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Perceived Social Support and Loneliness as Predictors of Cardiac Rehabilitation Outcomes

Elizabeth Stein

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Perceived Social Support and Loneliness as Predictors of
Cardiac Rehabilitation Outcomes

by

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Bachelor of Science

THESIS

Submitted in Partial Fulfillment of the
Requirements for the Degree of

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Perceived Social Support and Loneliness as Predictors of
Cardiac Rehabilitation Outcomes

by

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ABSTRACT

Cardiac rehabilitation (CR) is the most common means of targeting risk factors related to cardiovascular disease, but there are still uncertainties regarding what components of CR are most essential to successful rehabilitation. The current research focuses on perceived social support and loneliness and how these psychosocial factors influence health directly or indirectly by moderating perceived stress. Patients (n= 122) who completed a 12 week CR program agreed to participate, and they completed measures at both baseline and program completion. Multiple regression was used to determine if the direct or indirect moderation model best accounts for changes in days spend exercising, positive affect, negative affect, depression, and anxiety. A paired-sample t-test was used to determine changes in reported loneliness from baseline to CR completion. The results demonstrate that the direct effects models were best at predicting changes in depression and anxiety, while the indirect, moderation models were better for predicting changes in days spent exercising, positive affect, and negative affect. Also, those who were most the most socially inhibited at the start of the program experienced the greatest decrease in loneliness from baseline to follow-up. The findings suggest, that different interventions may be useful for targeting difference health variables and that those who are the most socially inhibited may benefit the most from social support interventions. Clinical implications and future directions are discussed.

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Perceived Social Support and Loneliness as Predictors of Cardiac Rehabilitation Outcomes

Cardiovascular disease (CVD) is the leading cause of mortality in the United States, and it accounts for 40% to 50% of all deaths in industrialized countries (Kochanek, Xu, Murphy, Minino, & Kung, 2011; Melvin et al., 2013; Mookadam & Arthur, 2004). Although recent trends show a decrease in deaths attributed to CVD, the prevalence of this disease remains exceedingly high (Roger et al., 2012; Staniute, Brozaitiene, & Bunevicius, 2013). This disease has large financial implications for the United States, including approximately \$179 billion spent in direct expenditures, such as hospital services and prescribed medications, and \$188.5 billion in indirect costs from lost productivity (Roger et al., 2012). Commonly targeted risk factors of CVD are hyperlipidemia, diabetes mellitus, smoking, and elevated blood pressure; however, many other complex biological, psychological, and environmental factors play an influential role in the development and progression of CVD and related morbidity and mortality (Mookadam & Arthur, 2004).

Cardiac Rehabilitation

Although evidence indicates that prevention is an effective strategy to curb the prevalence of CVD and related mortality (Labarthe, Dai, Day, Fulton, & Grunbaum, 2009; Lysanne et al., 2013), factors related to CVD are more commonly targeted after a cardiac event has occurred in cardiac rehabilitation (CR) (Martin & Woods, 2012; Rodgers, Murray, Selzler, & Norman, 2013). Cardiac rehabilitation programs can vary along several separate continuums including duration, frequency, location, and comprehensiveness (Rodgers et al., 2013; Shepherd & While, 2012). The American Heart

Association (AHA, 2012a) had defined CR as a professionally supervised program to help people recover from heart related events by providing “education and counseling services to help heart patients increase physical fitness, reduce cardiac symptoms, improve health, and reduce the risk of future heart problems.”

Traditional CR is a non-pharmacological intervention involving a combination of moderate exercise, nutritional education, stress management, and/or psychological support to restore the patient’s pre-disease or pre-cardiac event physical, psychological, and social level of function (Aldana et al., 2006; Krieikebaum et al., 2011; Shepherd & While, 2012). The physical and psychological benefits of such programs have been well established (Fernandez et al., 2007). Oldridge (2012) reviewed six different meta-analyses that included 71 randomized clinical trials that examined the effectiveness of a variety of CR programs (e.g., exercise training alone, or exercise training in addition to psychosocial, risk factor management, and/or education interventions). The study demonstrated important clinical outcomes including reduced all-cause and cardiac mortality, nonfatal reinfarction, and hospitalization rates for those in CR programs. There were also significant positive changes in modifiable risk factors for CR participants such as total cholesterol, triglycerides, and systolic blood pressure. Such results have lead researchers to conclude that CR should be an integral part of care for post-cardiac event patients and should be promoted by healthcare professionals, and the AHA has deemed CR both useful and effective (Balady et al., 2007).

Despite the evidence that substantiates the use of CR as a valuable method to return cardiac patients to pre-disease or pre-cardiac event function, researchers have not been able to fully elucidate the components of CR that are most active or essential to the

rehabilitation process. Researchers are, however, convinced that a multidisciplinary approach is more effective than a one dimensional approach (Aldana et al., 2006; Kriekebaum et al., 2011). After reviewing the empirical evidence, the Agency for Health Care Policy and Research concluded that CR should provide an integrative and multifaceted approach and that CR should include more than just exercise training alone (Balady et al., 2007). The AHA presently recommends baseline evaluation and intervention in ten core areas: patient assessment at program admission; nutrition counseling; physical activity counseling; exercise training; and lipid, hypertension, weight, diabetes, smoking, and psychosocial management (Balady et al., 2007; Zullo, Jackson, Whalen, & Dolansky, 2012). Reviews have questioned whether the benefits of CR are largely due to psychosocial counseling, exercise training, or other aspects of CR programs (Redfern & Briffa, 2011). Identifying the most essential components to CR is difficult because the importance of the components CR may depend on individual differences. Despite AHA recommendations to address the ten core areas, not all CR programs adhere to this advice (Zullo et al., 2012). The non-adherence could be attributed to the expense of implementing such a comprehensive program, and the cost could potentially make the program inaccessible to some CVD patients, so research that seeks to identify of the most important aspects of CR is crucial.

Of the ten core components, there is considerable interest on the impact of psychosocial variables on the outcomes of CVD patients (Turner, Phillips, Hambridge, Baker, Bowman, & Colyvas, 2010). This focus is motivated by findings in the literature that psychosocial factors have important implications for recovery after a cardiac related event (Cuijpers & Smit, 2002; Frasure-Smith & Lesperance, 2008; Thomas, Friedmann,

Wimbush, & Schron, 1997). For example, even minimal symptoms of depression are a reliable indicator of poor prognosis for patients in CR programs, with more severe depression symptoms relating to a worse prognosis (Frasure-Smith & Lesperance, 2003; Lesperance, Frasure-Smith, Talajic, & Bourassa, 2002). Anxiety symptoms have similarly been found to be associated with poorer outcomes (i.e. increased mortality) in CHD patients; however, this relationship is not as clearly understood as the relationship of depression with CVD (Frasure-Smith & Lesperance, 2008; Turner et al., 2010).

Although depression and anxiety are considered risk factors for CVD, it has been suggested that social support can be a cardioprotective factor, meaning positive social support is associated with improved outcomes for CVD patients (Mookadam & Arthur, 2004, Turner et al., 2010). Other psychosocial factors that have garnered attention in the CVD literature include hostility, stress, coping, and quality of life (Aldana et al., 2006; Denollet, 1993). Accumulating evidence indicates that all of these factors can play an important role in the health of a CVD patient, and it provides support for the incorporation of psychosocial intervention as an integral component of CR (Aldana et al., 2006; Turner et al., 2010). Although all of the discussed psychosocial factors are influential, social support and social isolation and their impact on outcomes for CR patients will be the focus of this thesis.

Operationalizing Social Support and Social Isolation

Social support has a history of attracting the attention of researchers who are interested in factors that impact health and well-being. In 1976, Cobb wrote that social support is defined as “information leading the subject to believe that he [or she] is cared for and loved, esteemed, and a member of a network of mutual obligations.” Cobb (1976)

and Cassel (1976) both reviewed and provided evidence supporting the notion that social support could have a disease-protective effect.

Later, Seeman and Berkman (1988) emphasized the need to distinguish between the different dimensions of social networks and the type of support they actually provide. Consistent with this view, there is now general agreement among researchers and clinicians that social support can be understood in terms of two broad domains: functional support and structural support (Lett et al., 2005; Barth, Schneider, & Von Kanel, 2010). Structural support refers to the size, type, density, and frequency of contact with people within an individual's social network. A critique of this construct of support is that simply describing the structure of a social network does not provide information about the nature of the relationships (Lett et al., 2005).

Social integration falls into the category of structural support, and it refers to either the number and diversity of relationships or the involvement in a range of social activities (Cohen, Underwood, & Gottlieb, 2000, p. 5; House, Landis, & Umberson, 1988). Many researchers have studied social integration and found evidence to support the idea that individuals who are more socially integrated enjoy healthier lives; specifically, those who are more socially integrated tend to live longer, are less likely to have heart attacks, are less likely to develop upper respiratory illness when experimentally exposed to a common cold virus (Cohen et al., 1997; Cohen et al., 2000, p. 6), and are more likely to survive breast cancer (Helgeson, Cohen, & Fritz, 1998).

Functional support is the second way that researchers conceptualize social support, and it is defined by the types of support provided by the social structure (Lett et al., 2005). These include instrumental (e.g., help completing tangible tasks), financial,

informational (providing important information), and emotional support (e.g., feelings of being loved, sharing difficult feelings) (Barth et al., 2010; Lett et al., 2005). These forms of support can be provided by a range of people from an individual's primary care doctor (e.g., informational support), to a neighbor (e.g., instrumental support via car rides to appointments), to close friends and relatives (e.g., emotional support).

Another important feature of functional support is that it is not distinctly quantifiable in the same way that structural support is. In order to describe an individual's structural support network, the researcher counts the number of friends, interactions, or activities the individual has or is involved with. Functional support, however, is best understood through an individual's subjective report of the type and amount of support he or she believes would be available and received when it is needed (Lett et al., 2005). Psychologists call this perceived functional support or perceived support, and it is frequently assessed in research because it is easier to obtain an individual's subject perception of support than an objective account of the individual's social network.

Social isolation is sometimes considered to be the opposite or inverse of social integration, but some researchers would argue that it is a construct that is distinct from social support because isolation is more complex than the simple absence of support (Cohen et al., 2000, p. 64). As with functional and structural support, researchers have differentiated between objective measures of social isolation and the subject experience of social isolation. Shankar, McMunn, Banks, and Steptoe (2011) write that loneliness is the subjective experience of social isolation, while social isolation itself is measured using objective, quantitative methods (e.g., network size and contact frequency). However, it is important to understand that social isolation is not the same as loneliness

because one does not necessitate the other. For example, those who have small social networks do not always report subjective feelings of loneliness, while those with many social ties may report experiencing a great deal of loneliness (Cloutier-Fisher, Kobayashi, & Smith, 2011). Feelings of loneliness are believed to involve feelings of isolation, disconnectedness, and of not belonging, and these feelings are hypothesized to be the result of the discrepancy between one's desired and one's actual relationships (Peplau & Perlman, 1982). To further complicate the concept, it is recognized that the presence of certain social ties can actually lead to social isolation or loneliness (e.g., abusive relationships or caregiving arrangements) (Cloutier-Fisher et al., 2011). These examples speak to the complex nature of social isolation, and, like social support, it is difficult to study and measure. Despite this complexity, researchers agree that social isolation, both the objective and subjective experience, is generally associated with diminished health (Cloutier-Fisher et al., 2011; House et al., 1988; Shankar et al., 2011).

Theoretical Models of the Relationship between Social Support and Health

Cobb and Cassell have argued that strong social ties could protect an individual from experiencing the potentially pathogenic effects of stressful events (Cohen et al., 2000, p. 7). Cassel (1976) theorized that an individual who experiences stressors is at a greater risk for disease when they lack the appropriate amount of feedback from the social environment, leaving the individual feeling confused and helpless. However, if an individual has a social network that provides consistent communication regarding what is expected of them, instrumental support, evaluation of the individual's performance, and appropriate rewards, the impact of the stressor is mitigated. Cobb (1976) presented a similar theory that asserted that "those who interpreted communications from others as

signifying that they were cared for and loved, esteemed and valued, and that they belonged to a network of mutual obligation were protected” from the negative effects of stress (Cohen et al., 2000, p.6).

