of quality of life; Ware & Sherbourne, 1992). Step 2 included demographic variables: age, gender, race, and employment status. Step 3 included the following medical variables: risk stratification, obesity, body mass index, 6-minute walk distance, and diabetes status. The final model, Step 4, included any variables that were significant in the other steps.

<center>Results</center>

Participants

One hundred and seven CR participants were approached to join the study, and 99 agreed to participate (93% recruitment rate). Three participants declined for lack of time, and one participant declined for each of the following reasons: not feeling up to it, already completed many questionnaires at CR intake, and feeling uncomfortable with having personal information used in research. Another participant declined with complaints that the questionnaire was "ambiguous," but that participant was determined to be medically ineligible. Sixteen questionnaires could not be used. Ten questionnaires were unusable because they were completed after that participant's sixth CR session, four could not be used because they were medically ineligible, one could not be used because

the participant could not understand the questionnaire, and one was a duplicate. Thus, 84 of the CR participants approached to enter the study agreed to participate and completed questionnaires within the study parameters.

Twenty-seven women (32%) and 57 men (68%) enrolled in the study. Their mean age was 62.7 years (SD = 11.4, range 36 to 84 years). The majority of participants were Caucasian (64%), almost one quarter (23%) were African American, 12% described their race/ethnicity as "Other," and 1% was Asian American. A large margin of participants was married (61%) and lived with at least one other person (87%). Most participants were either retired (44.05%) or worked full-time (33.33%). Less than 10% were disabled (8.33%), 7.14% worked part-time, 4.76% were unemployed, and 2.38% had missing employment data.

All participants had CHD. Sixty-five percent of participants entered CR following a major cardiac event such as an MI, PCI, or CABG. The remaining 35% of participants enrolled with a diagnosis of CHD, stable angina, or CHF with a history of ischemia. Most participants were positive for hypertension (84%), high cholesterol (99%), low physical activity (80%), obesity (52%), and a family history of heart disease (65%). Nearly half (45%) of the participants had diabetes, but few (11%) smoked tobacco. The mean body mass index was 31 (SD = 6.4), and the mode was 29.8, which suggests that most participants were obese or near obese. The mean diet score was 37.36 (SD = 28.73), which suggests that the participants diet was "fair," but it neared the "poor" range. The mean total MET hours (an estimate of weekly energy expenditure through exercise) was 4.62 (SD = 9.53), which is about half of the recommended minimum of 10 MET hours. As an estimate of overall physical functioning, the distance (in meters) participants could

walk in 6 min was measured. Participants initially walked an average of 1320.71 m ($SD =$ 400.51) in 6 min. Regarding psychological and social health, few participants (23%) reported taking antidepressant medication, and even fewer (5%) reported taking antianxiety medication. Participants in the coping study are representative of the UAB CR population, as evidenced by their similarity to the participants in Study1. Descriptive data are presented in Tables 7 to 10.

Coping Strategies

By far, participants reported using more approach coping strategies than avoidance coping strategies, t (80) = 24.34, p < .0001 (Table 11). On a scale of 0 to 3 the mean (SD) was 2.09 (*0.61*) for approach coping and 0.37 (*0.37*) for avoidance coping. The most frequently reported approach coping strategy was acceptance, followed in order by active coping, planning, seeking emotional support, positive reframing, and seeking emotional support. The most frequently used avoidance coping strategy was self-blame, followed by denial. behavioral disengagement and substance use were the least frequently reported avoidance coping strategies.

Depressive Symptoms

BDI-II scores averaged 8.22 (SD = 7.07), indicating minimal depressive symptoms (Beck et al., 1996). Scores ranged from 0 to 37 (possible range 0 to 63). Cognitive and somatic-affective scores were calculated for each participant, based on the factor analysis in Study 1. The average somatic-affective depressive symptom score across participants was 5.33 (SD = 3.21), and the average cognitive depressive symptom score was

Table 7

Demographic Data for Study 2

Variable	*Mean (SD)/ n* (%)
Age	
Mean	62.72 (11.4)
Minimum	36
Maximum	84
Gender	
Male	57 (68%)
Female	27 (32%)
Race	
White	54 (65%)
Black	19 (23%)
Other	10 (12%)
Asian	1 (1%)
Employment Status	
Fulltime	28 (33%)
Retired	37 (44%)
Disabled	7 (8%)
Part-time	6 (7%)
Unemployed	4 (5%)
Missing	2 (2%)

Note. Values may add up to slightly more or less than 100% due to rounding.

Table 8

Social Support Data for Study 2

Variable	*n* (%)
Marital Status	
Married	51 (61%)
Divorced	11 (13%)
Single	9 (11%)
Widowed	7 (8%)
Other	3 (4%)
Missing	3 (4%)
Living Status	
Not Alone	73 (87%)
Alone	11 (13%)

Note. Values may add up to slightly more or less than 100% due to rounding.

Table 9

Medical Data for Study 2—Continuous Variables

Specific Risk Factors	*Mean (SD)*
Diet Score	37.36 (28.73)
MET Hours	4.62 (9.53)
6-Min. Walk Distance (meters)	1320.71 (400.51)

Note. Diet Score is "fair." MET Hour goal = 10.

