SOCIAL SUPPORT AND HEALTH BEHAVIORS IN CARDIAC REHABILITATION:

DEPRESSION AS A MEDIATOR

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JILLIAN MAE RICKS CLARK

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Jillian Mae Ricks Clark, Candidate for the Master of Arts Degree

University of Missouri-Kansas City, 2014

ABSTRACT

Social support and psychological factors (i.e., depression) have been linked to negative outcomes, such as recurrence and mortality, following a cardiac event. Further, these constructs have been associated with health behaviors in both the general population and within samples of patients with cardiovascular disease. As suggested by a conceptual model, the purpose of this study was to examine the relationship between social support and health behaviors in individuals with cardiovascular disease, and the mediating roles adherence to cardiac rehabilitation (as measured by number of sessions completed) and depressive symptoms may play in this relationship. It was hypothesized that social support at the beginning of cardiac rehabilitation would be positively related to health behaviors 18 months after cardiac rehabilitation, and that adherence to cardiac rehabilitation and depressive symptoms at the end of cardiac rehabilitation would mediate this relationship. Participants (n=83) were recruited at the beginning of a cardiac rehabilitation program and completed questionnaires at Time 1 (beginning of their programs), Time 2 (end of their programs), and Time 3 (18 months following the end of their programs). Path analysis results did not support the hypothesized model as fitting these data. Further, parameter estimates of the path model indicated that both social support and adherence to cardiac rehabilitation were not related to any constructs within the model. Depressive symptoms

were negatively related to health behaviors, confirming prior research. Results suggest that cardiac rehabilitation practitioners should identify individuals who are experiencing greater depressive symptoms following a cardiac event and promote intervention methods to address their heightened psychological distress. This approach would be complementary to the ultimate goal of cardiac rehabilitation—lifestyle modification to adhere to recommended health behaviors to reduce the likelihood of cardiac event recurrence and cardiac-related mortality.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the College of Arts and Sciences have examined a thesis titled "Social Support and Health Behaviors in Cardiac Rehabilitation: Depression as a Mediator," presented by Jillian M. R. Clark, candidate for the Master of Arts degree, and certify that in their opinion it is worthy of acceptance.

Supervisory Committee

Kymberley K. Bennett, Ph.D., Committee Chair
Department of Psychology

Delwyn Catley, Ph.D.
Department of Psychology

Tamera B. Murdock, Ph.D.
Department of Psychology

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ILLUSTRATIONS

LIST OF ABBREVIATIONS

Beck Depression Inventory-II = BDI-II

Cardiac Rehabilitation = CR

Cardiovascular Disease = CVD

Comparative Fit Index = CFI

Coronary Heart Disease = CHD

Emotional Social Support = ESS

Metabolic equivalents = METs

Myocardial Infarction = MI

Root Mean Square Error of Approximation = RMSEA

Satorra-Bentler Scaled Chi-Square = SB χ^2

Standardized Root Mean Square Residual = SRMR

90% Confidence Interval = 90% CI

CHAPTER 1

INTRODUCTION

Cardiovascular Disease (CVD) is the leading cause of death of American adults and has proven to be debilitating and costly (Roger et al., 2012). Individuals who have experienced an initial cardiac event are at greater risk for subsequent events, such as recurrence or cardiac-related mortality. Social, psychological, and behavioral risk factors associated with CVD onset have been linked to greater risk for experiencing subsequent events. For example, engagement in healthy behaviors (such as greater consumption of fruits and vegetables, decreased intake of high-fat foods, and non-sedentary activity) has been associated with lower instances of recurrence and mortality following CVD. Additionally, greater perceived emotional social support following CVD has been associated with healthier dietary and non-sedentary behaviors. Psychological factors, such as depression, also have been negatively associated with healthy behaviors. In fact, psychological factors have been proposed to play a mediating role in the relationship between social support and health behaviors. This study sought to test this mediating relationship in a longitudinal manner, addressing a gap in the current literature that mostly relies on cross-sectional designs or focuses on direct relationships between these three variables.

Based on Umberson, Crosnoe, and Reczek's (2010) conceptual framework, this study hypothesized that social support at the beginning of cardiac rehabilitation (CR) would be directly, positively related to engagement in healthy behaviors 18 months later. Additionally, it was predicted that adherence to CR and depressive symptoms at the end of CR would mediate the relationship between social support and healthy behaviors. This study used an existing data set of 83 individuals with CVD recruited from two CR programs in order to examine the aforementioned hypotheses. These 83 participants had complete

data at the beginning of CR, the end of CR (12 weeks later), and 18 months following

graduation from CR. Path model results indicated that the hypothesized model did not fit

the data well. Parameter estimates indicated that social support and adherence to CR were

not significantly associated with any variables in the model. Thus the mediating effect of CR

adherence and depressive symptoms on the relationship between social support and

engagement in healthy behaviors was not supported. Results showed a negative relationship

between depressive symptoms experienced at the end of CR and health behaviors 18 months

later (after controlling for baseline levels). Therefore, these data support other research

showing that emotional distress can negatively affect engagement in health behaviors.

Overall, results of the current study do not fully support the theoretical mediated

model proposed by Umberson and colleagues (2010), nor do they support my hypotheses.

The current study does fill a gap in the literature by examining the aforementioned

constructs longitudinally; however, further research, especially research addressing the

limitations of this study, is needed to better understand the relationship between social

support and health behaviors following CR, as well as the influence of adherence to CR and

psychological constructs on this relationship.

CHAPTER 2

REVIEW OF THE LITERATURE

Cardiovascular Disease and Cardiac Rehabilitation

Cardiovascular Disease (CVD) is a class of diseases involving the heart or blood vessels, which can be debilitating and are very costly. Approximately 82.6 million American adults have one or more types of CVD and an estimated $297.7 billion is paid annually for the direct and indirect cost of CVD. CVD is the leading cause of death in the United States, accounting for one of every three deaths in 2008 (Roger et al., 2012). On average, CVD claims the life of one American every 39 seconds, and claims more lives annually, than cancer, respiratory disease, and accidents combined. The most common form of CVD is coronary heart disease (CHD), comprised of myocardial infarction (MI) and angina pectoris among others, which affects an estimated 16.3 million Americans. The prevalence of CHD in men is 8.3% and 6.1% in women. The American Heart Association estimates that 785,000 Americans will experience their first coronary attack in 2012, with an additional 470,000 experiencing a recurrent attack. Additionally, approximately 34% of individuals who experience a cardiac event in a given year will die from this event.

There are several modifiable and non-modifiable risk factors for CVD. High blood cholesterol levels, high blood pressure, and a diagnosis of Diabetes Mellitus increase a person's risk for CHD and are considered modifiable factors as these can be controlled by diet, exercise, and medication (Centers for Disease Control and Prevention, 2012). Additionally, the use of tobacco products, excessive alcohol use, physical inactivity, obesity, and a diet high in saturated fats, cholesterol, or sodium have also been linked to CVD. Non-modifiable risk factors for CVD include age, a family history, gender, and ethnic origin (World Heart Federation, 2012). Psychosocial factors have also been investigated as

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predictors of coronary events. Depressive symptoms and anxiety have been studied as potential risk factors for CHD, with consistent results indicating that those with elevations in depressive symptoms are more likely to experience a CHD event than those without depressive symptoms (Matthews, 2005). Anxiety also has been linked to CVD onset (Rozanski, Blumenthal, & Kaplan, 1999). Additionally, job stress and stressful primary relationships have been shown to be related to CHD. Specifically, elevated job stress and marital distress are associated with elevated risk of CHD events (Matthews, 2005).