These theories have together become known as the stress-buffering hypothesis. Cohen and Wills published a review paper in 1985 with a conclusion that supported the stress-buffering hypothesis; namely, when the perceived availability of social resources matched the needs elicited by the stressful event, the individual was protected from the pathogenic effects of stressful events. Since that time, other researchers have conducted studies that have also found evidence to support the stress-buffering hypothesis (e.g. Graham & Barnow, 2013; Zickar, Balzer, Aziz, & Wryobeck, 2008). Underlying this theory is the understanding that social support can buffer against the negative effects of stress by minimizing perceived stress or by providing functional support that facilitates adherence to healthy behaviors (e.g., healthy coping), thereby mitigating or extinguishing the impact of the stressor (Graham & Barnow, 2013). A critical part of this hypothesis is that it is the perception of social support, not the actual social support that one receives, that is relevant to the buffering effect (Cohen et al., 2000, p. 7). In other words, health and adjustment to stress is more dependent on an individual’s beliefs about the availability of social support and less reliant on whether or not the support is actually received. The buffering effect is also believed to become more important as the level of stress increases (Cohen & Wills, 1985).

While this hypothesis has some empirical backing, the findings regarding the model are mixed (Field & Schulberg, 2011). The varied results can be explained, in part, by the fact that both social support and stress are complex constructs that are difficult to

operationalize and study. As discussed, there are different varieties of social support, and some types of social support are more helpful than others, and there are also types of social support that are actually detrimental (Boutin-Foster, 2005; Field & Schulberg, 2011). Boutin-Foster (2005) conducted a study that examined the characteristics of problematic social interactions from the perspectives of patients hospitalized with acute coronary syndrome. It was concluded that social support providers' unhelpful behaviors could be grouped into five general categories: 1) excessive telephone contact; 2) high expression of emotions; 3) unsolicited advice; 4) information without means for implementation; and 5) taking over. While the patients in this study acknowledged that these behaviors were intended to be helpful support, the patients felt that they were unhelpful because they were in excess of what was needed, incongruous with what was desired, or contributed to negative feelings. Franks, Stephens, Rook, Franklin, Keteyian, and Artinian (2006) corroborated these results with finding that showed that spousal health-related support predicted increased patient mental health and spousal health-related social control (i.e., attempts to induce needed changes in the health behavior of a partner who is unable or unwilling to make change on her or his own) predicted decreases in both patient mental health and health behavior adherence. These findings demonstrate the complexity of social support and how difficult it can be to measure social support appropriately.

The direct effects model of social support is the other major theory that predicts the relationship between social support and health. In this model, social support is not a moderating factor; it has a direct influence on health-related factors. It supposes that high levels of support result in higher levels of functioning and lower levels of distress

(Graham & Barnow, 2013). Research has supported the direct effects model, with studies showing that high levels of social support are associated with fewer depressive symptoms (Dalgard et al., 2006) and a decreased likelihood of suffering from a variety of psychiatric disorders (Graham & Barnow, 2013). The complexities of social support make it difficult for researchers to fully elucidate the process or mechanism through which social support impacts health. The answer might be that both the stress-buffering model and the direct effects model correctly account for this relationship, and the action of social support, direct or indirect, depends on the factor that it is acting upon.

Theoretical Models of the Relationship between Social Isolation and Health

Cacioppo and Hawkley (2003) wrote a review that described and examined four separate mechanisms through which perceived social isolation could affect health, and the two mechanisms with the most support are presented here. The stressful life event account asserts that individuals who are socially active and connected also experience lower levels of stress than individuals who are isolated and/or lonely. In one version of this account, perceived social isolation (e.g., loneliness) is a stressor itself that produces negative affect, negative reactivity, and lowered feelings of self-worth. These psychological states create an environment that promotes chronic elevations in the sympathetic nervous system (SNS), sympathetic adrenomedullary (SAM), and hypothalamic pituitary adrenocortical (HPA) activation. In another version of this account, those without strong social ties are hypothesized to receive lower levels of tangible, emotional, appraisal, or self-esteem support in times of stress and, consequently, show more frequent activation of the SNS and the SAM and HPA axes. The chronic or frequent activation is implicated in diminished health. The other well supported

mechanism presented by Cacioppo and Hawkley (2003) is the repair and maintenance account. This account expands upon the stressful life account by asserting that social isolation may weaken ongoing anabolic processes that serve to repair and maintain physiological functioning, support recovery from stress, and contribute adaptive physiological functioning in response to interactions with the environment.

The latter version of the stressful life account is congruent with the stress-buffering model of social support on health. In that version, social isolation has the largest impact on health when an individual experiences stress; otherwise, when an individual is not experiencing stress, social isolation is not impacting health in a meaningful way. However, in the former version of the stressful life account, social isolation is a stressor on its own, which is congruent with the direct effects model of social support on health.

Along with the uncertainty regarding the mechanisms that mediate the relationship between social isolation and health, there is also some controversy regarding causal directionality of the association between social isolation and health. House and colleagues (1988) addressed this issue by conducting a review of prospective studies that examined social isolation and health and found that social relationships do predict mortality for men and women in a wide range of populations, even after adjustments for biomedical risk factors and mortality.

Because loneliness is conceptually different from social isolation (Peplau & Perlman, 1982), it is also necessary to examine literature that examines the relationship between loneliness and health. Although the data is more limited, the existing research supports a link between loneliness and mortality (Seeman, 2000). Cacioppo and

colleagues (2002) used cross-sectional data to examine the mechanistic relationship between reported loneliness and diminished health, and it was determined that both cardiovascular activation and sleep dysfunction could account for this relationship. Additionally, VanderWeele, Hawkey, Thisted, and Cacioppo (2011) summarized a large body of literature with findings that loneliness is a risk factor for elevated blood pressure, increased HPA activity, and impaired cognitive performance and cognitive decline. These findings contribute to the hypothesis that, while loneliness is different than social isolation, loneliness may impact health through the same or similar pathways as the hypothesized mechanistic impact of social isolation on health.

One aim of the present study will be to determine if it more useful to consider perceived social support and loneliness as predictor variables (as they are conceptualized in the direct effects models) or to consider them as moderators (as they are conceptualized in the stress-buffering models). It is important to understand that while both the stress-buffering and direct effects models both attempt to explain the relationship between perceived social support/loneliness and health, the two models are operating on different initial assumptions. In the direct effects model, perceived social support and loneliness are causing the changes in health. In the stress-buffering models, it is presupposed that stress is impacting health while perceived social support and loneliness are moderating this relationship. Although the present study will compare these two models to determine which one account for more predictive variance, they cannot be compared directly because they are not based on the same initial assumptions.

Perceived Stress in Cardiac Rehabilitation

The present thesis addresses the questions: Are the effects of perceived support and loneliness on health-related factors direct, or are they best accounted for by stress-buffering model? Do the effects of social support depend on the factor being measured? The stress-buffering model predicts that the level of perceived social support is most relevant and has the greatest impact on health when there are high levels of perceived stress. The study will also explore whether there is an equivalent relationship between loneliness, perceived stress, and health outcomes. The interaction between social support and stress has a meaningful place in CR research because CR patients are often faced with a number new stressors, and the experience of stress has direct implications for cardiac health (Aldana et al., 2006; Donovan, Doody, & Lyons, 2013). Among post-operation cardiac patients, the most common psychological stressors reported are a loss of control and missing one's spouse (Soehren, 1995). The AHA (2012b) reports that it is common for CR patients to feel a range of emotions such a fear, anxiety, depression, or anger, which are all related to perceived stress.

There is also a growing literature that focuses on Type D personality, which is characterized by both negative affectivity and social inhibition (Denollett, 2005). Individuals with this personality type perceive stress chronically, tend to be generally tense and insecure, and show low self-esteem (Denolett, 2005). Type D personality has been associated with an increased risk of cardiac events (Denollet, Pedersen, Vrints, & Conraads, 2006), suggesting that there might be a substantial sub-population of CR patients that enter the program with Type D personality. In a study that assessed the Type D Scale—14, a measure of Type D personality, Denolett (2005) found that 21% of the

sample was classified as Type D in the general population versus 28% in coronary heart disease and 53% in hypertension. Although there are many CR patients who do not have Type D personality, it is important to consider that CR patients may be more likely to have this disposition than the general population.

Stress can have a negative effect on risk factors for cardiovascular disease, such as high blood pressure, smoking, physical inactivity, and overeating (AHA, 2012b). In accordance with the stress-buffering hypothesis, the negative effects of stress can be attenuated by social support, and potentially exacerbated by loneliness. A focus of this study will be to determine if the effects of social support and loneliness on health related factors are direct or are best accounted for by stress-buffering model.

Impact of Perceived Support and Loneliness on Cardiac Patient Outcomes

Although the mechanisms are not fully understood, research does indicate that perceived social support and loneliness can play a critical role in health, and they are, therefore, important factors to consider when studying determinants of CR patient outcomes. The present study will examine the impact that social support and loneliness have on exercise adherence, self-efficacy, and affect. These factors have been selected because research suggests that they have a large influence on CR patient outcomes, and the following sections will explore these relationships.

Impact of Perceived Social Support and Loneliness on Exercise. Exercise has been established as a very important, if not essential, component of CR that significantly impacts patient outcomes. Researchers have found that exercise alone can reduce both subsequent morbidity and mortality by up to 30% (Reeves & Whellan, 2010; Rodger et al., 2013; Taylor et al., 2004). Regular exercise has also been associated with less re-

hospitalization (Ades, Huang & Weaver, 1992) fewer CVD related symptoms (Thompson et al., 2003), greater reductions in cholesterol level, triglyceride level, and systolic blood pressure (Taylor et al., 2004). Wise (2010) conducted a review that described the benefits of exercise for coronary heart disease and found that exercise was associated with significant improvements in cardiovascular pathophysiology, cardiovascular risk factors, physical function, and psychological wellbeing. It is recommended that CR patients should engage in a minimum of three days of exercise each week, but it is ideal if patients engage in exercise on most, if not all, days of the week (Wise, 2010).

Despite the prolific amount of evidence that demonstrates the value of exercise, not all CR patients adhere to program recommendations. The World Health Organization (WHO) identified a number of barriers to exercise that fall into five categories: patient related factors, social and economic factors, factors related to the healthcare team/system, condition related factors, and therapy-related factors (Conraads et al., 2012). The social factors are of interest in the present study, and, in particular, lack of resources and support, lack of motivation, and anxiety and depression are a focus in this study because of their associations with social support. In addition, cardiac patients have reported that inadequate social support reduced adherence to physical activity in CR (Conraads et al., 2012).

Because exercise is known to have a large impact on the outcomes for CVD patients, it is important to understand not only the barriers, but also the determinants of increasing and maintaining exercise. A recent review of the literature indicates that for older adult populations, social support has been positively associated with physical activity initiation, and there is also a positive, but weaker association between social

support and physical activity maintenance (van Stralen, De Vries, Mudde, Bolman, & Lechner, 2009). The review also indicates that the source of social support could be important for physical activity maintenance because there was a negative association between maintenance and social support from a health care provider while there was a positive association between maintenance and social support from sports instructors and group members or sports partners.

Warner, Ziegelmann, Schuz, Wurm, and Schwarzer (2011) conducted a study that examined the combined effect of social support and self-efficacy on physical exercise in older adults, and they found that people who had low support were less likely to be active even if they were high in self-efficacy. This research emphasizes the critical role that social support may be playing in initiation and maintenance of exercise for older adults, and it substantiates the need for further investigation in this domain because the influence of social support on exercise in CR programs has not been extensively examined. Additionally, many studies that have focused on social support for exercise in CR have conceptual and measurement problems (Woodgate, Brawley, & Shields, 2007), providing further impetus to study this relationship.

Impact of Perceived Social Support and Loneliness on Emotional Factors.

Affect has been defined as the experience of an emotion—negative, positive, or both at the same time—and there is ample evidence indicating that both can impact health. Negative affect is “a general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness” (Watson, Clark, & Tellegen, 1988). Many studies have yielded evidence to support the positive relationship between negative affect (e.g.,

depression and anxiety) and poor prognosis for CR patients (Frasure-Smith & Lesperance, 2003; Lesperance, Frasure-Smith, Talajic, & Bourassa, 2002). Moreover, researchers have documented high rates of negative affect in CVD patients. For example, in a retrospective study, Thiel, Parker, and Bruce (1973) compared the responses of patients who had recently been admitted to hospital for myocardial infarction with the responses of patients who had been admitted for a non-cardiac illness on a questionnaire that assessed for anxiety and depression symptomology. The results showed that the cardiac patients reported more symptoms of anxiety and depression that compared to the control subjects.