Table 10

Medical Data for Study 2—Categorical Variables

Variable	n (%)
Diagnosis	
MI	27 (32%)
Post-intervention procedure	26 (31%)
CHD	17 (20%)
Stable angina	10 (12%)
CHF with Ischemia	2 (2%)
Missing	2 (2%)
Risk Stratification	
High	40 (48%)
Intermediate	22 (26%)
Low	22 (26%)
Specific Risk Factors	
Hypertension	71 (84%)
High Cholesterol	83 (99%)
Low Physical Activity	66 (80%)
Obesity	44 (52%)
Family History	55 (65%)
Diabetes	38 (45%)
Smoke tobacco	9 (11%)
Antidepressant Medication	19 (23%)
Antianxiety Medication	4 (5%)

Note. Values may add up to slightly more or less than 100% due to rounding.

Table 11

Coping Strategy Frequency Reported Among CR Participants

Coping Strategy	Mean (*SD)*
Approach	
Mean of all Items	2.09 (0.61)
Acceptance	2.42 (0.60)
Active Coping	2.29 (0.75)
Planning	2.08 (0.90)
Seeking Emotional Support	2.03 (0.91)
Positive Reframing	1.86 (0.83)
Seeking Instrumental Support	1.85 (0.88)
Avoidance	
Mean of all Items	0.37 (0.37)
Self-blame	0.76 (0.79)
Denial	0.52 (0.73)
Behavioral Disengagement	0.13 (0.37)
Substance Use	0.07 (0.34)

Note. Scale 0 – 3, 0 = not at all, 1 = a little bit, 2 = a medium amount, 3 = a lot

2.08 (*SD* =3.54). The highest scores for these two scores were 24 and 33, respectively.

Based on these scores, it appeared that participants endorsed more somatic-affective than

cognitive symptoms. In order to determine if participants truly endorsed more somatic-

affective than cognitive symptoms of depression, average cognitive and somatic-affective

symptoms were calculated for each participant. That is, for each participant, the sum of

cognitive symptoms of depression was divided by 11, and the sum of somatic-affective

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symptoms was divided by 8. Indeed, somatic-affective symptoms were reported with greater severity t (79) = -13.60, p <.0001.

Discharge Status and Attendance

Participants were prescribed 12 to 36 CR sessions (M = 29.14, SD = 7.57), and most (52%) were prescribed 36 sessions. Participants attended an average of 22 sessions (SD = 10, range 3 to 36 sessions) and, on average, attended 77% of their prescribed sessions (range: 11 – 133%). Fifty-two participants (62%) were counted as completing their sessions. This group included participants who completed all sessions (n = 50), transferred to another program (n = 1), or completed the program without final data (n = 1). Thirty-two participants (38%) did not complete the program for the following reasons: medical condition (n = 14), no specified reason (n = 7), personal decision (n = 5), schedule conflict (n = 5), and financial issues (n = 1).

Differences Between Groups

The time of completion of the Brief COPE (pre- or post-interview with the behavioral health specialist) was not significant for either coping strategy, F (1, 80) = 3.01, p >.05 (approach coping), F (1, 80) = 0.19, p >.50 (avoidance coping).

Coping and Depressive Symptoms

Data were examined for the presence of outliers. Three cases with high leverage or influence were eliminated from further analysis. The assumptions of the F-test were tested prior to further analyses. The Shapiro-Wilk's W indicated a violation of the

assumption that the errors in the dependent variable were normally distributed, $W =$ 0.96, $p < .01$. White's test for heteroscedasticity also suggested a violation of the assumption that the variances of the dependent variable error variance for any value of the independent variable are equal, $X^2 (5, N = 80) = 24.37$, $p < .001$. The independent errors assumption was met, however. Errors were independent of each other, $DW = 2.27$, $p > .80$ (p-value testing for positive autocorrelation), and $p > .10$ (p-value testing for negative autocorrelation). Finally, the assumption that coping strategies (the independent variable) and depressive symptoms (the dependent variable) were linearly related appeared to be met, but it could also improve (Figure 1).
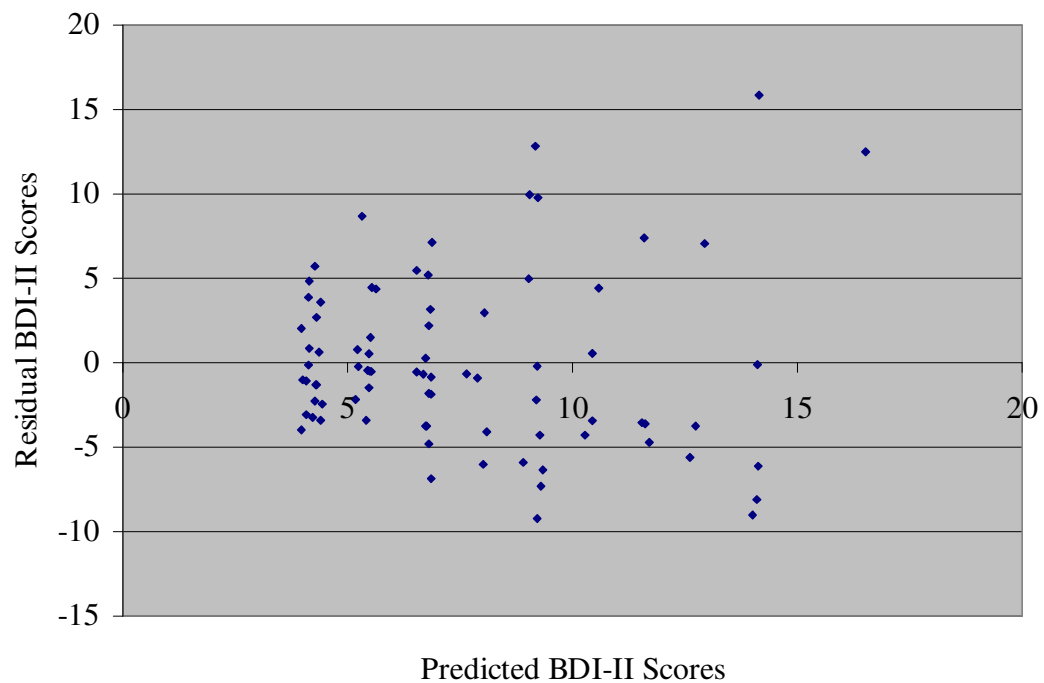