Death rates attributed to CHD have been declining from 1968 to the present. This decline can be associated with greater preventive strategies and advances in medicine; however, an estimated 44% of the reduction in CHD deaths can be attributed to changes in risk factors. For instance, reductions in cholesterol, blood pressure, smoking prevalence, and physical inactivity are all uniquely associated with the decrease in CHD related deaths (Ford et al., 2007).Secondary prevention programs, like cardiac rehabilitation (CR), that promote the reduction of these risk factors also are likely partly responsible for declining mortality rates. In fact, CR should be recommended to all patients suffering from a cardiac event and is an essential part of the recovery plan for CVD patients (Thomas et al., 2010). A recent update from the American Heart Association proposed health-related goals that each CR program should promote in their patients: complete smoking cessation, being physically active for a minimum of 30 minutes for three or four days per week, weight management, diabetes management, and control of blood pressure and cholesterol levels (Braverman, 2011). CR programs have been shown to positively influence health outcomes, such as reductions in cardiac-related and all-cause mortality, as well as cardiac event recurrence

(Clark, Hartling, Vandermeer, & McAlister, 2005). Further, CR programs have been shown to improve quality of life (Yohannes, Doherty, Bundy, & Yalfani, 2010).

Cardiac Event Recurrence and Health Behaviors

Although CHD-related mortality rates are declining, the rates of secondary outcomes following CVD (e.g., mortality, secondary cardiac event) remain high, as those who have experienced a recent cardiac event are at higher risk for subsequent ones (Thune et al., 2011). The aforementioned modifiable risk-factors identified as contributors to the onset of CVD have also been identified as risk-factors in recurrence. Similar to the onset of CVD, these risk-factors can be controlled by diet, exercise, and medication. Adherence to dietary, exercise, and medication recommendations reduces the risk of these secondary outcomes. For example, adherence to a Mediterranean diet has been shown to improve outcomes following a cardiac event. Specifically, diets characterized by a moderate consumption of vegetables (raw and cooked), fruit, fish, and foods low in saturated fats were associated with a relatively lower chance of premature death and reduced chance of post-cardiac events (Barzi et al., 2003). In fact, those classified to be in the top quartile in adherence to a Mediterranean diet were found to have a reduced chance of death by 49%. Furthermore, these authors found that each food characterizing the Mediterranean diet seemed to have a protective effect on outcomes, even when controlling for the effects of the other foods. These results are consistent with previous findings suggesting that a Mediterranean diet is protective against all-cause and cardiovascular mortality, and recurrent MI, in comparison with a Western-type diet (de Lorgeril et al., 1999). Chrysohoou et al. (2010) suggest these protective effects may function by way of the left ventricular systolic function, as adherence to a Mediterranean diet is negatively associated with recurrence of left ventricular systolic

dysfunction, a process found to be associated with higher CVD event risk following the initial cardiac event.

Complementing the results suggesting better prognosis following cardiac events with adherence to a heart healthy diet, consistent exercise has also been shown to have positive effects. Lisspers et al. (2005) determined that adherence to a lifestyle modification program, which combined consumption of a heart healthy diet, regular exercise, and stress management, reduced the likelihood of mortality and a secondary cardiac event. Although no significant difference was found between the lifestyle modification group and the control group in secondary cardiac events within the first 12 months following the initial cardiac event, the lifestyle modification group showed a significant risk reduction of 41% following the initial 12 months and across the subsequent four years. Again, these findings have been supported by other studies indicating that consistent exercise following an initial MI decreases the risk of post-MI mortality and secondary cardiac events (Blumenthal et al., 2004). Specifically, the proportion of deaths for individuals classified as regular exercisers was about half (5.7%) that of non-exercisers (12.0%), and the rate of nonfatal secondary cardiac events was lower in the exercise group (6.5%) than in the non-exercise group (10.5%). Exercise remained significantly effective, even after controlling for other health conscious behaviors such as diet and smoking. Therefore, lifestyle modification targeting the modifiable risk-factors associated with CVD, such as a heart healthy diet and consistent exercise, reduces the likelihood of recurrent cardiac events and mortality following an initial cardiac event. Furthermore, modifiable risk factors are important to empirically study as proximal outcomes in the long-term process of recovery following a cardiac event.

Conceptual Framework for Relationship between Social Support, Depressive

Symptoms, and Health Behaviors

Reducing the occurrence of detrimental secondary outcomes following CVD should be a top priority in recovery from an initial cardiac event. Research suggests health behaviors, such as physical activity and diet, are instrumental in reducing the risk of these outcomes; however, the psychosocial mechanisms influencing engagement in these health behaviors are still under investigation. Several theories from social and health psychology propose that psychosocial variables, including one's social environment, have direct and indirect effects on engagement in healthy behaviors. The current proposal focuses on one such theory outlined by Umberson, Crosnoe, and Reczek (2010).

Social ties influence health behaviors through psychological processes, personal control, social control, and physiological responses. Umberson, Crosnoe, and Reczek (2010) suggest a conceptual framework (see Figure 1) describing the mechanisms by which social ties, or social networks, social support, and social stress, impact health behaviors. This model distinguishes between structural components and content components of social ties. Structural components involve social integration and social networks, or the existence of particular ties and the linkages between an individual and others in a network, respectively. Content components include stress, or difficulties in relationships, and social support, or the emotionally withstanding qualities of relationships. Although evidence suggests social ties, both structural and content, have a positive effect on healthy behaviors, there is also evidence to suggest the reverse may be true as well, specifically in stressful social circumstances (Taylor, Repetti, & Seeman, 1997). In addition to distinguishing between the components of social ties, Umberson and colleagues predict several mediated pathways by

which these social ties influence health behaviors. Figure 1 outlines these predictions, with

the shaded variables and bolded pathways reflecting the ones of primary focus in the current
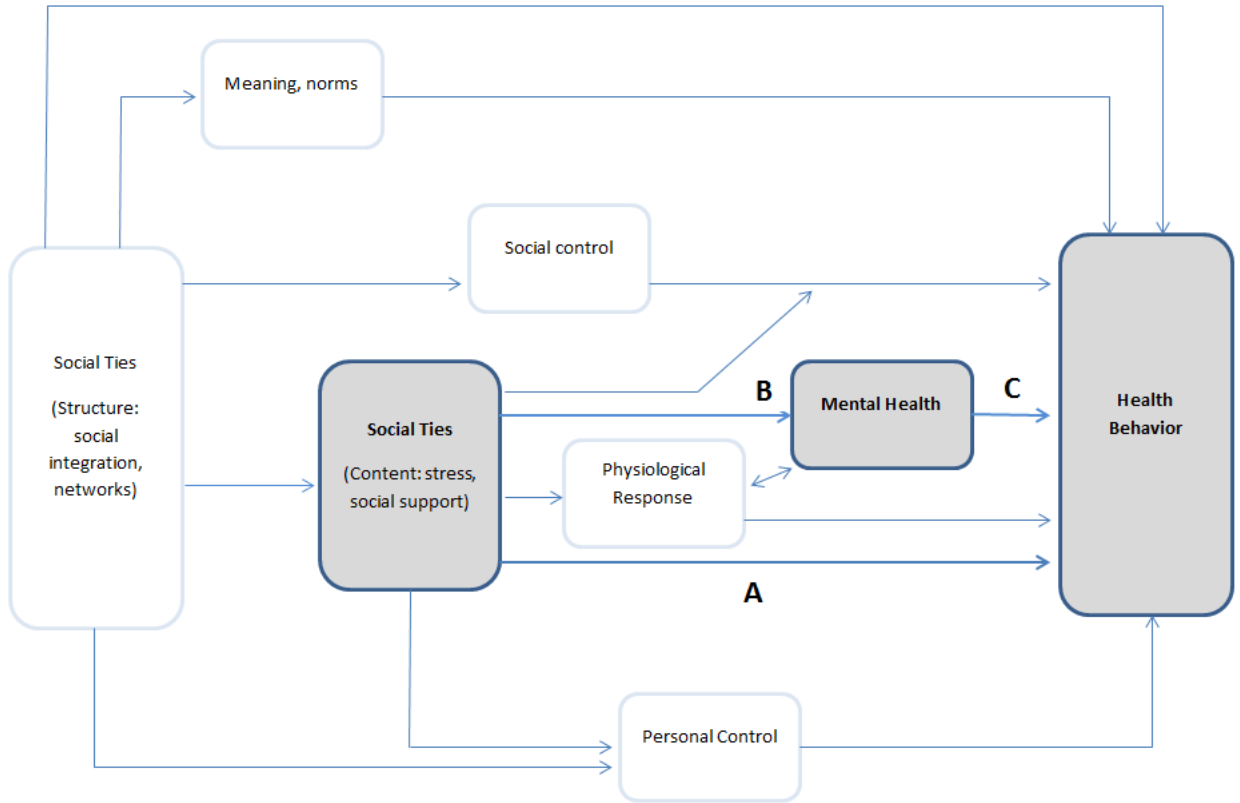
study.