A more recent cross-sectional study examined the relationship between negative affect and cardiovascular disease by interviewing angina patients and a healthy control group regarding their psychological condition (Billings, Hjemdahl, & Rehnqvist, 1997). The data indicated that the angina patients consistently reported a more sleep disturbances, symptoms of dizziness, headaches, tiredness, irritability, and a tendency to weep during the day than the control group. Of particular interest, some of these (i.e., sleep disturbances, tiredness, irritability, and weepiness) are symptoms of depression from the Diagnostic and Statistical Manual of Mental Disorder (American Psychiatric Association [APA], 2013).

Although the relationship between CVD and negative affect is well established, it is less clear if research supports the notion that negative affect, depression, and/or anxiety, among other factors, contributes to the development or maintenance of cardiovascular disease. In order to explore this question, researchers turn to prospective studies. In one large study, Frasure-Smith and Lesperance (2003) used a prospective

design to examine the relative importance of depression, anxiety, and anger in predicting five year cardiac related mortality following a myocardial infarction, and they assessed the role of any common underlying dimensions of these factors. They examined the records of 896 individuals for whom they attained baseline data, and they determined that negative affectivity was common underlying dimension, and negative affect along with some unique aspects of depression predicted long-term cardiac-related mortality after the occurrence of an initial heart attack. Cuijpers and Smit (2002) conducted a meta-analysis of 25 prospective studies of adults consistently showed an increased risk of mortality when both clinical and subclinical depression levels of depression were present. Additionally, negative affect, such as depression, is also associated with an increased risk for coronary heart disease, type-2 diabetes, and disability (Golden et al., 2004; Penninx, Leveille, Ferrucci, van Eijk, & Guralnik, 1999), all of which have implications for CR patient outcomes.

Alternatively, Watson et al. (1998) write that positive affect “reflects the extent to which a person feels enthusiastic, active, and alert.” Although it has not been studied as extensively as negative affect, researchers have also explored the relationship between positive affect and cardiovascular disease. It has been demonstrated that positive affect is not only associated with the absence of cardiovascular disease, but it is also believed to have a protective effect on CR patient outcomes. Boehem and Kubzansky (2012) conducted an extensive review that investigated the associations between positive psychological well-being (PPWB) and cardiovascular disease, and they specifically sought to differentiate between different aspects of PPWB and how they impact cardiovascular health. The findings suggested that PPWB consistently protects against

cardiovascular disease, and, more specifically, optimism is most strongly associated with a reduced risk of cardiovascular events. Additionally, Steptoe, Wardle, and Marmot (2005) found that positive affect in middle-aged men and women is associated with reduced neuroendocrine, inflammatory, and cardiovascular activity, which have implications for CVD. Furthermore, these effects remained independent of psychological distress, supporting the notion that positive affect is uniquely related to health-relevant biological process independent of negative affect.

Consistent with some of the findings discussed, Zautra (2003) discusses positive and negative affective states as conceptually distinct constructs that are not merely inversely related. In other words, positive affect is not the absence or opposite of negative affect and vice versa. Additionally, research has supported the idea that vulnerability factors (e.g., depression, anxiety, social isolation) appear to independently increase negative affect while resilience factors (e.g., optimism, social support, a sense of purpose in life) appear to independently increase positive affect (Zautra, 2003). Because both positive and negative affect have a unique impact on cardiovascular health, it is imperative that researchers understand both vulnerability and protective factors that impact affect. In accordance with this research, the present study is interested in examining the potential differential effects of perceived support on positive affect and the effects of loneliness on negative affect.

Loneliness has been identified as a source of considerable psychological distress (Zawadzki, Graham, & Gerin, 2013); however, the mechanisms that underlie this relationship are not fully understood. It is established that loneliness is a major risk factor for depression (Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006; Wei, Russell, &

Zakalik, 2005). Researcher have also found that loneliness is positively correlated with poor self-concept and more incidences of self-criticism, boredom, restlessness, and stress related illness (McWhirter, 1990), which are related to negative affect (Watson et al., 1988). Zawadzki et al. (2013) conducted a study using college students that examined possible mechanisms that could explain the effect of loneliness on depressed mood and poor sleep quality, and they concluded that both rumination and anxiety mediate the effect. On the other hand, the mechanistic connection between perceived support and positive affect has not been studied as thoroughly. Generally, research demonstrates that social support influences measures of well-being via the availability and provision of different forms of social support (Zhu, Woo, Porter, & Brzezinski, 2013). This study intends to examine these two factors to determine if there is a strong relationship between perceived social support and positive affect.

Differential effects of Perceived Social Support and Loneliness

One theoretical understanding of perceived social support and loneliness asserts that these two constructs are opposite extremes on the same spectrum (Cohen et al, 2000, p. 64), which could obviate the need to study both because they supply redundant information. However, to the author's knowledge, research has not confirmed this interpretation. Although it is not within the scope of this study to fully address this question, analyses will be conducted to examine if loneliness or perceived social support explains more of the variance in the selected health-related variables and to explore if these effects seem to be unique. The rationale for this question stems from research that indicates that negative social interactions have a relatively greater effect on well-being than positive social interactions, and the effects of the interactions are independent of one

another (Rook, 1984). Although negative social interactions are not the same as loneliness, they are both negative experiences implicated in social relations. Rook's (1984) research justifies the present hypothesis that loneliness will have a greater effect on health-related outcomes than perceived support.

However, this may not tell the complete story. Smith and Zautra (2008) correlated positive interactions, negative interactions, positive affect, and negative affect, and they found that positive interactions were significantly correlated with positive affect in the positive direction and negative interactions were significantly correlated with negative affect in the positive direction, but the remaining correlations between interaction and affect type were not significant. This finding indicates that positive and negative interactions have unique relationships with affect. It is possible that loneliness and perceived support also have unique effects on health-related variables.

Change in Reported Loneliness Associated with the Completion of Cardiac Rehabilitation

Thus far this thesis has primarily focused on how an individual's baseline perceived support and loneliness effects CR outcomes at program completion. However, an additional focus of the study is the examination of whether loneliness can be reduced by participating in and completing CR. Although limited, research findings have indicated that social support increases for CR participants in both programs that include and that do not include group support elements (Aldana et al., 2006). This finding suggests that social support focus groups, though helpful, may not be necessary to increase feelings of support or to decrease feelings of loneliness and that other features of CR may be active in this change. This conclusion begs the question: What aspects of CR

are necessary to decrease feelings of loneliness? Researchers have examined the impact of doctor-patient relationships on health outcomes in general (Singh, 2013; Stewart et al. 2000), but this research has not been conducted in CR settings, and it doesn't specifically address the impact of the relationship on loneliness. Although this information was not collected as a part of the study, it is noteworthy to include that patients in the New Heart CR program, from whom this data was collected, did not attend group support sessions, but some patients report that the center cultivates a hopeful and supportive atmosphere. Additionally, some patients report feeling encouraged by seeing and exercising with other CR patients. This observation gives rise to the hypothesis that the characteristics of CR staff and the design of the program are likely important to CR patient outcomes.

Unfortunately, researchers have not empirically studied these kinds of experiences and their potential impact on reported feelings of loneliness. It is hypothesized that the mere experience of attending CR three times a week to exercise in addition to interactions with staff and other CR patients will have an impact on loneliness. Although this study makes an attempt at investigating this question, it will not be able to get at the underlying explanation for why loneliness might change over the course of CR. This is an important question to explore because it has implications for quality of care, patient-staff interactions, the importance staff characteristics, and CR program design.

Research Aims and Hypotheses

The aims of this study were developed to continue the ongoing investigation to understand the roles that perceived social support and loneliness may be playing in the health-related outcomes for CR patients. The results of this study will be used to help

determine whether it would be beneficial for CR programs to target perceived social support and/or loneliness as part of rehabilitation.

Specific Aim 1. The first aim is to examine the direct effects of social support and loneliness measured at baseline on changes in days exercised per week, positive affect, negative affect, depression and anxiety for patients from baseline to follow-up at the end of cardiac rehabilitation (CR). Hypothesis 1.a. Social support will predict more days per week spent exercising, greater positive affect, and less negative affect, depression, and anxiety. Hypothesis 1.b. Loneliness will predict fewer days per week spent exercising, less positive affect, and greater negative affect, depression, and anxiety. Hypothesis 1.c. Loneliness will account more of the predictive variance than perceived social support in the regression models.

Post hoc: Specific Aim 1. After determining the changes in dependent variables that perceived social support significantly predicted, it was queried whether it was the emotional or instrumental support that was driving the effect. This is an exploratory aim, so no hypotheses are given.

Specific Aim 2. The second aim is to examine the buffering effects by determining whether the effects of social support and loneliness on days exercised per week, positive affect, negative affect, depression and anxiety for patients in CR vary depending on the level of perceived stress. Hypothesis 2.a. There will be a significant interaction between social support and stress such that the effect of stress on the independent variables will depend on the amount of reported social support. Hypothesis 2.b. There will be a significant interaction between loneliness and perceived stress such

that the effect of stress of on the independent variables will depend on the amount of loneliness reported.

Specific Aim 3. The third aim is to determine whether loneliness changes for patients who complete CR. Hypothesis 3 – Patients who have completed CR will report lower levels of loneliness at the end of CR than at the beginning of CR.

Post hoc: Specific Aim 3. After determining the changes in patient loneliness, it was questioned whether this would differ for different subpopulations of the sample. In particular, this post hoc aim is to determine whether there is a greater decrease in loneliness for those who are high in social inhibition versus those who are low in social inhibition at the beginning of the program. This is an exploratory aim, so hypotheses are not given.

Methods

Participants

The New Heart Cardiac Rehabilitation and Wellness Center conducts a 12-week cardiac rehabilitation program that focuses on monitored exercise, cholesterol diagnosis and management, and nutritional evaluation and support. Patients are referred from local hospitals and have been prescribed cardiac rehabilitation. Patients have diagnoses of myocardial infarction

(MI), angioplasty with or without stent placement, coronary artery bypass grafting (CABG), or heart failure. This study is part of a larger study assessing psychosocial vulnerability and resilience in cardiac rehabilitation patients. The research sample included 260 CR patients at baseline and 122 CR patients at the three month follow-up. Basic demographic information is discussed in the results section (Table 1).

Adherence to the program involves monitored exercise three times per week for 12 weeks, attending one session of nutritional counseling and attending a cardiac risk profile feedback session delivered by a member of the exercise staff. Patients also have a consultation with a cardiologist at eight weeks, and reassessment at program completion.

Procedures

All patients who enter the cardiac rehabilitation program attend a one and a half hour orientation session. At that time a trained research assistant presented a brief description of the study and read the Human Research Review Committee (HRRC) approved consent form and asked if they would like to participate. Patients were able to take additional time to decide and were informed that they could consent at that time, at

the end of orientation, or before starting the rehabilitation program. They were given two copies of the consent form and the HRRC HIPAA form, one to sign and return and one to keep. Once consented into the program, the health information they gave as part of their standard medical care at New Heart was collected. Information was gathered using a questionnaire at intake and at their reassessment at program completion at 12 weeks.

If potential participants were not able to speak English adequately enough or if he or she had a neurological disorder or form of dementia that would prevent them from understanding the study or from giving proper consent, they were excluded from the study. Individuals also had to be 18 years or older to participate.

Measures

Demographics. Basic demographic information was collected through a series of questions assessing gender, age, ethnic background, years of education and degrees completed, marital status, income, and health insurance coverage of medical expenses (See Appendix A).

Non-Psychological Measures. Days per week spent exercising is a dependent variable that was assessed using one item that asked participants to report how many days per week on average they were exercising for at least 30 minutes in the last two weeks (See Appendix A). Participants were asked to complete this item at both baseline and program completion.

Psychosocial Measures. The independent variables are perceived social support and loneliness, and perceived stress is a proposed moderating variable. The dependent variables are self-efficacy and positive and negative affectivity.