Figure 1. Scatter plot of predicted BDI-II scores by residual BDI-II scores.

The *F*-test is robust to violations of either normality or heteroscedasticity, but it is not robust to simultaneous violations of these assumptions (Myers, 1979). Additionally, the *F*-test is not robust to violations of the linearity assumption (Tabachnick & Fidell, 2001). The data were transformed to improve their fit to parametric statistics based on the recommendations of Tabachnick and Fidell. Of note, the SAS program subtracts a constant of 3 from skewness and kurtosis scores, so that "0" becomes the upper limit of the skewness range. BDI-II scores and Avoidance Coping were substantially positively skewed (1.68, and 0.89, respectively); therefore they were transformed by adding a constant of 10 and using the logarithm with a base of 10. Approach Coping was moderately and negatively skewed (-0.66), so the square root of the raw score subtracted from the constant 4 (1 + the highest score) was used (Tabachnick & Fidell). Somatic-Affective Depressive Symptoms were severely skewed (2.44), so they were transformed by dividing 1 by the denominator of the raw score plus a constant of 10. Skewness for Cognitive Depressive Symptoms was 0.57, indicating moderate skewness, so data were transformed using the square root of the raw value (Tabachnick & Fidell).

Following the transformations, the data met the assumption of normality ($W = 0.98, p > .3$), heteroscedasticity ($X^2 (5, N = 80) = 9.33, p > .09$), and independent errors [$DW = 2.21, p > .83$ (positive autocorrelation), and $p > .17$ (negative autocorrelation)]. The data did not change much in terms of linearity, and they still appeared to have an acceptably linear relationship (Figure 2).
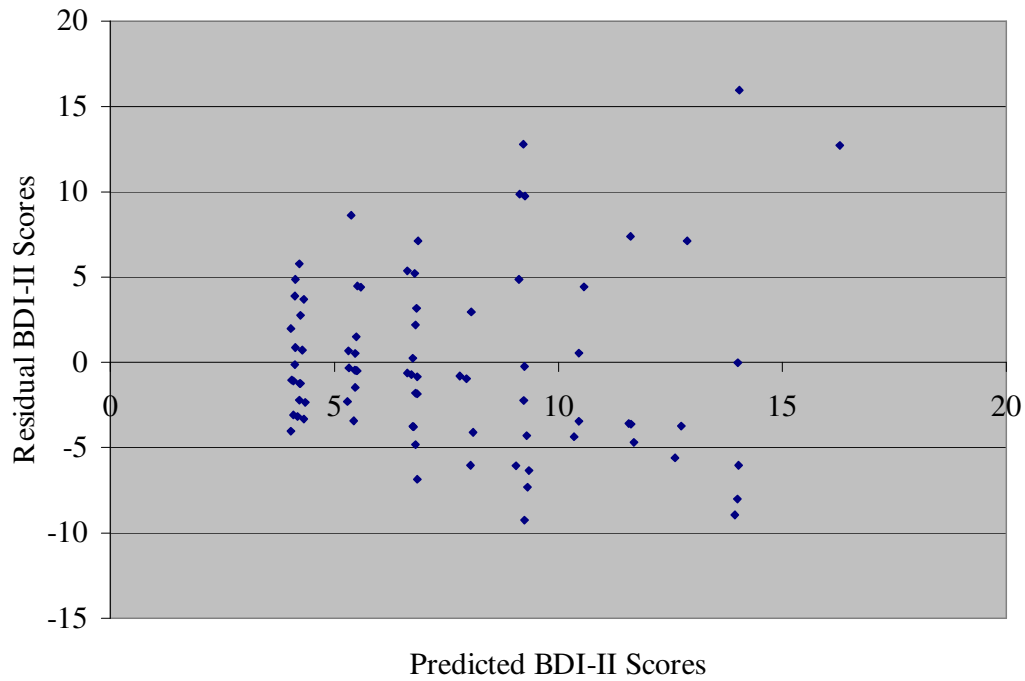
Figure 2. Scatter plot of predicted BDI-II scores by residual BDI-II scores after deletion of outliers and transformation of the variables.