Figure 1. Theoretical model suggesting depressive symptoms are a mediator of the

relationship between social support and health behaviors.

Social support, a content component of social ties, can be defined in terms of both emotional and tangible assistance. Emotional support is the sense that one is cared for and listened to, whereas tangible support encompasses receiving assistance or help with tasks from others. Social support has been found to directly affect health behaviors (Umberson et al., 2010). As Figure 1 suggests, social support also may indirectly affect the performance of health behaviors by enhanced psychological well-being, reduction in physiological response, and increased personal control. For example, greater satisfaction with social support has been associated with decreased levels of depressive symptoms (Park, Fenster, Suresh, & Bliss, 2006).

Both components of social ties may enhance personal control, or an individual's belief that they are capable of controlling their personal outcomes through their own actions. Those with greater personal control are more likely to perform preventive behaviors and to reduce risky behaviors. Specifically, increased personal control reflects an individual's belief that they have control of their outcomes through action, and they demonstrate this action in the form of appropriate health behaviors. In contrast, an individual who has lower levels of personal control does not believe that his/her outcomes can be controlled by his/her actions, and therefore may not be inclined to perform certain health promoting behaviors. Social stress, another form of social ties, can also have a negative effect on personal control. Specifically, greater social stress, via disruptive life events or chronic strains, challenges coping capacities and one's ability to maintain the belief that they can control outcomes based on their own actions.

Both components of social ties also may enhance social control. Social control refers to the influence of social norms over an individual to engage in non-deviant behavior. Social

control may be influential over an individual via internalization of norms, or via external influences, such as sanctions for unconventional behavior. Further, social ties may introduce norms that indirectly control behavior by communicating valued behaviors in society, thus promoting the internalization of these values. Social ties also may act directly by facilitating and regulating healthy behaviors, perhaps instilled by social roles. For example, Umberson (1987) examined the influences of social roles (e.g., marriage and parenthood) on participation in health-compromising behaviors such as substance use. Results indicated that those who were married and those who were parents engaged in fewer maladaptive health behaviors than those who were not married or who did not have children. These results suggest that those who are in a social role that is responsible for another may internalize norms of responsibility, in this case toward a child or a spouse, thus controlling their own behavior and exhibiting the indirect influence of social control on behavior.

Psychological well-being and psychological distress are manifestations of the mental health mediator depicted in Figure 1. Umberson and colleagues (2010) describe mental health as a route through which other focal mediators of the proposed conceptual framework function. For instance, social stress may lead to psychological distress, which may also influence a physiological response that activates a coping mechanism linked with greater tendencies for unhealthy behavior (Kiecolt-Glaser & Glaser, 2002). In contrast, greater levels of social support may enhance psychological health. For example, Park, Fenster, Suresh, and Bliss (2006) examined the relationship between social support and depression in 163 community-dwelling adults with congestive heart failure. Results showed that satisfaction with social support at baseline was significantly associated with depression six months later, with greater satisfaction predicting reduced depression.

Of most interest to the current research are the pathways labeled A, B, and C in Figure 1. Path A represents the direct, positive relationship between content social ties (i.e., social support) and engagement in health behaviors. Path B represents the expected negative relationship between social support and mental distress (i.e., depressive symptoms). Path C represents the expected negative relationship between depressive symptoms and health behaviors. Together, Paths B and C reflect the predicted indirect effect of social support on health via depressive symptoms. These pathways will be discussed in greater depth in the sections that follow.

Social Support and Health Behaviors (Path A)

Social support has been found to be associated with performance of several health behaviors in a wide range of populations (Resnick, Orwig, Magaziner, & Wynne, 2002; Vyavaharkar et al., 2007). This relationship has been observed with beneficial health behaviors (i.e., exercise; Resnick et al., 2002), as well as behaviors considered detrimental to one's health (i.e., smoking; Allgöwer, Wardle, & Steptoe, 2001). For example, in a community-based sample, Jackson (2006) found that higher levels of social support were indicative of better dietary practices, willingness to participate in routine medical exams, and trended toward increased rates of exercise and decreased rates of substance abuse in women when controlling for the effects of depression and sociodemographics.

The link between social support and health behaviors has been evidenced within the CVD population as well. Family social support and encouragement from physicians have been found to increase attendance in, and adherence to, CR programs (Daly et al., 2002). Brummett et al. (2005) examined perceptions of social support as a predictor of mortality in individuals with coronary artery disease. Specifically, the authors investigated patterns of

smoking, sedentary behavior, and depressive symptoms as mediators of this relationship. Findings suggested that greater levels of perceived social support were related to lower likelihoods of smoking and sedentary behavior, and fewer depressive symptoms. Further, findings from this study indicated that sedentary behavior mediated the relationship between perceived social support and mortality.

Both emotional and tangible social support have been linked to health behaviors. For example, Sayers, Riegel, Pawlowski, Coyne, and Samaha (2008) examined the effects of emotional social support and structural social support, or the availability of support offered by one's social circumstances, from family and friends on self-care behaviors in patients with heart failure. Findings indicated that emotional social support was significantly associated with medication adherence and dietary adherence. Specifically, higher levels of perceived emotional social support were predictive of higher levels of medication adherence and greater adherence to a low-sodium diet. Structural social support was not found to be significantly associated with these behaviors in this study. In a study investigating predictors of exercise maintenance in women following CR, tangible social support was found to significantly predict exercise persistence (number of weeks of exercise) and approached significance for predicting exercise frequency (number of exercise sessions) three months following CR (Moore, Dolansky, Ruland, Pashkow, & Blackburn, 2003). In sum, perceived social support, both emotional and tangible, may promote adherence to health-conscious behaviors such as diet and exercise; however, a lack of social support is associated with poorer health behaviors in both the general population and individuals with CVD.

Social Support and Depression (Path B)

Depression prevalence rates between the general population and individuals with CVD are greatly disproportionate. For instance, the Centers for Disease Control (2008) estimate that 5.4% of Americans age 12 and older experience depression in any two week period. Comparatively, an estimate of prevalence rates of major depressive disorder among individuals with CVD is 20% (Thombs et al., 2006). Social support has been suggested as having an inverse relationship with depressive symptoms. For instance, in individuals with CVD, greater levels of social support have been associated with decreased indication of depressive symptoms (Brummett et al., 2005). Frasure-Smith et al. (2000) examined changes in depressive symptoms over the first post-MI year and discovered that those with lower levels of perceived social support experienced more symptoms of depression than would have been expected based on their baseline depressive symptom scores. Likewise, individuals with higher perceived social support and categorized as depressed at study onset showed fewer symptoms than anticipated at follow-up based on their baseline depressive symptoms. These relationships remained significant after controlling for disease severity. These results coincide with research indicating a direct inverse relationship between social support and depressive symptoms, with social support predicting depressive symptoms in persons with congestive heart failure or self-reported cardiac illness six months to one year after baseline measurement while controlling for baseline depressive symptoms (Holahan, Moos, Holahan, & Brennan, 1995; Park, Fenster, Suresh, & Bliss, 2006).