Social Support Survey. Perceived social support was measured using selected items from the Medical Outcomes Study (MOS) social support survey (Sherbourne & Stewart, 1991). Multitrait scaling analyses supported the dimensionality of four functional support scales (i.e., emotional/informational, tangible, affectionate, and positive social interaction) and the construction of an overall functional social support index. This survey was designed to assess information that is distinct from structural support measures. The participants are asked to indicate on a five point Likert scale from 1-5 how often different kinds of social support are available to them where 1 = “none of the time” and 5 = “all of the time” (See Appendix A). For example, “Someone to confide in or talk to about yourself or your problems” and “Someone to have a good time with” are two items on the measure that address emotional support. Participants completed this measure at baseline but not at program completion. The overall support index had a Cronbach’s alpha of .97, and the measure demonstrated high convergent and discriminant validity for that administration of the measure (Sherbourne & Stewart, 1991).

UCLA Loneliness Scale. Loneliness, or perceived social isolation, was measured using an abbreviated, three item version of the Revised UCLA Loneliness Scale (R-UCLA; Russel et al., 1980) that was developed for measuring loneliness in long surveys (Hughes, Waite, Hawkey, and Cacioppo, 2004). The participants are instructed to indicate how often statement describes them on a seven point scale from 1-7 where 1 = “hardly ever” and 7 = “often” (See Appendix A). An example of a statement is “How

often do you feel that you lack companionship?” Participants were asked to complete this item at both baseline and program completion. The shortened survey demonstrated satisfactory reliability and both concurrent and discriminant validity in the administration completed in the investigation conducted by Hughes and colleagues (2004). Cronbach’s alpha was .72, which was considered to be good for a three-item measure, and the measure was also determined to have adequate convergent and divergent validity on that administration of the measure (Hughes et al., 2004).

Perceived Stress Scale. Perceived stress was measured using 10 items of the Perceived Stress Scale (PSS; Cohen, Karmarck, & Marmelstein, 1983). The participants indicate on a five from 0-4 point scale how often they felt or thought a certain way in the last 30 days where 0 = “never” and 4 = “very often” (See Appendix A). For example, one statement reads “How often did you feel that you were unable to control the important things in life?” Participants were asked to complete this item at both baseline and program completion. The scale was developed to determine the degree to which situations are appraised as stressful (Cohen et al., 1993). Cohen and colleagues (1983) examined the reliability and validity of the test in three sample populations. Cronbach’s alpha for the PSS ranged between .84 and .86 for the administrations in the three samples, and the PSS also demonstrated adequate internal, concurrent, and predictive validity in that administration of the measure.

Mood Adjective Checklist. Positive and negative affect was measured 12 items from Larson and Diener’s (1992) Mood Adjective Checklist (MAC) that captures different dimensions of mood pleasantness and mood arousal. The measure consists of words that describe different affective states(e.g., cheerful, active, blue, nervous, tired),

and the participant is instructed to indicate to what extent he or she has felt that feeling or affect in past two weeks by selecting a number from a seven point scale from 0-6 where 0 = “none” and 6 = “extremely” (See Appendix A). Participants were asked to complete this item at both baseline and program completion. Zautra, Smith, Affleck, and Tennen (2001) examined psychometrics of the MAC and reported that Cronbach’s alpha ranged from .84 to .96 for positive affect and from .84 to .88 for negative affect on two separate administrations.

Hospital Anxiety and Depression Scale. Depression and anxiety were measured using the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). The scale was developed in order to assess for depression and anxiety in primary and secondary healthcare settings to exclude somatic items that typically appear on assessments for anxiety and depression because the somatic symptoms could be reflective of the patient’s physical condition rather than mental distress (Covic et al., 2012). The measure is self-report and consists of 14 statements with two subscales. Each subscale consists of seven statements; one subscale assesses for depression and the other for anxiety. The participants are asked to indicate the degree to which each statement applies to them over the past two weeks by selecting one of four responses that are coded a scale from 0-3. The wording of the responses varies with each statement, but they all reflect a similar spectrum from “very much” to “not at all/very infrequently.” For example, one statement from the depression subscale reads “I enjoyed the things I used to enjoy,” and the possible responses include “Definitely as much;” “Not quite as much;” “Only a little;” or “Hardly at all” (See Appendix A). In a review of the psychometric properties of the HADS, Bjelland, Dahl, Haug, & Neckelmann (2002) found that the anxiety subscale

had a Chronbach's alpha ranging from .68 to .93, and the depression subscale had a Chronbach's alpha ranging from .67 to .90. The reviews also determined that most studies found that an optimal balance between sensitivity and specificity was achieved when 8 was used as a cutoff score to detect the presence of anxiety and depression (Bjelland et al., 2002). Luckett et al. (2010) also discussed reliability and brevity as strengths of the HADS.

Type D Personality. Social inhibition was measured using Denolett's (2012) Type D Scale- 14 (DS14). The scale consists of two 7-item subscales that reflect negative affectivity and social inhibition, which are the two subcomponents of Type D personality. The measure is self-report, and the participants are asked to rate on a scale of 1 to 5 how true each of the 14 statements are, and the responses range from "False" to "True" with varying degrees in between. Examples of items from the social inhibition subscale are "I make contact with others easily," and "I often talk to strangers" (See Appendix A). In a review of psychometric properties of the subscales, Denolett (2012) found that Cronbach's α was 0.88 and 0.86 for negative affectivity and social inhibition respectively.

Design and Analyses

All of the analyses will be conducted using SPSS version 19.0, and $p < .05$ is the alpha level selected for statistical significance. Descriptive statistics were calculated for demographics variables. If the correlation (r) of a demographic variable with any of the predictor or criterion variables was approximately 0.2 or greater, it was included in the initial multiple regression analyses as a covariate because, although this is a small effect (Cohen, 1988), it is meaningful in social science research. If it did not account for a

significant amount of the predictive variance or contribute to the fit of the model to the data, it was dropped from the analysis to retain degrees of freedom.

Aim 1. The first aim is to examine the direct effects models of perceived social support and loneliness at baseline (i.e. the predictor variables) on selected outcomes. Five separate multiple regressions were carried out to assess the ability of the predictor variables to account for the predictive variance of the change in the five dependent variables (e.g., days exercised per week, positive affect, negative affect, depression, and anxiety) from baseline to follow-up. The dependent variables scores were transformed into residualized change scores and selected as the criterion variables in the five separate analyses. The variables were entered into a linear regression model in one block using the “enter” method.

Aim 2. The second aim is to examine perceived social support and loneliness as potential moderators of the relationship between perceived stress and the four dependent variables. Five separate multiple regression analyses were carried out to assess ability of the perceived stress X perceived social support and perceived stress X loneliness interactions to account for the predictive variance of the change in the five dependent variables of interest. Again, the residualized change scores were calculated from the selected dependent variables and were used in these analyses as the criterion variables. Perceived social support, loneliness, and perceived stress at baseline and all of the two and three way interactions between them were the predictor variables. For these interactions, the variables were centered in order to ensure a meaningful interpretation of the results. The perceived stress X perceived social support and perceived stress X loneliness interactions were used to test hypotheses 2.a. and 2.b., and any non-significant

two or three way interactions were dropped from the analyses. As for aim 1, the variables were entered into a linear regression model in one block using the “enter” method.

Aim 3. The third aim considers the hypothesis that loneliness will decrease for patients who complete the CR program. In order to address this hypothesis, a paired-sample t-test was used to compare loneliness scores at baseline to loneliness scores at program completion at 12 weeks. In addition to considering significance at an alpha of 0.05, Cohen’s d effect size is examined. An effect size above 0.8 is considered a large, meaningful effect (Cohen, 1988).

Results

Demographics

The descriptive statistics for the sample at baseline and follow-up are shown in Table 1. The sample was composed of 260 CR patients at baseline and 122 at the three month follow-up, but the only baseline demographics are discussed here because the demographics did not change in a notable way at follow-up. The majority of the sample was male (68.8% male), and the sample's ages ranged from 30 to 88 ($M = 64.15$ years; $SD=10.76$). The sample predominantly identified as non-Hispanic, Caucasian (67.7%) or Hispanic (18.8%). The number of years the participants received an education ranged from 2 to 26 ($M = 14.45$ year; $SD = 3.18$). There was a bimodal trend in the participant income with 32 participants earning over \$100,000 and 26 of the participants earning between \$20,000 and \$29,000. Although marital status was not a part of any of the analyses, this demographic is of particular interest in this study because of its implications in perceived support and loneliness, so it is included in Table 1. The majority of the sample was married (71.2%), and 10.8% were divorced, 6.9% were widowed, and 5.0% were never married.

Correlations

The relationship between the demographic variables and the predictor and criterion variables are displayed in Table 2 with the exception of marital status because its response set is categorized in a way that does not permit meaningful correlations with other ratio or scale variables. The results of the bivariate correlation analysis indicated that age was not significantly correlated with any of the predictor or criterion variables,

and the number of years of education obtained was significantly and positively correlated with perceived social support and negatively with perceived stress. Gender was significantly and positively correlated with perceived stress, and there was a trend toward a positive, significant correlation with anxiety. In the case of gender, a positive correlation means that women had higher scores of perceived stress and anxiety. Income was significantly and negatively correlated with both loneliness and perceived stress, and positively with positive affect. Additionally, there was a trend toward a significant negative correlation between income with both negative affect and depression.

Table 2 also displays the correlational relationships between the selected independent and dependent variables. Unsurprisingly, there was a strong, significant negative relationship between perceived social support and loneliness. There was also a significant, positive relationship between perceived stress and loneliness and a significant, negative relationship between perceived stress and perceived social support. Depression has a significant, strong, positive relationship with anxiety, and both of these variables have significant, positive correlations with negative affect and negative correlations with positive affect. However, positive affect has a notably stronger relationship with depression ($r = .5$) than it does with anxiety ($r = .26$). Interestingly, depression is significantly, negatively correlated with perceived social support but not significantly correlated with loneliness, and anxiety is significantly, positively correlated with loneliness but not with perceived social support.

Aim 1

Five separate linear regression analyses were carried out in order to test the direct effects hypotheses, and all of the models included perceived social support and loneliness

at baseline as the predictor variables. The models presented are the final models that have excluded covariates that were dropped because they did not explain a significant amount of the variance in the criterion variables or improve the fit of the model.

The first model included the residualized change score of the number of days spent exercising per week from baseline to follow-up as the criterion variable, and income was included as a control variables. The overall fit of the model was non-significant in its prediction of change in exercise days. The regression analysis indicates that neither perceived social support nor loneliness accounted for a significant amount of the predictive variance in the change of days spent exercising per week from baseline to follow-up (Table 3).

The second model included the residualized change score of positive affect from baseline to follow-up as the criterion variable, and income was included as a covariate. The overall fit of the model was significant in its prediction of the change in positive affect. The results of the regression analysis indicated that although income accounts for the most predictive variance in the change of positive affect from baseline to follow-up, there is a trend toward loneliness at baseline significantly predicting this change (Table 4). Specifically, as loneliness scores at baselines increase, there are larger decreases in positive affect from baseline to follow up.

The third model included the residualized change score of negative affect from baseline to follow-up as the criterion variable, and income was included as a control variables. There was a trend toward a significant overall fit of the model in predicting the change in negative affect. The results of the regression analysis indicate that neither of

the predictor variables account for a significant amount of the predictive variance in the change of negative affect from baseline to follow-up (Table 5).

The fourth model included the residualized change score of depression from baseline to follow-up as the criterion variable, and income was included as a covariate. The overall fit of the model was significant in its prediction of the change in depression. The results of the regression analysis indicate that both income and perceived social support account for a significant amount of the predictive variance in the change in depression from baseline to follow-up (Table 6). As social support decreases, there are greater increases in depression from baseline to follow-up, and the same relationship exists for income.

Finally, the fifth model included the residualized change score of anxiety from baseline to follow-up as the criterion variable, and both income and gender were included as control variables. There was a trend toward a significant overall fit of the model in predicting the change in anxiety. The results of the regression analysis indicate loneliness accounted for a significant amount of the predictive variance in the change in anxiety from baseline to follow-up (Table 7). In this relationship, as loneliness increases, there are greater increases in anxiety from baseline to follow-up.

Aim 1: Post hoc analysis. A follow-up question of interest was raised in order to determine what aspect of perceived social support is explaining the majority of the variance in the regression model where social support significantly predicted change in depression. In order to answer this question, the final regression models were rerun with the social support factor broken down into two component variables: instrumental

support and emotional support. The results of the analysis indicate that emotional support was driving this effect (Table 8).