Coping and Depressive Symptom Types

The regression model with approach and avoidance coping predicting BDI-II scores was significant, $F(2, 79) = 13.22$, $p < .0001$, $R^2 = 0.26$, Adj. $R^2 = 0.24$. Thus, after adjusting for likely inflation of R because of small sample size, coping accounted for 24% of the variance in BDI-II scores. Examination of the individual predictors revealed that avoidance coping was positively associated with BDI-II scores, $t = 5.11$, $p < .0001$, while approach coping was not associated with BDI-II scores, $t = -0.11$, $p > .90$. The following covariates were added to the model: gender, smoking, 6-minute walk distance, diabetes status, obesity, body mass index, risk stratification, and employment status. The model remained significant, $F(9, 77) = 4.17$, $p < .001$, $R^2 = 0.35$, Adj. $R^2 = 0.27$. Avoidance

coping remained positively associated with BDI-II scores, $t = 5.09$, $p < .0001$, but no other variable was significantly related to BDI-II scores, ps $>.11$.

There was no relationship between approach coping and somatic-affective symptoms, $r(80) = .18$, $p >.10$, nor between approach coping and cognitive symptoms, $r(80) = .82$, $p >.81$. There was a small inverse relationship between avoidance coping and somatic-affective symptoms, $r(80) = -0.51$, $p <.0001$, and a small positive correlation between avoidance coping and cognitive symptoms, $r(80) = .36$, $p <.01$.

Coping, Discharge Status, and Attendance

The assumptions of logistic regression were met. The cases were independent, as tested by the Durbin-Watson statistic, $DW = 2.01$, $p >.50$ (positive autocorrelation), and $p >.40$ (negative autocorrelation). The data were also absent of multicollinearity (VIF = 1.00 for approach and avoidance coping), suggesting that the independent variables were not highly correlated. Finally, the model was linear as determined by the Wald test, X^2 (4, $N = 61) = 6.33$, $p >.10$.

Coping strategies did not predict attendance rates or discharge status. The model with approach and avoidance coping predicting attendance rates was not significant, $F(2, 80) = 0.31$, $p >.50$. For the logistic regression, the full model, with both approach and avoidance coping predicting discharge status, was not significant, X^2 (1, $N = 81) = 0.32$, $p >.80$. Upon further investigation of the model, neither approach nor avoidance coping were predictors of discharge status, X^2 (1, $N = 81) = 0.03$, $p >.80$, X^2 (1, $N = 81) = 1.26$, $p >.20$, respectively. Because the model was not significant, the proposed covariates were not entered into the regression model.

The step-wise logistic regression evaluating groups of variables (psychological, demographic, and medical) revealed that only obesity was associated with discharge status (Table 12). Each step in the model was analyzed independently of the others. Odds ratios and confidence intervals are shown in Table 12 for variables which were significant at the end of each step. Step 1 included the following psychological variables: approach coping, avoidance coping, BDI-II score, and the physical and mental component scores from the quality of life measure (Ware & Sherbourne, 1992). None of the variables was retained in the model. Step 2 included the demographic variables age, gender, race, and employment status. Again, no variable was retained in the model. Step 3 was comprised of medical variables. These included risk stratification, obesity, body mass index, 6-minute walk distance (a measure of physical functioning), and diabetes status. Although obesity, body mass index, and 6-minute walk distance all appeared significant predictors initially, only obesity remained in the model. The final model (Step 4) included only obesity. Participants classified as obese were four times more likely to fail to complete the program, OR = 4.16 with a 95% confidence interval (1.56, 11.28).

Discussion

Participants in this study reported more approach coping than avoidance coping strategies. These results are consistent with other studies of coping strategies in cardiac surgery patients 1 day before and 1 day after surgery (Crumlish, 1998). The mean scores indicated that participants endorsed approach coping strategies with a frequency between "a medium amount" and "a lot." Approach coping seems to be a consistent characteristic of CR participants, perhaps in part because participants are using approach coping

Table 12

Step-wise Logistic Regression Predicting Discharge Status from Psychological, Demographic, and Medical Variables

Variable	Wald X^2	p	OR (95% CI)
Step 1: Psychological Variables			
Approach	0.04	.84	--
Avoidance	1.56	.21	--
BDI-II	0.11	.73	--
Physical Component Score	3.28	.07	--
Mental Component Score	0.86	.35	--
Step 2: Demographic Variables			
Age	0.99	.32	--
Gender	1.63	.20	--
Race	3.33	.34	--
Employment Status	6.11	0.19	--
Step 3: Medical Variables			
Risk Stratification	4.11	.13	--
Obesity	8.59	<.01	4.16 (1.56 − 11.28)
Body Mass Index	5.11	<.05	--
6-Min. Walk Distance	4.01	<.05	--
Diabetes	1.64	.20	--
Step 4: Final Model			
Obesity	8.59	<.01	4.16 (1.56 − 11.28)

Note. Each step represents a separate step-wise regression model analysis. Odds ratios and confidence intervals are provided for variables found to be significant at the end of each analysis.

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by attending CR. To illustrate this point, acceptance, active coping, and planning were the most frequently reported approach coping strategies. Each of these strategies is an intrinsic component of enrolling in and attending CR.