Depressive Symptoms and Health Behaviors (Path C)

Depressive symptoms have been shown to be associated with health behaviors in both community-based samples and persons with CVD. For example, Jackson (2006) found

that depressive symptoms are predictive of health behaviors in a community-based sample comprised of both men and women. Specifically, higher levels of reported depressive symptoms were associated with a lower frequency of consuming a balanced diet, a lower frequency of regular exercise, lower levels of healthcare utilization, increased frequency of substance abuse, and lower levels of adequate sleep. Allgöwer et al. (2001) examined the relationship between depressive symptoms and health behaviors in university students across 16 countries and found depressive symptoms to be positively associated with sedentary behavior and irregular sleep. The influence of depressive symptoms on health behaviors has been acknowledged in medical populations as well. For instance, DiMatteo, Lepper, and Croghan (2000) conducted a meta-analysis of the effects of depression on adherence to medical treatment in participants with a variety of diagnosed medical conditions (e.g., renal disease, cancer, rheumatoid arthritis). Results indicated that patients meeting criteria for depression were three times more likely to be non-compliant with treatment recommendations when compared to patients who did not meet criteria for depression. A similar relationship between psychological distress and non-adherence to treatment recommendations is evident in CVD populations in regards to CR. Given its beneficial effects on recovery (e.g., Clark et al., 2005), attendance at CR is an important health-promoting behavior that should be encouraged among CVD patients. However, several studies have identified increased depressive symptoms and presence of Major Depressive Disorder as being predictive of non-completion of, and non-adherence to, CR programs (Casey, Hughes, Waechter, Josephson, & Rosneck, 2008; Caulin-Glaser, Maciejewski, Snow, LaLonde, & Mazure, 2007).

Casey et al. (2008) determined that those considered to have mild to severe depression were 2.2 times less likely to complete CR compared to those who were not experiencing as many depressive symptoms. Similarly, Swardfager et al. (2011) determined that those classified as having Major Depressive Disorder had much higher rates of non-completion of CR (44.2%) than those without this classification (28.9%). Of those completing CR, only 34.9% of participants with Major Depressive Disorder were adherent to 70% of scheduled CR visits; whereas, 48% of those without Major Depressive Disorder were adherent to the program. Increased levels of depressive symptoms may also be associated with low adherence to other health behaviors recommended during CR. It has been suggested that individuals with greater depressive symptoms have lower levels of adherence to low-fat and low cholesterol diets, lower adherence to medications as prescribed by a doctor, and have decreased rates of regular exercise following myocardial infarction (Romanelli, Fauerbach, Bush, & Ziegelstein, 2002; Ziegelstein et al., 2000).

Gaps in the Literature

Although many studies have examined the individual (direct) relationships predicted in Paths A, B, and C in cardiac samples, few have tested the theory's predictions together in a path model using longitudinal data. Further, few studies have incorporated a measure of adherence to CR in order to understand the relationship between these variables within a sample of individuals who have attended an intervention program aimed at health behavior modification. In this study, adherence to CR was hypothesized to mediate the relationship between social support and depressive symptoms, as prior studies have supported the predictive ability of social support on participation in CR (Johnson, Weinert, & Richardson, 1998). CR has also been associated with greater reduction in depressive symptoms following

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a cardiac event (Milani & Lavie, 2007). Additionally, the placement of the CR adherence construct as hypothesized was supported temporally by our data: social support was measured at Time 1 (beginning of CR), depressive symptoms were measured at Time 2 (end of CR), and health behaviors were measured at Time 3 (18 months after completion of CR).

Hypotheses

According to the model proposed by Umberson et al. (2010), I hypothesized the following (Figure 2):

Hypothesis One

Social support at the beginning of CR would be directly, positively related to engagement in healthy behaviors 18 months post-CR (after controlling for baseline levels of health behaviors).

Hypothesis Two

There would be a double-mediated model, with social support at the beginning of CR positively predicting CR adherence. In turn, CR adherence would be negatively associated with depressive symptoms at the end of CR. Depressive symptoms would be negatively associated with engagement in healthy behaviors 18 months post-CR (after controlling for baseline levels of health behaviors).
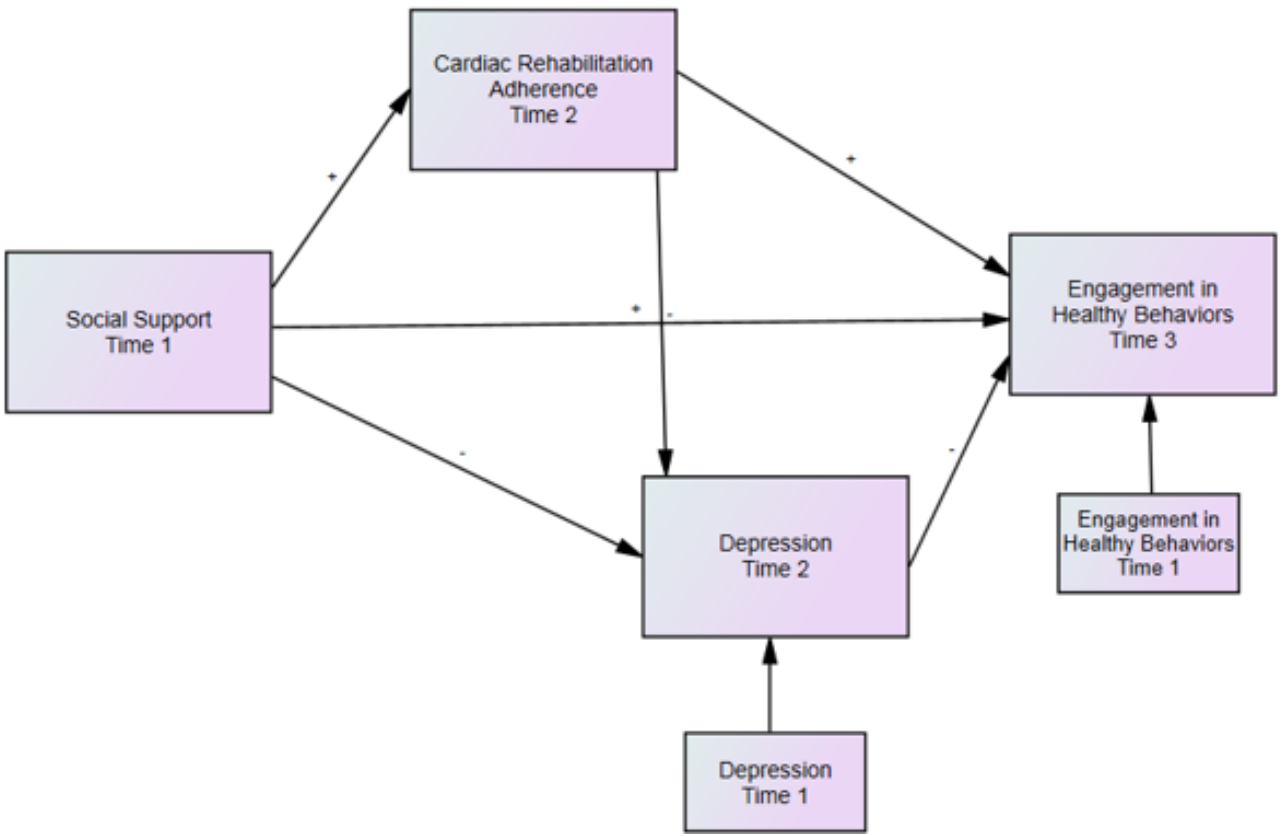
Figure 2. Hypothesized double-mediated path model.