Summary. The direct effects models were significant predictors for some, but not all, of the selected criterion variables. According to the data, perceived social support significantly predicted the change in depression, but did not account for a significant amount of variance in other models. Loneliness significantly predicted the change in anxiety, and there was a trend toward significance in its prediction of change in positive affect. Loneliness did not account for a significant amount of variance in other models. Neither perceived social support nor loneliness accounted for changes in days exercising per week or negative affect.

Aim 2

The second aim of the study was to test the stress buffering hypothesis of perceived social support where both perceived support and loneliness moderate the relationship between stress and selected health outcomes. Again, five multiple regressions were completed. All of the models included perceived social support, loneliness, perceived stress, and all of the two and three way interactions between them as the predictor variables. The models presented are the final models that have excluded covariates and interactions that were dropped because they did not explain a significant amount of the variance in the criterion variables or the fit of the model was improved by dropping them.

The final model that best predicted the change in days exercised per week included the perceived social support by perceived stress and loneliness by perceived stress interactions, the lower order variables, and income as a control variable. Although

the overall model did not significantly predict the change in days exercised per week, there was a trend toward a significant interaction between loneliness and perceived stress (Table 8). When this interaction was graphed, it was apparent that among those who reported high levels of loneliness, there was an increase in days exercising per week when perceived stress was low and a decrease when perceived stress was high. However, for those who reported low levels of loneliness, there was an decrease in days exercising per week when stress was low and there was a slight increase when stress was high (Figure 1). Perceived social support did not significantly moderate the relationship between perceived stress and the change in days exercising per week.

The final model that best predicted the change in positive affect from baseline to program completion included the perceived social support by perceived stress and loneliness by perceived stress interactions, the lower order variables, and income, gender, and years of education as control variables. The overall fit of the model was significant in its predictions of change in positive affect, and there was a trend toward significance for the perceived stress by loneliness interaction (Table 9). When this relationship was graphed, it was apparent that for those who reported high levels of loneliness, there were greater increases in positive affect as perceived stress increased and positive affect decreased when perceived stress was low. However, for individuals who reported low levels of loneliness, there was an increase in positive affect when perceived stress was low and there were greater decreases in positive affect as stress increased (Figure 2). Interestingly, income was the most significant predictor of change in positive affect in this model such that a higher income predicted greater increases in positive affect (Table 9).

The final model that best predicted negative affect included all of the two way interactions, the lower order variables, and income as a control variable. The overall fit of the model was significant in its prediction of change in negative affect from baseline to program completion. Both the perceived social support by perceived stress and the perceived social support by loneliness interactions were significant (Table 10). A graph of the perceived social support by perceived stress interaction indicated that for individuals who reported low levels of support, there were greater increases in negative affect from baseline to program completion as perceived stress increased. However, when individuals reported high levels of support, there were small increases in social support when stress was low, but as stress increased, there were greater decreases in negative affect (Figure 3). There was also a trend toward a significant interaction between loneliness and perceived stress. The graph of this interaction indicates that when stress was high, there was a small decrease in negative affect for those who report high levels of loneliness and those who report low levels of loneliness. However, when stress was low, there was there was an increase in negative affect for those who reported high levels of loneliness and there was a decrease in negative affect for those who reported low levels of loneliness (Figure 4). Finally, a graph of the significant interaction between loneliness and perceived social support indicated that when perceived support was low, there was an increase in negative affect for both those who reported high and low level of loneliness. However, when perceived support was high, there was an increase in negative affect for those who reported high levels of loneliness and a decrease in negative affect for those who reported low levels of loneliness (Figure 5).

The final model that best predicted change in depression included the perceived social support by perceived stress and the loneliness by perceived stress interactions, the lower order variables, and income and gender as the control variables. The overall fit of the model was not significant in its predictions of change in depression from baseline to program completion, and none of the interactions significantly predicted this change. Again, income was the only variable that significantly predicted the outcome variable, change in depression, such that the higher income meant the greater decreases in depression scores (Table 11).

The final model that best predicted change in anxiety also included both the perceived social support by perceived stress and the loneliness by perceived stress interactions, the lower order variables, and income and gender as the control variables. The overall fit of the model was not significant in its predictions of change in anxiety from baseline to program completion, and none of the interactions significantly predicted this change (Table 12).

Summary. The moderation models appeared to be a better fit for some of the selected criterion health variables including change in days spent exercising per week, positive affect, and negative affect. There was a trend toward significance of the perceived stress by loneliness interaction in predicting days spent exercising per week, positive affect, and negative affect; however, this interaction never accounted for a statistically significant amount of the variance in change for the selected variables. Whereas the perceived social support by perceived stress interaction and the perceived social support by loneliness interaction did significantly predict the change in negative affect. The most surprising results were the nature of some of these interactions. For

example, the interaction of high loneliness and high stress at baseline predicts an increase in positive affect. This finding, among others, will be discussed in detail in the discussion.

Aim 3

A paired-sample t-test was carried out to test the final hypothesis of the study that loneliness will decrease for those participants to complete the program. The results of the test demonstrated that, for the overall sample, there was a non-significant decrease in loneliness scores with a small effect size ($d = 0.119$) (Table 13).

Aim 3: Post hoc analyses. After examining the results of the paired-sample t-test from aim 3, it was decided that additional information could be garnered by examining if there was a greater decrease in loneliness for subpopulations of the sample who had higher levels of social inhibition at baseline. It was reasoned that individuals who do not have high levels of social inhibition at baseline may not experience a decrease in loneliness because they already receive the social interaction they desire; however, those with higher levels of social inhibition may experience a greater decrease over the course of the program because they may become less isolated and gain companionship in while in the program. The participant's level of social inhibition was determined by his or her score on the social inhibition scale of Denollet's (2005) Type D personality questionnaire, and paired-sample t-tests were performed to determine if there was a change among the selected subpopulations. A score of 10 or more out of 28 has been determined as the cut-off score that indicates a clinically relevant amount of social inhibition is present.

In this study, participants who scored less than 10 on the social inhibition scale showed a small decrease in loneliness from baseline to follow-up that was non-significant and had a small effect size ($d = 0.031$) that was even smaller than the effect size when the whole population was analyzed together (Table 14). For individuals who scored 10 or greater ($n = 36$), there was also a non-significant decrease in loneliness with a small effect size ($d = 0.286$); however, the effect size was notably larger for this group than it was for the group with scores less than 10 (Table 15). Finally, it was decided to analyze the difference in loneliness scores for individuals who scored 17 or greater on the scale. This number was chosen because there are 7 questions on the subscale, so a score of 17 is on average of 1 point higher on each question than the clinical cut-off of 10; additionally, a score of 17 is approximately 2 standard deviations above the mean. The subpopulation of participants ($n = 9$) who scored 17 or greater on the scale had a large decrease in loneliness that was trending toward statistical significance and had a large effect size ($d = 0.897$).

Summary. Individuals who have the highest levels of social inhibition at baseline, are experiencing the greatest decreases in reported loneliness from baseline to program completion. Although this group is small, it may have meaningful clinical implications.

Discussion

The purpose of the study was to explore the relationships between social support, loneliness, and the health outcomes of cardiac rehabilitation patients. Specifically, this study was interested in examining the ability of self-reported levels of social support and loneliness to predict the change in days spent exercising, positive affect, negative affect, depression, and anxiety from baseline to follow-up at the end of the cardiac rehabilitation program. Also, in an attempt to better understand this relationship, two separate models were tested to determine whether it was more useful to consider the main effects of support and loneliness on health or to consider these variables as moderates. Finally, the change in loneliness was assessed from baseline to follow-up in order to test the hypothesis that loneliness scores would decrease with the completion of the program.

Model of Best Fit

Although there was not a hypothesis about which model would be a better fit, one of the aims of the study was to compare a direct effects model to a moderation model. The moderation models, in which perceived social support and loneliness moderated the relationship between perceived stress and the selected health outcomes, were a better fit for predicting the changes in days spent exercising, positive affect, and negative affect. However, the direct effects models, where the main effects of perceived social support and loneliness predicted the outcome variables, were a better fit for predicting the changes in depression and anxiety.

The most interesting aspect of this finding is that changes in depression and anxiety, which are commonly understood to be highly related to negative and positive affect, are best accounted for by a model that is different from the model that best

accounts for changes in positive and negative affect. One way to bring meaning to this difference is to consider positive and negative affect as emotional states that are transient (e.g., current mood states) and influenced by situational factors, while depression and anxiety are more trait-like and have a pervasive presence, especially when they are considered clinical (Naragon-Gainey, Gallagher, & Brown, 2013). This difference could help explain how separate models best predict the emotional factors. The moderation models examine the effects of perceived stress on the selected variables with perceived social support and loneliness as moderators. As the data suggests, it might be the case that affective states are more readily influenced by stressors (e.g., situational factors) than depression and anxiety. Depression and anxiety could be more enduring and less likely to be impacted by passing stressors but more directly influenced by a more stable sense of support or loneliness. The implication is that perceived stress will play a larger role in predicting changes in positive and negative affect, and perceived social support and loneliness may, consequently, take on a role as the moderator in this relationship. However, when predicting depression and anxiety, perceived stress is less important than the direct effects of either perceived social support or loneliness.

Direct Effect Models

The direct effects model, as discussed, were the best models for explaining the change in anxiety and depression from baseline to follow-up at 12 weeks. One model supported hypothesis 1a, and this model demonstrated that perceived social support significantly predicted the change in depression. Specifically, as perceived social support increased, there were larger decreases in depression scores. Hypothesis 1b was also only supported by one of the models. In this case, loneliness scores significantly predicted the

change in anxiety. As loneliness scores increased, there were greater increases in anxiety from baseline to follow-up. The direct effects models did not significantly predict change in any of the other criterion variables; however, there was a trend toward loneliness significantly predicting changes in positive affect. This effect could not be interpreted unambiguously because the moderation model involving changes in positive affect was significant, so the main effect of loneliness on changes in positive affect is recognized but not interpreted. Hypothesis 1c was not supported by the data because results did not indicate that loneliness accounted for more variance in the regression models than perceived social support. This suggests that unlike previous studies that have demonstrated that negative social experiences have a relatively greater effect on well-being than positive social interactions (Rook, 1984), perceived social support and loneliness may have distinct but equally strong effects.

The post hoc-analysis revealed that in the model where social support significantly predicted the change in depression scores, it is the emotional support construct that is accounting for the majority of the variance. This indicates that emotional support from social networks may be more important than forms of instrumental support when attempting to decrease depression. This is consistent with findings from an older study that found that emotional support was associated with fewer depressive symptoms for cardiac disease patients, and this same study found that instrumental support was actually associated with more depressive symptoms (Penninx et al., 1998). The authors hypothesized that instrumental support decreases the patient's sense of self-efficacy and, consequently, increases depression, but the right kind of emotional support can help the patient feel better and assured about the situation. The clinical implication is that

emotional support groups could have a large impact on decreasing depression, and emotional support should be targeted over instrumental support. This may be good news for cardiac rehabilitation centers because it is likely easier to provide emotional support via groups than to provide instrumental support which includes activities such as helping an individual with chores or cooking meals for an individual. Although it would not be impossible to increase instrumental support, it likely poses a larger challenge than increasing emotional support.

Moderation Models

In the moderation models, the interactions between perceived stress and social support and between perceived stress and loneliness were the predictor variables of greatest interest. The moderation models were the best models for explaining the changes in days spent exercising, positive affect, and negative affect from baseline to follow-up at 12 weeks. Hypothesis 2a was supported by one regression model in which the interaction between support and perceived stress significantly predicted the change in negative affect. The results were in the expected direction such that when support was high, there was a greater decrease in negative affect when perceived stress was also high compared to when it was low. In contrast, when support was low, there were greater increases in negative affect when stress was high compared to when it was low.

This finding suggests that when stress is low, the amount of support individuals believe they are receiving has a small impact on change in negative affect overtime. However, for individuals who are experiencing a large amount of stress the support matters because the data indicates that when these individuals believed they were receiving high levels of support, their negative affect scores decreased overtime. In

contrast, those who reported that they received low levels of support showed an increase in negative affect when perceived stress was high. One possible explanation for this finding is that when an individual's perceived stress is low, there is less need for others' help and support, so there will be little change in negative affect even for those who report low support. This is because a low stress state lends itself to less fluctuation in affect. However, when stress is high, the individual may be more likely to reach out for help from others. If the individual perceives that the desired amount and type of support is available, they are likely to experience a decrease in negative affect. If, however, low levels of support are perceived, there may be an increase in negative affect over time because the individual is not receiving the necessary support, especially if the stress persists.