There were no associations between approach coping and depressive symptoms, neither cognitive symptoms of depression, nor somatic-affective symptoms of depression. This is in contrast to Van Elderen and others (1999), who found that approach coping was associated with coexisting depressive symptoms within 1 month of a cardiac event, and 3 and 12 months later. However, these data are consistent with data from CR participants (Shen et al., 2004). One difference is that Van Elderen et al. examined how participants anticipated they would react to various scenarios, but the present study asked participants how they were reacting to their current situation. CR was not a factor in Van Elderen et al.'s study. It may be that the associations would be weaker for study participants who enrolled in rehabilitation.

Participants in this study reported infrequent use of avoidance coping strategies, consistent with Crumlish's (1998) findings. The mean endorsement of the frequency of avoidance coping strategies use was between "not at all" and "a little bit." Self-blame and denial were the most frequently reported avoidance coping strategies. Self-blame was reported more frequently among cardiac patients than controls by Pignalberi and others (1998), suggesting that this may be an important coping strategy among cardiac patients. Avoidance coping strategies were positively associated with depressive symptoms, which is consistent with findings of other CR participants (Shen et al., 2004). These findings contrast those of Van Elderen and others (1999), who found no association between avoidance coping and depressive symptoms. One major difference between that study

and the present study are the samples. Van Elderen et al. studied CHD patients, while the present study included only CHD patients who enrolled in CR. As noted by Wyer and others (2001), persons with CHD who attended CR did so because they felt in control of their recovery and thought of CR as an avenue for improving their health. In that study, persons who did not attend CR used avoidance coping strategies. This suggests that CR participants use approach coping by attending CR; therefore, the avoidance coping strategies they endorse have a greater valence than they would in CHD patients as a whole. Additionally, participants in the present study were asked how they were coping with their current medical problem, but Van Elderen et al. used a questionnaire asking participants how they *would* respond to three different scenarios, a medical problem, a psychological problem, and a social problem, instead of referencing their current medical problem. Although a direct comparison cannot be made because they involved different study populations and coping measures, it seems that avoidance coping is not associated with depression among CHD patients as a whole, but the two psychological variables are associated among a subset of CHD patients who attend CR.

When examining depressive symptom types more closely, avoidance coping strategies and cognitive symptoms were positively correlated, but avoidance coping strategies were inversely correlated with somatic-affective symptoms. The positive correlation between avoidance coping and cognitive depressive symptoms may have been influenced by the similarity between items of the two scales. For example, self-blame (an avoidance coping strategy) is similar to guilty feelings and punishment feelings (cognitive depressive symptoms). It is also possible that avoidance coping results in cognitive

depressive symptoms, but the temporal relationship between the two variables would need to be tested to draw that conclusion.

As stated above, avoidance coping strategies exhibited an inverse relationship with somatic-affective depressive symptoms. This suggests that avoidance coping confers a benefit for participants in terms of somatic-affective symptoms of depression. These data are consistent with Levenson et al. (1984) and Levine et al. (1987), who found that denial was associated with less pain and faster recovery among cardiac patients in the acute phase of illness. Participants in the Levenson and Levine studies could have denied their symptoms in order to leave the hospital sooner, but CR participants would not benefit in this way because their participation is voluntary. Additionally, avoidance coping (as measured in this study), includes more than denial. Indeed, this is a complex relationship which clearly warrants further study. Although participants in this study reported cognitive depressive symptoms concurrently with avoidance coping, avoidance coping also seemed to be protective in terms of somatic and affective symptoms of depression.

Approximately two-thirds of participants in this study completed their CR course, and coping strategies did not predict discharge status. Shen et al. (2004) also found no relationship between coping and discharge status. Whitmarsh and colleagues (2003) examined the percent of sessions attended and found that approach coping was associated with greater CR attendance, but they found no association with avoidance coping and attendance. However, this study, in combination with similar studies, suggests that the use of approach coping may result in attending more CR sessions, but not completion of CR. A direct comparison within one study would help illuminate the difference. Furthermore,

it should also be examined whether benefit increases with attendance, or if participants need to complete all prescribed sessions to gain from the experience.

When psychosocial, demographic, and medical variables were explored as predictors of discharge status, only obesity predicted discharge status. Participants classified as obese were four times more likely to fail to complete the program than individuals who were not obese. It may be that the CR exercises, exercise equipment, or the environment are more difficult to navigate with extra weight, thus decreasing the likelihood of completing the program. Additionally, obesity may be associated with social factors such as discrimination, fear of judgment, and embarrassment, which may make attending the program more difficult. Finally, obesity may contribute to a lower sense of well-being and fatigue.

Approach coping is not likely to predict discharge status, possibly secondary to a floor effect of approach coping. That is, because participants are engaging in approach coping by attending CR, their scores on this scale may not be as low as in a more representative sample of CHD patients. Surprisingly, avoidance has not been associated with discharge status in any study (e.g., Shen et al., 2004). One possible reason is the low endorsement of avoidance. Substance abuse is endorsed with a frequency of almost zero, and behavioral disengagement may be rare because it is inconsistent with CR participation. Interestingly, even though participants are enrolled in CR, denial (of the event) is still one of the highest reported avoidance strategies. It seems that although participants are reporting denial, it is not influencing their understanding of the need to engage in healthy behaviors. Although self-blame is thought of as an avoidance strategy, it may serve as motivation for participants to engage in health-promoting behaviors.