CHAPTER 3

METHODOLOGY

Participants

This project used an existing data set of CVD patients recruited from two CR programs in Indiana between 2008 and 2010. Participants attended a CR program at the recommendation of their cardiologist or physician, were over the age of 18, and must have been diagnosed with a form of CVD and without cognitive impairments which may have impeded their ability to consent to and complete the study. Of the 552 patients initially approached to participate in the study, 398 agreed to be contacted by research staff to learn more about the study. Following attempts by research staff to contact these patients, 321 agreed to participate in the study and consented to being mailed a Time 1 questionnaire, of which 211 returned the questionnaire. Of the 211 participants completing surveys at the beginning of CR, 83 participants completed all three time points described below, with complete data, and were included in the analysis.

Descriptive statistics of participant characteristics for the full sample and study sample are included in Table 1. Most participants were male, European American, and partnered. The most common diagnosis was the placement of a stent. Most participants were stratified as low in risk for disease progression, based on their comorbidities and presence of CVD-related risk factors (American Association of Cardiovascular and Pulmonary Rehabilitation, 2004). There were no differences between those who completed all time points and those who did not in age, sex, race, marital status, employment status, education, income, diagnosis, body mass index, CR sessions completed, depressive symptom score, or emotional social support score at Time 1.

Table 1
Descriptive statistics of participant characteristics

Participant Characteristic	Study Sample (*n*=83)	Full Sample (*n*=211)
	M (*SD*)	
Age in years	63.9 (9.2)	61.6 (12.1)
CR Sessions Completed	15.7 (7.0)	16.4 (7.3)
Body Mass Index	29.3 (5.0)	30.3 (7.4)
Emotional Social Support	24.6 (6.6)	24.4(7.3)
Depressive Symptoms	8.8 (8.5)	10.4 (9.0)
Health Behaviors	4.4 (1.6)	4.2 (1.7)
	%	
Male	63.9	66.4
European American	92.7	91.9
Partnered	78.3	73.1
Employed	39.8	42.7
Education		
High School/GED	20.5	25.8
Some College/Trade School	24.1	24.2
2-year college degree	13.3	10.5
4-year college degree	20.5	23.4
Graduate degree	20.5	12.9
Income		
<$10,000	5.1	3.4
$10,000-19,999	8.9	6.0
$20,000-29,999	8.9	9.4
$30,000-39,999	5.1	12.8
$40,000-49,999	7.6	9.4
$50,000-59,999	7.6	14.5
$60,000-69,999	2.5	8.5
$70,000-79,999	16.5	3.4
$80,000-89,999	6.3	9.4
$90,000-99,999	13.9	6.0
≥$100,000	17.7	17.1
Diagnosis		
Stent	38.6	39.2
MI & Stent	14.5	13.6
CABG	25.3	12.8
Valve replacement/repair	10.8	8.0
Risk stratification		
Low	62.2	57.7
Medium	35.4	36.1
High	2.4	6.2

Note: CR = cardiac rehabilitation; MI = myocardial infarction; CABG = coronary artery bypass surgery.

Procedures

This study used data collected from a larger longitudinal study investigating psychosocial outcomes following CR. Participants were approached during their first visits to CR, for their intake interviews, and were asked by CR staff if they were interested in learning more about the study. If a patient consented to being contacted, a member of the research team telephoned him/her to provide additional information regarding the study and to answer any questions about the study. If patients consented, they were then mailed study materials, including the Time 1 questionnaire, the consent document, and a self-addressed, stamped envelope. If, after reading through these materials, patients consented to being in the study, they were instructed to sign the consent form and complete the questionnaire, returning them to the research team in the provided envelope. Signing the consent form also provided our research team permission to access patients' medical records from their CR programs. Participants were contacted at the end of CR, approximately 12 weeks later (Time 2), and again 18 months after completion of the CR program (Time 3), by mail and asked to complete follow-up questionnaires. All study procedures were approved by the appropriate hospital and university institutional review boards.

Measures

Questionnaires comprised of several standardized measures were used at Times 1, 2, and 3. In addition to the measures outlined below, participants completed demographic questions at each data collection time point. CR sessions completed was obtained at the end of CR from the patient's medical records.

Social Support Scale

Seven items adapted from Barrera and Ainlay (1983) were used to examine

emotional social support (ESS) at Time 1. This scale asks participants to determine how

often in the past month someone has provided them with nondirective support. Specifically,

an example of an ESS question in this scale is: "Over the last month, how often has someone

comforted you by showing some physical affection?" Responses are made on a 5-point scale

(*not at all* to *about every day)*. This scale has been found to have sufficient reliability (α =

.86) and concurrent and content validity in a CVD sample (Hilbert, 1985).The seven ESS

items are summed to create a composite ESS variable, with higher scores indicating more

frequent ESS. In the current sample, the reliability coefficient of ESS at Time 1 was .88.

Depressive Symptoms

The BDI-II (Beck, Steer, & Brown, 1996) was used to measure symptoms of

depression at Time 1 and Time 2. This is a 21-item self-report measure designed to assess

the presence and degree of depressive symptoms in accordance with criteria for depressive

disorders in the Diagnostic and Statistical Manual of Mental Disorders-IV (American

Psychiatric Association, 1994). It has been used with both psychiatric and non-psychiatric

samples. Each item is answered on a 4-point scale ranging from 0 to 3 (e.g., *I do not feel sad*

to *I am so sad or unhappy that I can't stand it*), with the maximum total score being 63. A

score greater than 13 indicates mild depressive symptoms, with higher scores suggesting

greater depressive symptoms. The BDI-II has been found to have sufficient reliability

coefficients in an outpatient sample (.92) and in a college student sample (.93), and has been

found to be more positively correlated with a well-known scale for depression than with a

scale for anxiety (Beck et al., 1996). In the current sample, the BDI-II at Time 1 and Time 2 had a reliability coefficient of .92 and .93, respectively.

<center>Health Behavior Scale</center>

Eight items were adapted from Naslund and Fredrikson (1993) to assess health behaviors at Times 1 and 3. Items in this scale asked participants to indicate how often over the prior month they consumed fruits, vegetables, red-meat, and high-fat foods. The participants also were asked about their cigarette use and how often they added salt to their meals. Additionally, the scale inquires about engagement in light intensity exercise, such as walking or gardening, as well as moderate intensity exercise, such as jogging. Responses are made on a 7-point scale (*never* to *more than once per day*) for the diet and exercise items. A 6-point response scale (*none to more than 40 per day*) is used to indicate cigarette use. Prior research within a CVD sample has indicated that a shortened, seven-item version of this scale has somewhat acceptable reliability (α = .64; Bennett & Marte, 2013). In an effort to improve reliability in this study, a composite score was calculated from the eight items to indicate adherence to recommended health behaviors. Each item was rescaled to indicate whether the participant's response met the recommended frequency of the behavior (1) or did not adhere to recommendations (0). Specific rescaling criteria are indicated in Appendix A-3 and represent health behavior recommendations provided by several health organizations and research (American Heart Association, 2014a; American Heart Association, 2014b; Appel et al., 2011; Azadbakht & Esmaillzadeh, 2008; Laukkanen, Kauppinen, & Heikkinen, 1998; Smith et al., 2011). Once each item was rescaled, the values were summed with higher scores indicating a greater level of adherence to recommended health behaviors. In the current study, the reliability of this scale was poor at both Time 1

<center>23</center>

($KR_{20}=.47$) and Time 3 ($KR_{20}=.47$). The removal of one item at each time point would improve the reliability of the scale slightly; however, the same item was not suggested at each time point and the improved reliability was not enough to warrant re-scaling of the measure and re-running of the analyses. Furthermore, because the scale taps into disparate health behaviors that may only slightly correlate with one another, an argument can be made that typical levels of reliability are not necessary in this case. Regardless, some caution when interpreting findings is warranted.