Hypothesis 2b was also partially supported through three separate models. Namely, the interaction between loneliness and perceived stress significantly predicted the change in days spent exercising, positive affect, and negative affect. In the model that predicted the change in days spent exercising, for those who reported high levels of loneliness, there was an increase in days exercising per week when perceived stress was low, and when stress was high there was a decrease in days exercised per week. However, for those who reported low levels of loneliness, there was a decrease in days spent exercising per week when stress was low and there was a slight increase when stress was high. Although significant, this interaction was not in the expected direction.

The pattern of this interaction is, in part, difficult to explain. It suggests that when stress is low, it is advantageous to have high levels of loneliness, and low levels of loneliness result in a decrease in days exercised. This finding is at odds with the idea that

loneliness has a negative influence on health behaviors (Segrin & Passalacqua, 2010). Because the measure used tapped perceived isolation, it can be assumed that individuals do notice that they are isolated. However, it cannot be said with certainty that all of these individuals actually feel lonely. That is, someone who responds “Often” to the question “How often do you feel that you lack companionship?” may be acknowledging that they lack companionship, but this does not necessarily mean that the individual feels that this is a negative state or that it makes the individual feel lonely, especially when the individual is not perceiving high levels of stress. The finding that days spent exercising only decreases overtime for lonely individuals when stress is high could be interpreted to mean that lonely individuals are not at risk for engaging in adverse health behaviors (e.g., not exercising) unless they are experiencing high levels of stress. Some literature supports this pattern with findings that those who are lonely are more likely to engage in adverse health behaviors when stressed (Lauder, Mummery, Jones, & Caperchione, 2006; Steptoe et al., 1996).

In contrast, those who report low levels of loneliness show the opposite pattern. In this case, one possible explanation for the pattern is that stress is serving as a motivating factor such that feeling stressed and not experiencing loneliness can beget motivation to make a positive change. Anecdotally, some participants at New Heart who reported feeling stressed by both their heart events and other life stressors were also the individuals who were extremely motivated to make positive health changes. Although it has not been thoroughly explored by researchers, Taylor et al. (2000) proposed the “tend-and-befriend” theoretical response to stress as an alternative to the “flight-or-flight” response. This alternative suggests that some individuals may respond to stress in a

positive way that involves tending to the situation in a constructive way that will increase health and decrease distress in addition to putting resources toward creating and/or maintaining social relationships. Perhaps this positive response to stress is easier for those who are less lonely to begin with, and the stressor itself serves as a motivator make a change.

Surprisingly, the interaction between perceived stress and loneliness predicting the change in positive affect showed a trend toward significance, but had an unexpected pattern. Where it was expected that there would be a greater decrease in positive affect for those with high levels of perceived stress and high levels of loneliness, the data indicated the opposite. There were increases in positive affect over time for those who reported high perceived stress and high levels of loneliness. Also, as perceived stress increased for those who reported low levels of loneliness, positive affect decreased. This undermines the explanations suggested for the pattern found when this interaction was predicting change in day exercised. It is possible that the effect of perceived stress moderated by loneliness could look different for health behavior outcomes than for affective outcomes. However, literature does not support the nature of this interaction, and the interaction takes a different pattern when predicting negative affect. This finding speaks to the complexity of social isolation, and it magnifies the importance of not assuming that loneliness always leads to worse outcomes and negative affective states. This relationship requires more attention in future research studies.

When negative affect was set as the criterion variable, for those who reported high levels of support, there was an increase in negative affect when stress was low, and there were larger decreases in negative affect as stress increased. However, for those who

reported low levels of support, the opposite pattern emerged. The latter part of the pattern was expected, but the former aspect, where high levels of perceived stress moderated by high support predicts decreases in negative affect, was not expected. Again, this pattern could be explained by a theory such as the tend-and-befriend response to stress where there is a positive reaction to high levels of perceived stress (Taylor et al., 2000).

Individuals who are experiencing high levels of stress may be better utilizing their social support resources, and this could, in turn, decrease negative affect.

There was also a trend toward a significant interaction between perceived stress and loneliness predicting change in negative affect. When stress was high, there was very little change in negative affect for both those who reported high and low levels of loneliness. When low levels of perceived stress were reported, there were decreases in negative affect for those who reported low levels of loneliness and increases in negative affect for those who reported high levels of loneliness. This was surprising because it was expected that there would be less change in negative affect when stress was low and greater changes, at least for those with high levels of loneliness, when stress was high. The finding can partially be explained by the “tend-and-befriend” theoretical response to stress because as stress increased for those with high levels of loneliness, there were smaller increases in negative affect. However, for those with low levels of loneliness, there were smaller decreases in negative affect as stress increased, which contradicts the tend-and-befriend hypothesis. Instead, this finding gains support from the more available explanations that negative affect is negatively impacted by increasing levels of stress. Because it is not parsimonious to have two separate explanations for changes in negative

affect for those who have high versus low levels of support, it is important for future research to explore this relationship more thoroughly.

Relationship between Social Support and Loneliness

Although it is not a primary aim of this paper, the relationship between loneliness and perceived social support is of interest. As discussed in the introduction, researchers such as Rook (1984) and Smith and Zautra (2008) have explored the idea that positive and negative social interactions are not merely opposites of the other and have unique relationships with other variables. This is supported by data in the present study via two findings. The correlation between perceived social support and loneliness is significantly inversely related, but not strong ($r = -0.38$), which indicates that one is not the simple inverse of the other. Additionally, there was a significant interaction between perceived social support and loneliness when predicting change in negative affect. Although it is difficult to interpret this finding, it does indicate that there is not a simple inverse relationship between loneliness and perceived social support.

Changes in Loneliness During Cardiac Rehabilitation

When all of the participants were examined together, there was not a significant decrease in loneliness from the start to the end of the cardiac rehabilitation program. However, post hoc analysis revealed a clear trend that when individuals entered the program with higher levels of social inhibition, there were greater decreases in loneliness from the start to the end of the program. For individual who entered the program with the highest levels of social inhibition (i.e., individual who scored 17 or greater on the social inhibition subscale), there was a trend toward a significant decrease with a large effect size. It is possible that regression to the mean is responsible for this finding in the more

extreme subpopulation of the group, but it is also possible that cardiac rehabilitation is providing this particularly isolated group with an opportunity to feel included and find companionship. The majority of the cardiac rehabilitation population who enter the program with low levels of social inhibition may find support and more companionship, but it should not be expected that their reported levels of loneliness will decrease because they entered with lower levels of loneliness to begin with. This finding suggests that social support groups or programs that emphasize client-to-client contact or support, though potentially helpful for all rehabilitation clients, is probably most important for those who are socially inhibited and who wouldn't easily seek companionship on their own.

Overall Clinical Implications

The clinical implications of this study are presented with the caution that there is a great need for future research to be conducted in order to further elucidate these complicated relationships. However, one possible implication is that clinicians should really consider the differences between positive/negative affect and clinical mood states such as depression and anxiety. The latter seems to be better accounted for by a direct effects model than by the moderation model that included perceived stress. These findings indicate that clinicians should be aware of what they are attempting to impact because it appears that there are different patterns of prediction for the selected dependent variables. Social support and isolation factors should be a more prominent focus for an intervention for those with anxiety and depression; however, addressing perceived stress in conjunction with support factors will likely be necessary as a general intervention for increasing days spent exercising and positive affect and decreasing negative affect.

The results also indicate that it is important for clinicians to consider that there are likely various responses to stress. One response pattern that emerged from the data possibly reflected a “tend-and-befriend” pattern that reflects a more positive response to stress that involves actively seeking ways to improve the situation and to reach out to others for support. This kind of reaction to stress could result in positive results (e.g., an increase in days exercised or a decrease in negative affect). This improvement would be seen as perceived stress increases, which is not an intuitive reaction to stress. In general, most empirical literature reflects the harmful effects of stress without addressing how stress could result in more positive outcomes for certain individuals (Keller et al., 2012; Kobasa, 1982). For example, a stress hardy individual may respond to a stressor in a positive way that allows him or her to rise to a challenge and commit to making a positive change. A major clinical implication is not that we should allow or encourage clients to experience or seek stress, but that clinicians should frame interventions around how to respond more positively to stress by developing appropriate responses and coping mechanisms. Additionally, incorporating a social support component to interventions in order to help clients acquire skills for reaching out to others for support and where to look for support could help individuals respond more positively to perceived stress. Clinicians should also be aware that the response patterns to stress may look different for lonely versus non-lonely individuals, and the response pattern could also vary depending on what the criterion variable of interest is. That is, the pattern could look different for health behaviors (e.g., exercising, smoking) than it does for affect.

Clinicians should differentiate between loneliness and social support. The results from this study clearly indicate that support and loneliness are not direct inverses.

Individuals can report that they feel both lonely and supported at the same moment, indicating that these are two different constructs that have different implications. Therefore, it is important consider both of the factors when working with cardiac rehabilitation population. Also, clinicians should be aware that different components of social support can have different effects on individuals. Emotional support may be more important than instrumental support for decreasing depressive symptoms, but this may not be true for other emotional or behavioral factors.

Finally, clinicians who work in cardiac rehabilitation centers should provide an initial screener in order to target those who are most socially inhibited. This screener could be the Type D personality questionnaire (Denolett, 2012). These are the individuals who may benefit most from an intervention that focuses on decreasing loneliness and increasing perceived support. This could, in turn, have a positive impact on other emotional or behavioral factors. Additionally, these are the individuals who are already at a higher risk for CVD (Denolett, 2012), so providing extra support for these clients should always be a priority.

Limitations

One major limitation to this study was that data regarding perceived social support was only collected at baseline and not a follow up. One of the questions of interest in this study was whether or not completing the cardiac rehabilitation program decreased loneliness, and it was determined that loneliness and perceived social support are not opposite constructs. Therefore, it is important to determine if completing the program could increase perceived social support. However, in order to shorten the length of the follow up survey, the social support portion of the questionnaire was excluded.

Sample size was also a limitation of the present study. Although the sample size was fairly large for the baseline analysis, there was a large amount of attrition from baseline to follow-up. Approximately half of the original sample took the questionnaire after completing the program, and this impacted the results. It is also difficult to say whether or not there was a selection bias due to the attrition from baseline to follow-up. In order to assess this, analyses would have to be run to determine if there was a certain “type” of person that tended to drop out of the program or to decline taking the follow-up survey. There is also a possibility some of the results obtained are skewed by an initial selection bias from the start of the program. Everyone who went through cardiac rehabilitation orientation program was given the option to participate in this study; however, not everyone elected to do so. The total number of rehabilitation patients who chose not to participate is unknown, but it is possible that those who did not participate had particular characteristics that are relevant to the study and could have altered the results. For instance, individuals who were more socially inhibited may have been less inclined to participate.

Finally, it is possible that the results of the paired-sample t-test could be explained by regression toward the mean. This suggests that the significant decrease in loneliness from baseline to follow-up for individuals with the highest social inhibition scores at baseline is actually just attributable to a common phenomenon in psychology in which those with the most extreme scores during a first measurement will have scores that are closer to the mean on the second measurement. If this phenomenon is responsible for this finding, the decrease in loneliness for those with the highest level of social inhibition at baseline is not attributable to the effects of the cardiac rehabilitation program.

Future Directions

Future studies should be aimed at clarifying the important differences between social support and loneliness and how each may have distinctly separate effects on emotional and behavioral variables. The results from this study also suggest that it would be important to examine the stability of the factors of interest over time. For example, it was suggested in the discussion that depression and anxiety are possibly more stable emotional factors overtime than positive and negative affect. This needs to be explored empirically, and researchers also need to investigate whether perceived stress is more transient than perceived support or isolation. Finally, researchers should further investigate the relationship between these stable and transient variables. It is hypothesized, based on this data, that future studies will find that more stable predictor variables will have a greater influence on the more stable outcome variables.

Future studies should also focus on determining how the separate components of social support (i.e., emotional, instrumental, affiliative) impact different outcome variables of interest. Researchers should also work to clarify how the source (e.g., from a family member or a doctor) of support or loneliness can influence how it impacts an individual with CVD. Finally, interventionist research should be implemented to test of the effects of different interventions in place in cardiac rehabilitation centers that are targeting different outcome variables in order to determine which ones appear to be most effective. Also, determining whether different interventions should be utilized for cardiac rehabilitation patients who are more socially inhibited at the start of the program should be a priority.