The results of this study can inform future studies. Future studies should examine the relationships between coping and medical variables in CR. For example, Levenson et al. (1984) and Levine et al. (1987) found that denial conferred salutary effects for cardiac patients in the acute phase of an emergent cardiac event. However, Levine and others (1987) also found that denial in the acute phase of illness was associated with poor health 1 year later. Examining associations between baseline CR coping and long-term outcomes will also help illuminate the role of coping in illness. Additionally, Lazarus (1993) noted that coping strategies are not stable over the course of an event. Individuals often call on different strategies depending upon where they are in the course of a scenario. Longitudinal changes in coping and effects of coping over time should also be examined, such as Van Elderen and colleagues (1999) who studied coping among CHD patients within 1 month of their cardiac event through their first year following their diagnosis. Finally, specific coping strategies can be studied in greater depth. Denial of the event was one of the most frequently reported avoidance coping strategies in this study. However, denial of the severity of the event and denial of the steps needed to care for one's self were not measured. Similarly, participants may deny the event cognitively (e.g., think "This didn't happen.") but not deny the event behaviorally (e.g., make the necessary health behavior change). Thus, cognitive versus behavioral approach and avoidance may reveal important distinctions regarding outcomes. Second, self-blame was also frequently reported, but differences in a punishing self-blame or an empowering self-blame could further the understanding of this strategy among CR participants.

There are several limitations to the present study. First, participants were recruited within the first six sessions of their CR course, which may influence the results

in several ways. Some participants may discontinue their participation before the first six sessions, thus potentially increasing the approach coping scores and decreasing the avoidance scores. However, it is noted that there was no correlation between the session number when participants completed the survey and coping scores. Nor was there a relationship between the elapsed time between CR enrollment and study enrollment and coping scores. Results are similar to those of Shen and others (2004) in which participants completed questionnaires prior to CR participation.

Another related limitation is that measures were taken at different times. Participants were asked to complete all intake measures except the Brief COPE during their first CR session. The time discrepancy is not ideal, but again, results are similar to those of Shen et al. (2004), whose measures were completed at the same time.

Finally, because participants were completing the questionnaires in the context of an interview with the behavioral health specialist, their scores may have been influenced by either. Similarly, participants may have misunderstood the concept of coping as indicating that something was wrong if they coped, even though coping was normalized. Several participants remarked that they were adjusting fine and did not need to cope. However, this limitation is reduced because the questionnaire asks about specific thoughts and behaviors, and indeed no one reported scores of zero on both approach and avoidance.

Despite these limitations, this study increases the knowledge of coping among CR participants. The results confirm prior studies of associations between avoidance coping and depression, and between coping and discharge status, with a more diverse sample. Additionally, this is the first study to investigate coping in association with depressive

symptom types. Results from this study suggest that CR participants are similar to cardiac

patients in the acute phase of illness because avoidance coping appears to be beneficial in

terms of somatic and affective symptoms. However, CR participants are like cardiac

patients 3 to 12 months away from their event, because cognitive symptoms of depression

were positively associated with depressive symptoms.

CONCLUSIONS

Coronary heart disease is a major health concern. While CR is an effective intervention, participants experiencing depressive symptoms are often disadvantaged in terms of medical, psychosocial, and economic outcomes. Study 1 delineated two depressive symptom types: cognitive and somatic-affective. Many somatic-affective depressive symptoms are similar to sequelae of CHD, and these symptoms can now be tested separately as predictors of CR outcomes. Such studies are a vital step in understanding the relationship between depressive symptoms and CR outcomes, and having the opportunity to improve CR. Interpreting the factors through a cognitive-behavioral therapy framework enhances the utility of the solution for the development of interventions.

Delineating depressive symptom types also helped to clarify the association between depressive symptoms and coping. In Study 2, CR participants' use of avoidance coping strategies was associated with experiencing cognitive depressive symptoms; however, avoidance coping was inversely related to somatic-affective symptoms of depression. These findings are consistent with prior studies of depressive symptoms and coping, in which avoidance coping was detrimental to mental health but showed a benefit for physical symptoms.

These studies demonstrate the multidimensional nature of both depression and coping, and the utility of examining the dimensions separately. Future studies should address how coping and depressive symptom types influence health behavior change, as

this is an important CR goal. Such studies would inform interventions to address barriers to health behavior change.

The present studies contribute to the understanding of psychological variables among individuals seeking treatment through a CR program. The conclusions drawn from these studies enhance the knowledge about psychological predictors of vital CR outcomes. This is the first study of depressive symptom types among CR participants and the first to examine depressive symptom types in relation to coping strategies. Additionally, these studies addressed the limitations of prior studies, thus increasing the generalizability of the results. The information gleaned from these studies is important for informing future research so that the individuals with CHD may have the opportunity for improved health, and the impact of the leading killer of adults in the United States may be reduced.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD FOR HUMAN USE FORMS

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56 and ICH GCP Guidelines. The Assurance became effective on November 24, 2003 and expires on September 19, 2010. The Assurance number is FWA00005960.