Data Analysis

SPSS 20 (IBM Corp, 2011) was used to calculate participant demographic characteristics, and to run descriptive and simple inferential statistics (e.g., correlations among variables). Correlational analysis was performed between hypothesized model endogenous variables and participant characteristics to identify potential covariates. Covariates were controlled for in the path analysis if they were significantly correlated with an endogenous model variable. MPlus 6 (Muthén & Muthén, 2010) was used to conduct the path analysis. G*Power 3.1.7 (Faul, Erdfelder, Lang, & Buchner, 2007) was used to perform power analysis calculations to identify the recommended sample size for the path analysis.

Hypotheses One and Two

To test the hypotheses, a path analysis was estimated in MPlus (see Figure B-2). The composite social support variable at Time 1 was entered into the path diagram as the exogenous variable. The number of CR sessions completed and Time 2 BDI-II scores were entered as mediators. Time 1 BDI-II was entered as a control variable predicting Time 2 scores. The composite health behavior score at Time 3 was entered as an endogenous variable, with the Time 1 score predicting it as a control variable. A power analysis

consistent with regression analyses was conducted which indicated that 98 participants were necessary to have adequate power (.80; $\alpha = .05$) to detect a medium effect size with six predictors: ESS, adherence to CR, risk stratification, BDI-II at Time 1, BDI-II at Time 2, and engagement in healthy behaviors at Time 1.

Model Fit

Model fit was assessed using global and local model fit indices. Specifically, the chi-square value examines whether the estimated model covariance matrix differs significantly from the actual model covariance matrix, and a non-significant chi-square is indicative of the data fitting the proposed model; however, this statistic is sensitive to sample size. The comparative fit index (CFI) compares the hypothesized model with a null model assuming no relationships, with a CFI $\geq .90$ indicating acceptable fit and a CFI $\geq .95$ implying a good fitting model. The following global model fit indices were also used: the root mean square error of approximation (RMSEA), which assesses the degree of error in fit by degrees of freedom, the 90% confidence interval of the RMSEA (90% CI), and the standardized root mean square residual (SRMR). A RMSEA $\leq .06$, RMSEA 90% CI upper limit $\leq .08$, and SRMR $\leq .08$ indicate good global model fit (Brown, 2006; Hu & Bentler, 1999; Kline, 2005). Local model fit, or the difference between each estimated pathway based on the predicted model and the pathway as indicated by the sample data (i.e. residual), was evaluated using standardized residual covariances. A standardized residual covariance greater than -1.96 or less than 1.96 indicates a good local fit for the given pathway. As depressive symptom variables often violate assumptions of normal distribution, MPlus 6 allows for the use of a robust maximum likelihood estimator, which is robust to non-normality and provides the Satorra-Bentler scaled chi-square (SB χ^2; Satorra & Bentler,

25

1994) and a robust CFI. This estimation method requires the use of complete data, therefore, participants with missing data on any of the variables in the model were excluded. This resulted in a higher rate of attrition than normal, so caution is warranted when interpreting these findings. The robust fit indices are interpreted similar to the aforementioned, non-robust fit indices. Parameter estimates and modification indices were examined to further evaluate and interpret each analysis.

CHAPTER 4

RESULTS

Preliminary Analysis and Descriptive Statistics

Preliminary analysis examining potential covariates indicated that risk stratification should be considered as a covariate of CR adherence. Correlations among all variables included in the hypothesized model are presented in Table 2. Risk stratification was included in the path analysis in addition to Time 1 depressive symptoms and Time 1 health behaviors controlling for their respective scores at Time 2 and Time 3. The mean scores for each variable included in the model are presented in Table 3. Descriptive information for risk stratification is presented in Table 1. The depressive symptom variables were not normally distributed, thus the robust maximum likelihood estimator was used in path model analyses.

Table 2

Correlations between model variables

	1	2	3	4	5	6
1. Emotional Social Support, T1	--					
2. CR Adherence	.17	--				
3. Risk Stratification	.11	.23*	--			
4. Depressive Symptoms, T1	-.42***	.10	.06	--		
5. Depressive Symptoms, T2	-.29**	.09	.06	.85***	--	
6. Health Behavior, T1	.23*	.06	-.05	-.27*	-.30**	--
7. Health Behavior, T3	.16	-.07	-.12	-.37***	-.38***	.41***

Note: $^*p \le .05$, $^{**}p \le .01$, $^{***}p \le .001$; CR = Cardiac rehabilitation; T1 = Time 1; T2 = Time 2; T3 = Time 3

Table 3

Descriptive statistics of model variables

Variable	*M*	*SD*	Range
Emotional Social Support, T1	24.55	6.56	11 - 35
CR Adherence	15.66	6.96	0 - 36
Depressive Symptoms, T1	8.83	8.46	0 - 40
Depressive Symptoms, T2	8.13	8.02	0 - 45
Health Behavior, T1	4.43	1.57	2 - 8
Health Behavior, T3	5.34	1.48	3 - 8

Note: CR = cardiac rehabilitation; T1 = Time 1; T2 = Time 2; T3 = Time 3

Hypothesized Model

Path analysis parameter estimates of the hypothesized model are presented in Figure 3. Overall, fit indices suggest poor model fit (SBχ^2 [6] = 79.36, $p \leq .001$; RMSEA = .39, 90% RMSEA CI [.31, .46]; CFI = .73; SRMR = .07). The fit indices indicate that this model should be rejected. ESS and adherence to CR were not significantly associated with any of the variables in the path model. Results did suggest that depressive symptoms at Time 2 was negatively associated with engagement in healthy behaviors at Time 3 ($\beta = -.29, p = .001$), after controlling for baseline levels of depressive symptoms and health behaviors. The total effect of Time 1 ESS on Time 3 health behaviors was .01, with an indirect effect via adherence to CR and depressive symptoms of .00 (non-significant). Thus, there was no evidence of mediation. The model in its entirety explained 24.5% of Time 3 health behaviors.
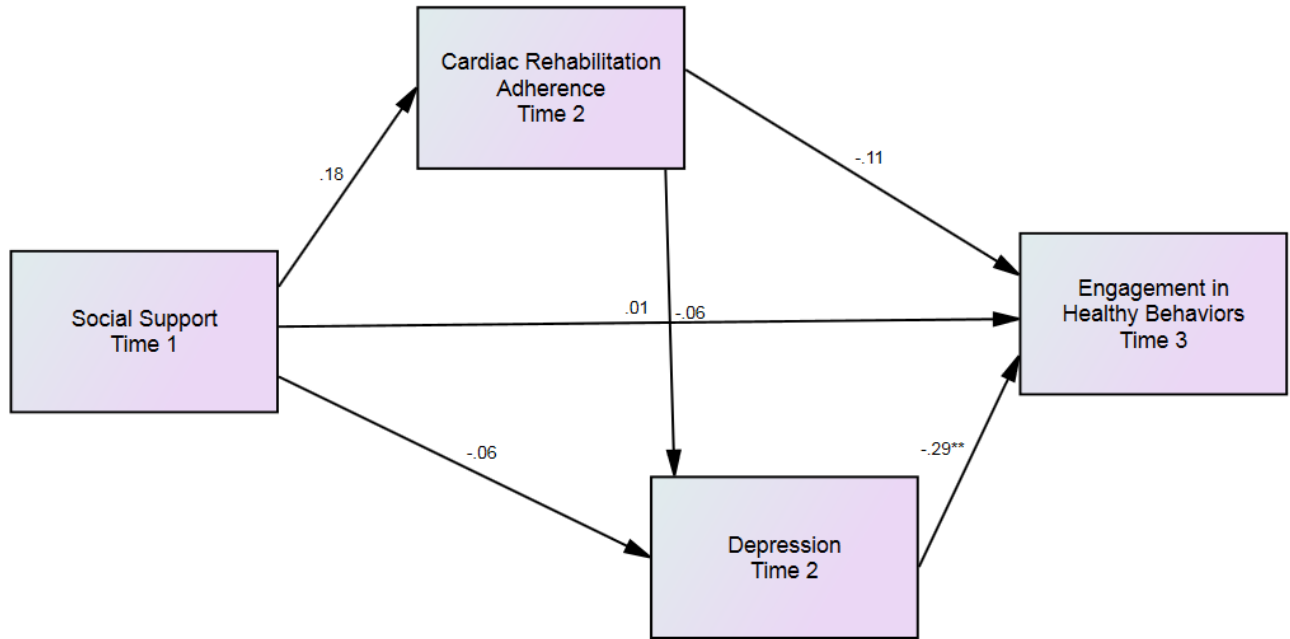
Figure 3. Hypothesized path model results. Double mediated path model examining

adherence to cardiac rehabilitation and depressive symptoms at Time 2 as mediators of the

relationship between emotional social support at Time 1 and health behaviors at Time 3.