Conclusions

There is still a lot to be learned about the nature of support and loneliness and how it impacts important outcome factors for CVD patients. Moving forward with the knowledge that not all support is necessarily good and loneliness is not necessarily bad, research will need to focus on how loneliness and support factors interact with perceived stress to impact health and recovery. This study highlights that there does not appear to be a straightforward, consistent relationship between the variables included in this design, and some of the patterns of the results are not intuitive. However, this study does provide a nice foundation for future research to make more progress in understanding the complexity of social support and loneliness and how they impact health in cardiac rehabilitation settings.

Table 1 Demographic Information at Baseline and Follow-Up.

	Baseline			Follow-up		
	Mean	SD	Frequency (%)*	Mean	SD	Frequency (%)*
Demographic Characteristics						
Age	64.16	10.76	-	65.81	9.78	-
Years Education	14.45	3.18	-	14.93	3.20	-
Gender:						
1) Male	-	-	179 (68.8)	-	-	88 (73.9)
2) Female	-	-	69 (26.5)	-	-	30 (25.2)
3) Missing data	-	-	12 (4.6)	-	-	1 (0.8)
Ethnicity:						
1) Hispanic	-	-	49 (18.8)	-	-	24 (20.2)
2) White, non- Hispanic	-	-	176 (67.7)	-	-	82 (68.9)
3) Black, non- Hispanic	-	-	1 (0.4)	-	-	1 (0.8)
4) American Indian/Alaskan Native	-	-	5 (1.9)	-	-	4 (3.4)
5) Asian/Pacific Islander	-	-	1 (0.4)	-	-	0 (0)
6) Other/mixed	-	-	2 (0.8)	-	-	1 (0.8)
7) Unsure/missing	-	-	26 (10.0)	-	-	7 (5.9)

Income (US\$)

1) Under \$5,000	-	-	2 (0.8)	-	-	1 (0.8)
2) \$5,000-9,999	-	-	4 (1.5)	-	-	2 (1.7)
3) \$10,000-19,999	-	-	17 (6.5)	-	-	9 (7.6)
4) \$20,000-29,999	-	-	26 (10.0)	-	-	8 (6.7)
5) \$30,000-39,999	-	-	21 (8.1)	-	-	12 (10.1)
6) \$40,000-49,999	-	-	20 (7.7)	-	-	8 (6.7)
7) \$50,000-59,999	-	-	16 (6.2)	-	-	7 (5.9)
8) \$60,000-69,999	-	-	17 (6.5)	-	-	11 (9.2)
9) \$70,000-79,999	-	-	16 (6.2)	-	-	4 (3.4)
10) \$80,000-89,000	-	-	12 (4.6)	-	-	5 (4.2)
11) \$90,000-99,999	-	-	11 (4.2)	-	-	7 (5.9)
12) Over \$100,000	-	-	32 (12.3)	-	-	18 (19.1)
13) I'd rather not say	-	-	4 (1.5)	-	-	1 (0.8)

Marital Status:

1) Married	-	-	185 (71.2)	-	-	87 (73.1)
2) Divorced	-	-	28 (10.8)	-	-	18 (15.1)
3) Separated	-	-	0 (0)	-	-	0 (0)
4) Widowed	-	-	18 (6.9)	-	-	8 (6.7)
5) Never married	-	-	13 (5.0)	-	-	5 (4.2)
6) Missing	-	-	16 (6.2)	-	-	1 (0.8)

Note. *() percent that corresponds with the frequency.

Table 2.

Correlation Analyses Among Dependent Variables, Independent Variables, and Demographic Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Perceived Social Support	-												
2. Perceived Social Isolation	-.38**	-											
3. Perceived Stress	-.14*	.38**	-										
4. Exercise Frequency‡	-.11	-.01	-.05	-									
5. Positive Affect‡	-.07	-.13	.02	.08	-								
6. Negative Affect‡	-.18†	.15	.10	.07	-.22*	-							
7. Depression‡	-.21*	.09	.05	-.06	-.50**	.53**	-						
8. Anxiety‡	-.13	.21*	.08	.04	-.26**	.51**	.58**	-					
9. Social Inhibition	-.27**	.39**	.18**	-.02	-.17†	.11	.22*	.21*	-				
10. Age	-.06	-.10	-.12†	.11	-.13	-.08	.04	-.03	-.13*	-			
11. Gender	-.01	.11†	.25**	.05	-.01	.04	.06	.18†	-.13*	.15*	-		
12. Years Education	.18*	-.04	-.22**	-.00	.02	-.17	-.16	-.10	-.00	-.12†	-.16*	-	
13. Income	.14†	-.15*	-.17*	-.10	.27*	-.19†	-.21†	.02	.01	-.35**	-.23**	.40**	-

Note. † $p < .10$, * $p < .05$, ** $p < .01$. ‡ indicates that the variable has been transformed into a residualized change score.

Table 3.

Multiple Regression Analysis Predicting Change In Days Exercised per Week

Variable	B	Std. Error	β	t	P	R ²	F	p
P. Social Support	-0.170	0.142	-0.155	-1.199	.235	0.032	0.772	0.513
Loneliness	-0.022	0.106	-0.027	-0.208	.836			
Income	0.037	0.038	0.117	0.977	0.332			

Note: R², F, and p are statistics for the overall best fit of this model.

Table 4.

Multiple Regression Analysis Predicting Change Positive Affect

Variable	B	Std. Error	β	t	p	R ²	F	p
P. Social Support	-0.155	0.119	-0.150	-1.301	0.197	0.112	3.265	0.026
Loneliness	-0.192	0.102	-0.219	-1.892	0.062			
Income	0.077	0.035	0.240	2.20	0.031			

Note: R², F, and p are statistics for the overall best fit of this model.

Table 5.

Multiple Regression Analysis Predicting Change In Negative Affect

Variable	B	Std. Error	β	t	P	R ²	F	p
P. Social Support	-0.167	0.113	-0.175	-1.483	0.142	0.077	2.163	0.099
Loneliness	0.072	0.096	0.088	0.748	0.457			
Income	-0.038	0.033	-0.126	-1.138	0.259			

Note: R², F, and p are statistics for the overall best fit of this model.

Table 6.

Multiple Regression Analysis Predicting Change In Depression

Variable	B	Std. Error	β	t	p	R ²	F	p
P. Social Support	-0.237	0.113	-0.228	-2.103	0.038	0.104	3.279	.025
Loneliness	-0.028	0.081	-0.038	-0.340	0.735			
Income	-0.067	0.032	-0.223	-2.118	0.037			

Note: R², F, and p are statistics for the overall best fit of this model.

Table 7.

Multiple Regression Analysis Predicting Change In Anxiety

Variable	B	Std. Error	β	t	p	R ²	F	p
P. Social Support	-0.107	0.110	-0.107	-0.973	0.333	0.105	2.422	0.055
Loneliness	0.170	0.079	0.241	2.153	0.034			
Income	0.046	0.032	0.158	1.155	0.149			
Gender	0.325	0.234	0.148	1.391	0.168			

Note: R², F, and p are statistics for the overall best fit of this model.

Table 8.

Post hoc: Multiple Regression Analysis Predicting Change In Depression

Variable	B	Std. Error	β	t	p	R ²	F	p
P. Instrumental Supp.	0.057	0.116	0.064	0.495	0.622	0.121	2.291	0.027
P. Emotional Supp.	-0.274	0.121	-0.298	-2.270	0.026			
Loneliness	-0.032	0.081	-0.043	-0.389	0.698			
Income	-0.068	0.032	-0.225	-2.151	0.034			

Note: R², F, and p are statistics for the overall best fit of this model.

Table 9.

Multiple Regression Analysis Predicting Change In Days Exercised per Week in the Moderation Model

Variable	B	Std. Error	β	t	p	R ²	F	p
P. Social Support	-0.101	0.156	-0.093	-0.651	0.517	0.091	1.124	0.358
Loneliness	0.076	0.118	0.093	0.641	0.524			
P. Stress	-0.215	0.229	-0.118	-0.940	0.351			
P. Social Support x P. Stress	-0.256	0.323	-0.115	-0.791	0.431			
Loneliness x P. Stress	-0.366	0.192	-0.255	-1.909	0.061			
Income	0.031	0.038	0.097	.806	0.426			

Note: R², F, and p are statistics for the overall best fit of this model

Figure 1. Stress x Loneliness Interaction Predicting Changes in Days Exercising

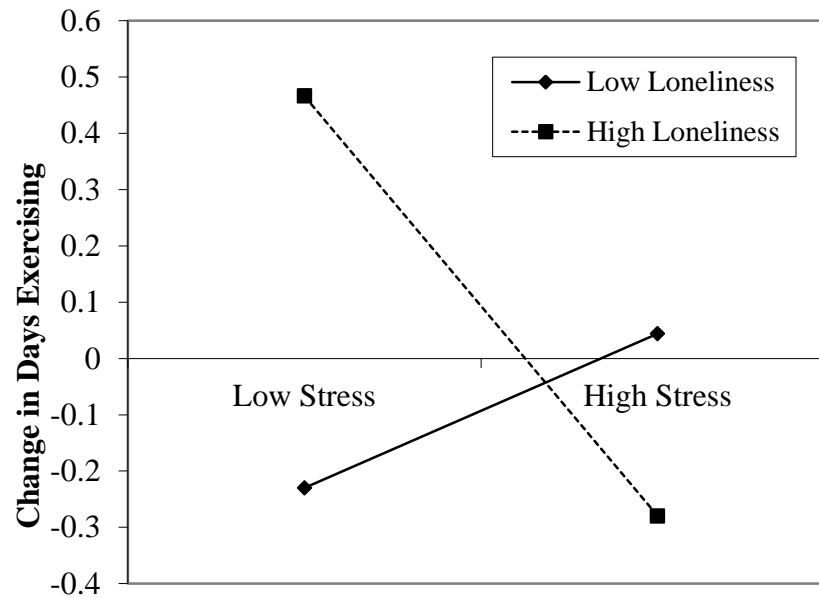


Table 10.

Multiple Regression Analysis Predicting Change In Positive Affect in the Moderation Model

Variable	B	Std. Error	β	t	p	R ²	F	p
P. Social Support	-0.240	0.130	-0.238	-1.840	0.072	0.273	2.391	0.028
Loneliness	-0.066	0.137	0.067	-0.483	0.631			
P. Stress	0.039	0.246	0.021	0.160	0.873			
P. Social Support x P. Stress	-0.169	0.243	-0.098	-0.696	0.489			
Loneliness x P. Stress	0.427	0.230	0.239	1.855	0.069			
Income	0.146	0.052	0.431	2.786	0.007			
Gender	0.690	0.334	0.271	2.064	0.044			
Years Education	-0.092	0.059	-0.240	-1.555	0.126			

Note: R², F, and p are statistics for the overall best fit of this model

Figure 2. Stress x Loneliness Interaction Predicting Changes in Positive Affect

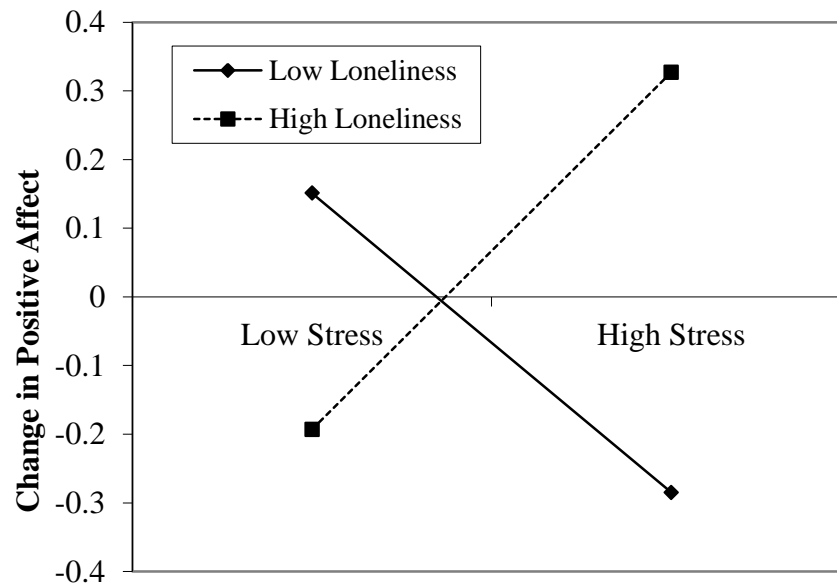


Table 11.