Principal Investigator: SANDERSON, BONNIE

Co-Investigator(s):

Protocol Number: **X031121006**

Protocol Title: *Depression among Cardiac Rehabilitation Patients*

The IRB reviewed and approved the above named project on *10/17/07* . The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: *10-17-07*

Date IRB Approval Issued: *10/17/07*

HIPAA Waiver Approved?: Yes

Marilyn Doss, M.A.
Vice Chair of the Institutional Review
Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

470 Administration Building
701 20th Street South
205.934.3789
Fax 205.934.1301
.rb@uab.edu

The University of
Alabama at Birmingham
Mailing Address:
AB 470
1530 3RD AVE S
BIRMINGHAM AL 35294-0104

Form 4: IRB Approval Form
Identification and Certification of Research
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Principal Investigator: JONES, JENNIFER D

Co-Investigator(s):

Protocol Number: **X060324011**

Protocol Title: *Coping Styles Associated with Cardiac Rehabilitation Attendance*

The IRB reviewed and approved the above named project on _5-20-08_ . The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: _5-20-08_

Date IRB Approval Issued: _5-21-08_

HIPAA Waiver Approved?: Yes

Marilyn Doss, M.A.
Vice Chair of the Institutional Review
Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

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Mailing Address:
AB 470
1530 3RD AVE S
BIRMINGHAM AL 35294-0104

APPENDIX B

BECK DEPRESSION INVENTORY-II

BDI-II

Date: _____

Name: _____ Marital Status: _____ Age: _____ Sex: _____

Occupation: _____ Education: _____

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today**. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1. Sadness
0 I do not feel sad.
1 I feel sad much of the time.
2 I am sad all the time.
3 I am so sad or unhappy that I can't stand it.

2. Pessimism
0 I am not discouraged about my future.
1 I feel more discouraged about my future than I used to be.
2 I do not expect things to work out for me.
3 I feel my future is hopeless and will only get worse.

3. Past Failure
0 I do not feel like a failure.
1 I have failed more than I should have.
2 As I look back, I see a lot of failures.
3 I feel I am a total failure as a person.

4. Loss of Pleasure
0 I get as much pleasure as I ever did from the things I enjoy.
1 I don't enjoy things as much as I used to.
2 I get very little pleasure from the things I used to enjoy.
3 I can't get any pleasure from the things I used to enjoy.

5. Guilty Feelings
0 I don't feel particularly guilty.
1 I feel guilty over many things I have done or should have done.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

6. Punishment Feelings
0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7. Self-Dislike
0 I feel the same about myself as ever.
1 I have lost confidence in myself.
2 I am disappointed in myself.
3 I dislike myself.

8. Self-Criticalness
0 I don't criticize or blame myself more than usual.
1 I am more critical of myself than I used to be.
2 I criticize myself for all of my faults.
3 I blame myself for everything bad that happens.

9. Suicidal Thoughts or Wishes
0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10. Crying
0 I don't cry anymore than I used to.
1 I cry more than I used to.
2 I cry over every little thing.
3 I feel like crying, but I can't.

Subtotal Page 1

Continued on Back

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11. Agitation

0   I am no more restless or wound up than usual.

1   I feel more restless or wound up than usual.

2   I am so restless or agitated that it's hard to stay still.

3   I am so restless or agitated that I have to keep moving or doing something.

12. Loss of Interest

0   I have not lost interest in other people or activities.

1   I am less interested in other people or things than before.

2   I have lost most of my interest in other people or things.

3   It's hard to get interested in anything.

13. Indecisiveness

0   I make decisions about as well as ever.

1   I find it more difficult to make decisions than usual.

2   I have much greater difficulty in making decisions than I used to.

3   I have trouble making any decisions.

14. Worthlessness

0   I do not feel I am worthless.

1   I don't consider myself as worthwhile and useful as I used to.

2   I feel more worthless as compared to other people.

3   I feel utterly worthless.

15. Loss of Energy

0   I have as much energy as ever.

1   I have less energy than I used to have.

2   I don't have enough energy to do very much.

3   I don't have enough energy to do anything.

16. Changes in Sleeping Pattern

0   I have not experienced any change in my sleeping pattern.

1a   I sleep somewhat more than usual.

1b   I sleep somewhat less than usual.

2a   I sleep a lot more than usual.

2b   I sleep a lot less than usual.

3a   I sleep most of the day.

3b   I wake up 1–2 hours early and can't get back to sleep.

17. Irritability

0   I am no more irritable than usual.

1   I am more irritable than usual.

2   I am much more irritable than usual.

3   I am irritable all the time.

18. Changes in Appetite

0   I have not experienced any change in my appetite.

1a   My appetite is somewhat less than usual.

1b   My appetite is somewhat greater than usual.

2a   My appetite is much less than before.

2b   My appetite is much greater than usual.

3a   I have no appetite at all.

3b   I crave food all the time.

19. Concentration Difficulty

0   I can concentrate as well as ever.

1   I can't concentrate as well as usual.

2   It's hard to keep my mind on anything for very long.

3   I find I can't concentrate on anything.

20. Tiredness or Fatigue

0   I am no more tired or fatigued than usual.

1   I get more tired or fatigued more easily than usual.

2   I am too tired or fatigued to do a lot of the things I used to do.

3   I am too tired or fatigued to do most of the things I used to do.

21. Loss of Interest in Sex

0   I have not noticed any recent change in my interest in sex.

1   I am less interested in sex than I used to be.

2   I am much less interested in sex now.

3   I have lost interest in sex completely.

18 19 20 A B C D E

Subtotal Page 2

Subtotal Page 1

Total Score

APPENDIX C

VERBAL CONSENT TO PARTICIPATE IN THE COPING IN CARDIAC
REHABILITATION STUDY

Verbal Consent to Participate in the Coping in Cardiac Rehabilitation Study

As we talked about, we know how some things, like depression, can be associated with heart problems. We are also interested in learning about how people cope or deal with heart problems. If you are willing to help us better understand this issue, we have an additional questionnaire that will take about 10 to 15 minutes to complete. Would you be willing to complete this questionnaire about how you deal with your heart condition? Your decision to participate or not participate will not impact your care in any way.