Model controls for Time 1 depressive symptoms, Time 1 health behaviors, and risk

stratification. *$p \leq$.05, **$p \leq$.01.

Trimmed Model

In an exploratory step to improve model fit, a trimmed path model was estimated that removed ESS since this variable did not significantly predict any other variable in the model above. Path analysis parameter estimates for this trimmed model are presented in Figure 4. Overall, fit indices again suggest poor model fit (SBχ^2 [6] = 75.38, $p \leq .001$; RMSEA = .38, 90% RMSEA CI [.30, .45]; CFI = .72; SRMR = .08), and that it should be rejected. Adherence to CR was not significantly associated with any of the variables in the path model, but depressive symptoms at Time 2 were again negatively associated with engagement in healthy behaviors at Time 3 (β = -.29, $p \leq .001$), after controlling for baseline levels of depressive symptoms and health behaviors. The total effect of CR adherence on Time 3 health behaviors was -.089, with an indirect effect via depressive symptoms of .022. Although non-significant, 24.7% of the total effect of CR adherence on Time 3 health behaviors operated indirectly through depressive symptoms. The model in its entirety explained 24.8% of Time 3 health behaviors.

Figure 4. Trimmed path model results. Mediated path model examining depressive symptoms at Time 2 as a mediator of the relationship between adherence to cardiac rehabilitation and health behaviors at Time 3. Model controls for risk stratification, Time 1 depressive symptoms, and Time 1 health behaviors. $^*p \leq .05$, $^{**}p \leq .01$.

CHAPTER 5

DISCUSSION

The purpose of this study was to examine whether depressive symptoms mediated the relationship between ESS and health behaviors, as proposed by Umberson and colleagues (2010), within individuals with CVD who participated in CR. Further, I examined the role of adherence to CR on these variables by hypothesizing that CR adherence would mediate the relationship between ESS and depressive symptoms. A path model was estimated to examine whether CR adherence mediated the relationship between baseline ESS and depressive symptoms at Time 2, and whether depressive symptoms mediated the relationship between CR adherence and health behaviors at Time 3.

Model fit indices did not indicate acceptable fit of this model to the data. Parameter estimates showed non-significant relationships between ESS and all other variables within the model. This finding is inconsistent with prior literature suggesting a positive relationship between social support and participation in CR (e.g., Johnson et al., 1998). However, at least one study has suggested that the positive relationship between social support and participation in CR may be better accounted for by additional biographic variables such as marital status (Husak et al., 2004). To test this idea, I estimated an exploratory path model where partner status, rather than ESS, predicted the other variables in the model, including CR adherence. Results showed the model fit the data poorly, and that partner status was un-related to CR adherence. Further, these findings are inconsistent with literature on the relationship between social support and mental health, and social support and health behaviors in individuals who have participated in CR. Prior research has documented a negative relationship between social support and mental health, and a positive relationship

between social support and health behaviors within this population (e.g., Franks, Stephens, Rook, Franklin, Keteyian, & Artinian, 2006). Thus, Hypothesis One was not supported since no relationship was found between ESS and health behaviors. Hypothesis Two also was not supported, though evidence was found to support the relationship between depressive symptoms and engagement in healthy behaviors within this sample (additional information about this below).

There are likely many possible explanations for why my findings regarding social support are inconsistent with prior research. I will focus on two that I think are most likely: mobilization of social support immediately following a trauma, and the specification of the scale to assess it. Specifically, in the aftermath of a stressor, our perceived social support may be greater as family, acquaintances, and health professionals tend to our needs. Thus, assessing perceived social support shortly after a traumatic medical event may not be an accurate indicator of the individual's social support over time. A repeated measures ANOVA within the current study sample supports this change in social support over time as social support at baseline was elevated and significantly decreased at Time 2 and then plateaued. This suggests that researchers and health professionals should be more concerned with sustained levels of perceived social support during CR rather than initial assessments shortly following a cardiac event. Further, the social support scale used within the current study was not specific to social support regarding one's health behaviors or psychological experiences, but rather inquired about general perceived social support. Reduced specificity may lower associations between the scale used in the current study and the other constructs within the model.

Results also did not support CR adherence or depressive symptoms as mediators within the hypothesized model. In fact, CR adherence was not related to depressive symptoms at the end of CR, nor was it related to engagement in healthy behaviors following CR, inconsistent with prior research. Specifically, studies have shown improved depressive symptoms following completion of CR, especially in individuals who have improved their exercise capacity. In turn, improved exercise capacity has been associated with reduced risk of mortality (Milani et al., 2007). Further, a positive relationship between participation in CR and performance of exercise, diet, and medication self-care has been documented (Conn, Taylor, & Casey, 1992). Within this study, depressive symptoms at Time 1 were highly correlated with depressive symptoms at Time 2, thus accounting for a large percentage of variance in Time 2 symptoms. Adherence to CR may not account for as much variance in Time 2 depressive symptoms once Time 1 symptoms are taken into consideration.

It also is possible that another aspect of adherence to CR (e.g., increase in exercise capacity) may better predict depressive symptoms in comparison to the number of sessions attended. To examine this possibility, I estimated an exploratory path model with available data ($n = 65$) substituting a change in metabolic equivalents (METs) score, from the beginning of CR to the end of CR, in place of CR adherence in the model while controlling for METs at the beginning of CR and age. Used as a measure of exercise capacity, METs is a measure used to quantify energy expenditure of an activity, with one MET being defined as the resting metabolic rate, or the amount of consumed oxygen while at rest (Jetté, Sidney, & Blümchen, 1990). A greater METs score indicates more energy expenditure required to perform the activity and, in the current exploratory analysis, a positive change in METs indicates improved exercise tolerance from the beginning of CR to the end. This model fit

the data poorly and did not provide evidence of mediation. Change in exercise capacity did not significantly predict depressive symptoms at Time 2; however, change in exercise capacity was negatively related to health behaviors at Time 3 (β = -.27, p = .002). Therefore, no evidence was found for the mediating effects of CR adherence when that variable was operationalized in two different ways.

Consistent with predictions, depressive symptoms were negatively associated with adherence to health behavior recommendations 18-months following CR. Prior studies have supported a relationship between mental health and health behaviors in individuals with and without CVD, and have suggested a negative relationship between these two constructs (Duivis, de Jonge, Penninx, Na, Cohen, & Whooley, 2011). For instance, Whooley et al. (2008) found depressive symptoms to be negatively related to physical activity, with physical activity mediating the relationship between depressive symptoms and subsequent cardiac events. Further, following a 12-week collaborative care depression treatment program, Bauer and colleagues (2012), found that improvement in depressive symptoms from pre-program to post-program predicted greater adherence to health behavior recommendations at six weeks, 12 weeks, and six months post-program in comparison to inpatient cardiac unit standard of care. These results suggest that CR providers should identify individuals experiencing psychological distress, specifically heightened depressive symptoms, following a cardiac event and provide resources aimed at reducing distress as a complementary approach to enhancing self-care behaviors and improving cardiac outcomes.

Limitations and Future Directions

Although this project was unique in that it tested theoretically grounded relationships between social support, mental health, and physical health using longitudinal data, several

limitations are worth noting. First, data were collected using self-report measures only; therefore, response biases may have occurred. Specifically, the health behavior scale inquired about participants' dietary and exercise behaviors over the past month, which may allow for recall biases. Further, items within the questionnaire refer to social, psychological, and behavioral constructs that are influenced by societal norms and expectations; therefore, social desirability bias is possible. As all data were collected via self-report measures, common method variance, or mono-method bias, should also be recognized as a plausible limitation of the proposed study. Therefore, future research should examine the constructs presented in the current study using varied methods for data collection, beyond self-report measures, and taking care to collect data in an environment limiting social desirability bias if possible.

Second, the two CR programs from which participants were recruited are located in affluent areas in a Midwestern city, and the sample was mostly European American. Furthermore, the CR programs (like most) required insurance or the ability to afford high cost medical care. Thus, the location and nature of the programs may limit generalizability for those with CVD who are classified as ethnic-minorities and are considered to have low socioeconomic status. Future research, therefore, should examine these relationships within individuals with CVD that provide a more accurate representation of the CVD population, specifically increasing inclusion of ethnic-minorities and individuals with low socioeconomic status Third, in regards to statistical conclusion validity, the path analysis performed in this study was under-powered as the number of participants completing all three time points (n=83) was lower than the desired sample size (n=98) as indicated by G*Power. Thus, interpretation of results should be conservative to account for low statistical

power. Future researchers should identify a larger sample to follow longitudinally, accounting for realistic retention over time, thus providing a larger sample for path analysis over a 21-month timespan.

Future research also should continue to examine constructs influencing adherence to health behavior recommendations following CR as performance of recommended health behaviors is associated with a reduced likelihood of subsequent cardiac events such as recurrence or mortality. Further, other mental health characteristics, such as anxiety symptoms, should be examined as potential mediators, as should other variables consistent with the theoretical model proposed by Umberson et al. (2010; e.g. self-efficacy).

Conclusion

The rates of mortality and secondary cardiac events following a primary cardiac event are very high. Maintaining beneficial health behaviors such as a balanced diet and regular exercise may decrease the likelihood of these events occurring. Understanding the social and psychological mechanisms that influence these behaviors may allow for identification of individuals who may be at risk for these outcomes. Results from the current study suggest that social support does not impact adherence to CR, depressive symptoms at the end of CR, or adherence to health behavior recommendations in the year and one-half following CR. Further, this study did not find support for relationships between CR adherence and depressive symptoms, or for CR adherence and engagement in healthy behaviors 18 months after CR. Findings do suggest a negative relationship between depressive symptoms at the end of CR and adherence to health behavior recommendations 18 months later, supporting other research. Results suggest that CR practitioners should identify individuals who are experiencing heightened depressive symptoms following a

cardiac event. Further, CR practitioners should promote interventions that address

depressive symptoms to increase the likelihood of performance of recommended health

behaviors following CR.

APPENDIX

Appendix A. Measures

A-1. Time 1 Social Support

<table>
<tr><td colspan="6">Your Relationships

Please read each of the following questions concerning your personal relationships. Beside each question below, <u>please circle the number</u> that represents how often each of these things has happened to you. Circling "1" indicates "not at all" and circling "5" indicates "about every day."</td></tr>
<tr><td>Not at all
1</td><td>Once or twice
per month
2</td><td>About once per
week
3</td><td>Several times
per week
4</td><td colspan="2">About every
day
5</td></tr>
<tr><td colspan="2">1. Over the last month (4 weeks), how often has someone let you know that he or she feels very close to you?</td><td>1</td><td>2</td><td>3</td><td>4   5</td></tr>
<tr><td colspan="2">2. Over the last month, how often has someone let you know that he or she will always be around if you need assistance?</td><td>1</td><td>2</td><td>3</td><td>4   5</td></tr>
<tr><td colspan="2">3. Over the last month, how often has someone told you that you are OK just the way that you are?</td><td>1</td><td>2</td><td>3</td><td>4   5</td></tr>
<tr><td colspan="2">4. Over the last month, how often has someone comforted you by showing some physical affection?</td><td>1</td><td>2</td><td>3</td><td>4   5</td></tr>
<tr><td colspan="2">5. Over the last month, how often has someone listened to you talk about your private feelings?</td><td>1</td><td>2</td><td>3</td><td>4   5</td></tr>
<tr><td colspan="2">6. Over the last month, how often has someone expressed interest and concern in your well-being?</td><td>1</td><td>2</td><td>3</td><td>4   5</td></tr>
<tr><td colspan="2">7. Over the last month, how often has someone let you know that you did something well?</td><td>1</td><td>2</td><td>3</td><td>4   5</td></tr>
</table>

BDI-II

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 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 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 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 do not 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.
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 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 if 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 changes 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 before. 3a = I have no appetite at all. 3b = I crave food all the time.
19. Concentration.	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 am 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.

A-3. Times 1 & 3 Health Behaviors

Health Practices
Please read each of the following questions concerning your current health practices. Beside each question below, please circle the number that represents how often you have engaged in that health practice. Circling "1" indicates "never" and circling "7" indicates "more than once per day."

Never	Less than once per week	About once per week	A few times per week	Almost every day	Every day	More than once per day
1	2	3	4	5	6	7

	Adherence rescaling (source)
1. During the last month (4 weeks), how often did you eat red meat (for example, steak or hamburgers)?	1-4 = met recommendations 5-7 = did not meet recommendations (Azadbakht & Esmaillzadeh, 2008)
2. During the last month, how often did you eat fruits (for example, bananas, apples, or grapes)?	6-7 = met recommendations 1-5 = did not meet recommendations (American Heart Association, 2014a)
3. During the last month, how often did you eat vegetables (for example, carrots, spinach, or green beans)?	6-7 = met recommendations 1-5 = did not meet recommendations (American Heart Association, 2014a)
4. During the last month, how often did you eat high-fat foods (for example, french fries, potato chips, cheesecake, or ice cream)?	0-4 = met recommendations 5-7 = did not meet recommendations (American Heart Association, 2014a)
5. During the last month, how often did you add salt to your meals?	1-5 = met recommendations 6-7 = did not meet recommendations (Appel et al., 2011)
6. During the last month, how often did you engage in light intensity exercise such as walking, gardening, or housework?	5-7 = met recommendations 1-4 = did not meet recommendations (Laukkanen, Kauppinen, & Heikkinen, 1998)

7. During the last month, how often did you engage in moderate aerobic activities such as jogging, using a stair master, dancing, hiking, or biking?	4-7 = met recommendations 1-3 = did not meet recommendations (American Heart Association, 2014b)

Cigarette Use
Finally, please mark the response that best reflects how often you smoked cigarettes in the last month.

None don't smoke	Less than one per day	1-10 per day	11-20 per day	21-40 per day	More than 40 per day
1	2	3	4	5	6

	Adherence rescaling (source)
8. During the month before your cardiac event, on average, how many cigarettes did you smoke each day?	1-2 = met recommendations 3-6 = did not meet recommendations (Smith et al., 2011)

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VITA

Jillian Clark was born in Fort Bragg, California and currently resides in Kansas City. She graduated from the University of California, San Diego in 2008 with a Bachelor of Science degree in Psychology. Jillian is currently working on her Doctor of Philosophy in Clinical Psychology at the University of Missouri-Kansas City.