A. If "Yes," present verbal instructions below and administer questionnaire. Allow the participant to complete the questionnaire in the room alone.

   a. Before the participant leaves the room, please be sure participants have completed <u>all</u> questions before they leave the room. If they have skipped any questions, please ask them if they skipped it unintentionally, because the question was difficult to understand, if they were uncertain of their answer for it, or if they were uncomfortable answering it. Please answer any questions they may have about it and ask them to give their best answer if they are uncertain about their answer. However, if they are uncomfortable answering the question, thank them for their participation.

   b. If all items are complete, thank participants for their participation.

B. If "No," state, "We need to keep track of the reasons people decide not to participate. Is it because of time, you don't feel up to it today physically or mentally, you're not interested, you feel it will negatively impact your care, or another reason?"

   a. If the participant indicates that he or she is not interested due to time constraints or not feeling up to it, offer to schedule a convenient time and suggest before or after their next exercise session.
       i. Record the time in the appointment book and indicate the appointment is for the COPE (i.e., Ms. Jones-COPE).

   b. If the participant is declining, record the reason on the Consent/Decline Form.

APPENDIX D

BRIEF COPE VERBAL INSTRUCTIONS

Brief COPE Verbal Instructions

The questions are related to how you've been coping since you had your heart condition. There are many ways to try to deal with problems and there are no right or wrong answers. Obviously, different people deal with things in different ways, but I'm interested in how *you've* tried to deal or cope with your heart condition. Each item says something about a particular way of coping. I want to know to what extent you've been doing what the item says; How much or how frequently. Don't answer on the basis of whether it seems to be working or not—just whether or not you're doing it. Try to rate each item separately in your mind from the others. Make your answers as true FOR YOU as you can. Use these response choices:

0 = I haven't been doing this at all
1 = I've been doing this a little bit
2 = I've been doing this a medium amount
3 = I've been doing this a lot

Do you have any questions?

APPENDIX E

BRIEF COPE

Participant Name/ID_____   Date_____

Brief COPE

1. I've been concentrating my efforts on doing something about the situation I'm in.

0	1	2	3
not at all	a little bit	a medium amount	a lot

2. I've been saying to myself, "this isn't real."

0	1	2	3
not at all	a little bit	a medium amount	a lot

3. I've been using alcohol or other drugs to make myself feel better.

0	1	2	3
not at all	a little bit	a medium amount	a lot

4. I've been getting emotional support from others.

0	1	2	3
not at all	a little bit	a medium amount	a lot

5. I've been giving up trying to deal with it.

0	1	2	3
not at all	a little bit	a medium amount	a lot

6. I've been taking action to try to make the situation better.

0	1	2	3
not at all	a little bit	a medium amount	a lot

7. I've been refusing to believe that it has happened.

0	1	2	3
not at all	a little bit	a medium amount	a lot

8. I've been getting help and advice from other people.

0	1	2	3
not at all	a little bit	a medium amount	a lot

9. I've been using alcohol or other drugs to help me get through it.

0	1	2	3
not at all	a little bit	a medium amount	a lot

10. I've been trying to see it in a different light, to make it seem more positive.

0	1	2	3
not at all	a little bit	a medium amount	a lot

11. I've been criticizing myself.

| 0 | 1 | 2 | 3 |
| not at all | a little bit | a medium amount | a lot |

12. I've been trying to come up with a strategy about what to do.

| 0 | 1 | 2 | 3 |
| not at all | a little bit | a medium amount | a lot |

13.   I've been getting comfort and understanding from someone.

| 0 | 1 | 2 | 3 |
| not at all | a little bit | a medium amount | a lot |

14.   I've been giving up the attempt to cope.

| 0 | 1 | 2 | 3 |
| not at all | a little bit | a medium amount | a lot |

15.   I've been looking for something good in what is happening.

| 0 | 1 | 2 | 3 |
| not at all | a little bit | a medium amount | a lot |

16.   I've been accepting the reality of the fact that it has happened.

| 0 | 1 | 2 | 3 |
| not at all | a little bit | a medium amount | a lot |

17.   I've been trying to get advice or help from other people about what to do.

| 0 | 1 | 2 | 3 |
| not at all | a little bit | a medium amount | a lot |

18.   I've been learning to live with it.

| 0 | 1 | 2 | 3 |
| not at all | a little bit | a medium amount | a lot |

19.   I've been thinking hard about what steps to take.

| 0 | 1 | 2 | 3 |
| not at all | a little bit | a medium amount | a lot |

20.   I've been blaming myself for things that happened.

| 0 | 1 | 2 | 3 |
| not at all | a little bit | a medium amount | a lot |