Multiple Regression Analysis Predicting Change In Negative Affect in the Moderation Model

Variable	B	Std. Error	β	t	p	R ²	F	p
P. Social Support	-0.178	0.113	-0.186	-1.579	.0119	0.173	2.181	0.046
Loneliness	0.183	0.108	0.218	1.700	0.093			
P. Stress	-0.142	0.197	-0.085	-0.821	0.473			
P. Social Support x P. Stress	-0.546	0.206	-0.320	-2.656	0.010			
Loneliness x P. Stress	-0.304	0.177	-0.206	-1.716	0.090			
P. Social Support x Loneliness	0.212	0.105	0.240	2.025	0.047			
Income	-0.038	0.033	-0.127	-1.160	0.250			

Note: R², F, and p are statistics for the overall best fit of this model

Figure 3. Stress x Support Interaction Predicting Changes in Negative Affect

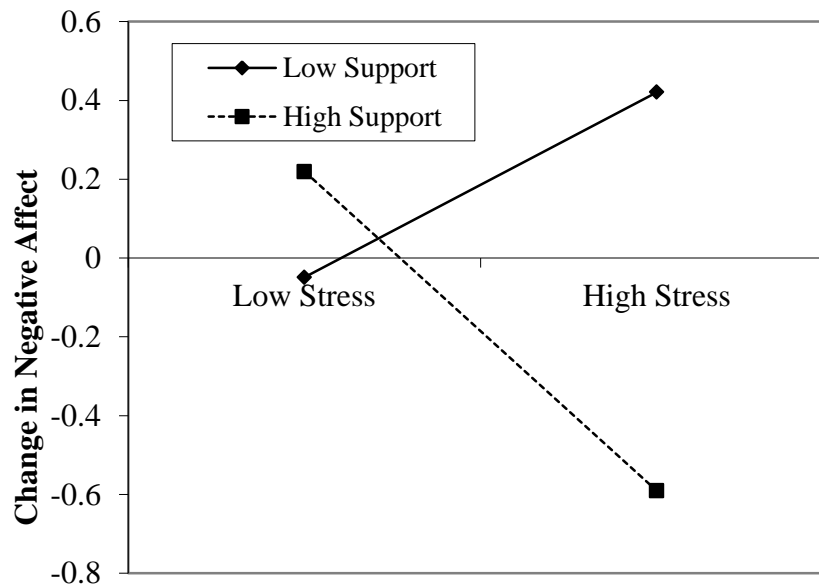


Figure 4. Interaction Predicting Changes in Negative Affect

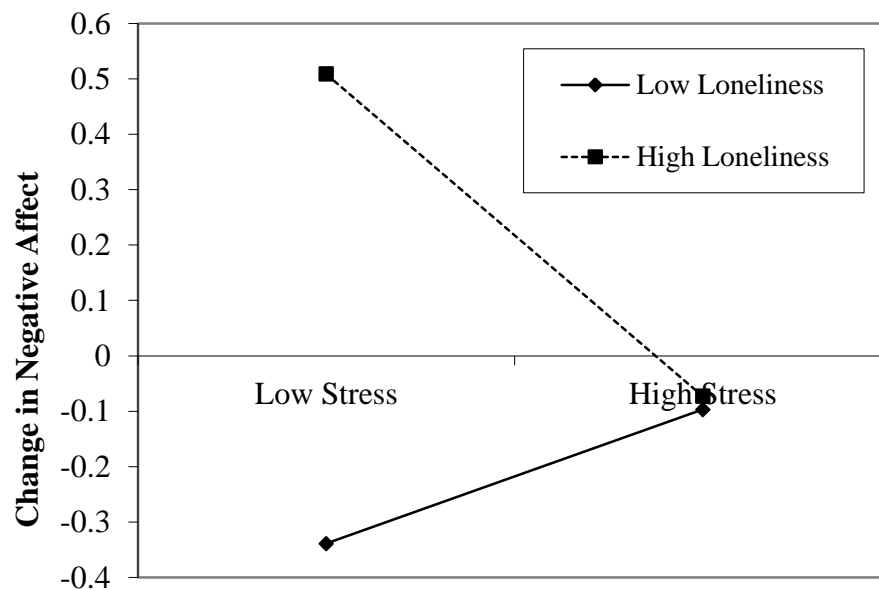


Figure 5. Interaction Predicting Changes in Negative Affect

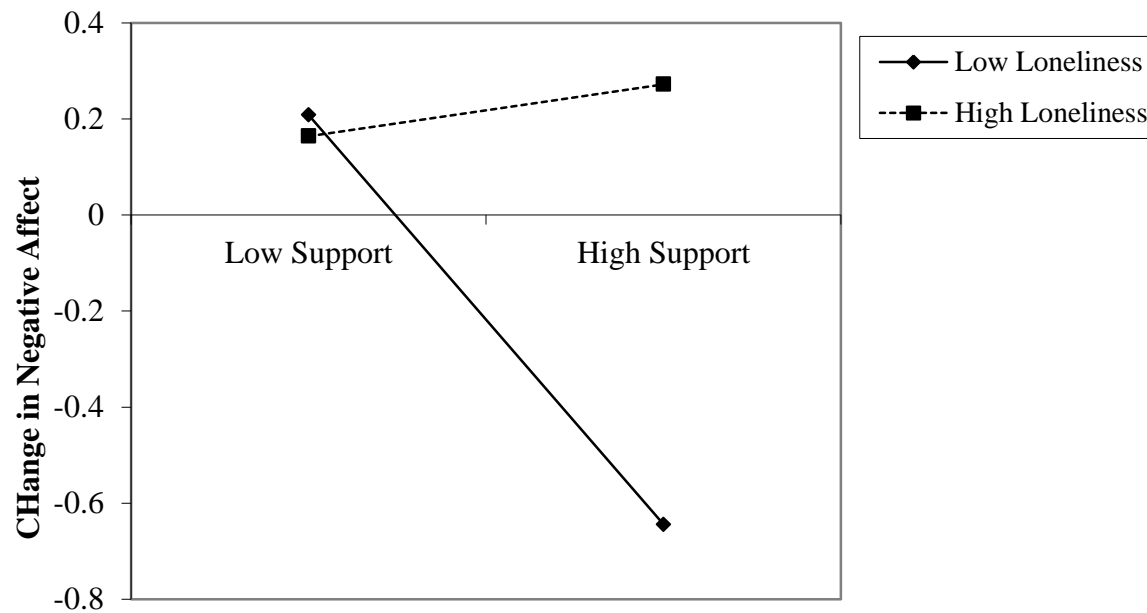


Table 12.

Multiple Regression Analysis Predicting Change In Depression in the Moderation Model

Variable	B	Std. Error	β	t	p	R ²	F	p
P. Social Support	-0.177	0.122	-0.174	-1.451	0.151	0.106	1.342	0.242
Loneliness	0.022	0.101	0.029	0.214	0.831			
P. Stress	0.000	0.192	0.000	-0.002	0.998			
P. Social Support x P. Stress	-0.122	0.214	-0.066	-0.569	0.571			
Loneliness x P. Stress	-0.162	0.147	-0.137	-1.103	0.273			
Income	-0.062	0.034	-0.205	-1.840	0.070			
Gender	-0.110	0.252	-0.048	-0.435	0.664			

Note: R², F, and p are statistics for the overall best fit of this model

Table 13.

Multiple Regression Analysis Predicting Change In Anxiety in the Moderation Model

Variable	B	Std. Error	β	t	p	R ²	F	p
P. Social Support	-0.067	0.119	-0.068	-0.562	0.576	0.098	1.222	0.301
Loneliness	0.171	0.098	0.239	1.737	0.086			
P. Stress	0.091	0.186	0.057	0.490	0.625			
P. Social Support x P. Stress	-0.017	0.208	-0.009	-0.080	0.936			
Loneliness x P. Stress	-0.108	0.143	-0.094	-0.753	0.454			
Income	0.053	0.033	0.181	1.616	0.110			
Gender	0.286	0.245	0.130	1.167	0.247			

Note: R², F, and p are statistics for the overall best fit of this model

Table 14.

Paired-Sample t-test of Loneliness from Baseline to Program Completion

Variable	Mean	SD	N	t	p	Cohen's d
Loneliness Baseline	2.052	1.250	115	1.287	0.201	0.119
Loneliness 12 Weeks	1.913	1.083				

Table 15.

Post hoc: Paired-Sample t-test of Loneliness from Baseline to Program Completion for Individuals with Low Levels of Social Inhibition

Variable	Mean	SD	N	t	p	Cohen's d
Loneliness Baseline	1.855	1.154	78	0.293	0.770	0.031
Loneliness 12 Weeks	1.821	1.022				

Table 16.

Post hoc: Paired-Sample t-test of Loneliness from Baseline to Program Completion for Individuals with High Levels of Social Inhibition

Variable	Mean	SD	N	t	p	Cohen's d
Loneliness Baseline	2.398	1.304	36	1.507	0.141	0.286
Loneliness 12 Weeks	2.046	1.150				

Table 17.

Post hoc: Paired-Sample t-test of Loneliness from Baseline to Program Completion for Individuals with The Highest Levels of Social Inhibition in this Population

Variable	Mean	SD	N	t	p	Cohen's d
Loneliness Baseline	3.074	1.690	9	2.006	0.080	0.897
Loneliness 12 Weeks	1.926	0.641				

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Appendix A: Assessments

Demographic Questionnaire

1. Age _____
2. Sex: Male Female
3. Years of Education (including grades 1-12) _____
4. Education: Diplomas, Certifications, and Degrees
- | | | |
|--|---|--------------|
| <input type="radio"/> High School Diploma | <input type="radio"/> Bachelor's Degree | Other: _____ |
| <input type="radio"/> Technical/Vocational Certificate | <input type="radio"/> Master's Degree | |
| <input type="radio"/> Associate Degree | <input type="radio"/> Doctorate Degree | |
5. What is your annual household income?
- | | | |
|---------------------------------------|---------------------------------------|---------------------------------------|
| <input type="radio"/> Under \$5,000 | <input type="radio"/> \$30,000-39,999 | <input type="radio"/> \$70,000-79,999 |
| <input type="radio"/> \$5,000-9,999 | <input type="radio"/> \$40,000-49,999 | <input type="radio"/> \$80,000-89,999 |
| <input type="radio"/> \$10,000-19,999 | <input type="radio"/> \$50,000-59,999 | <input type="radio"/> \$90,000-99,999 |
| <input type="radio"/> \$20,000-29,999 | <input type="radio"/> \$60,000-69,999 | <input type="radio"/> Over \$100,000 |
- I'd rather not say.
6. What ethnic and racial groups do you identify with?
- | | |
|--|--|
| <input type="radio"/> Hispanic | <input type="radio"/> Asian or Pacific Islander |
| <input type="radio"/> White, not of Hispanic Origin | <input type="radio"/> Don't know/Not sure |
| <input type="radio"/> Black, not of Hispanic Origin | <input type="radio"/> Other or Mixed, please specify _____ |
| <input type="radio"/> American Indian or Alaska Native | |
7. Marital Status:
- Married Divorced Separated Widowed Never married
8. What proportion of your medical expenses does health insurance or Medicare/Medicaid cover?
- None Some About half Most All

Days Per Week Exercising Item

During the **past 2 weeks**, on average, how many **days per week** have you exercised **at least 30 minutes?** (check one circle).

- 0 1 2 3 4 5 6 7

Perceived Social Support Measure

Social Support : People sometimes look to others for companionship, assistance, or other types of support. How often is each of the following kinds of support available to you if you need it?

Circle one number for each statement.

1 = None of the time 2 = A little of the time 3 = Some of the time
 4 = Most of the time 5 = All of the time

- | | | | | | |
|--|---|---|---|---|---|
| 1. Someone to confide in or talk to about yourself or your problems.. | 1 | 2 | 3 | 4 | 5 |
| 2. Someone to prepare your meals if you were unable to do it yourself..... | 1 | 2 | 3 | 4 | 5 |
| 3. Someone to help with daily chores if you were sick... | 1 | 2 | 3 | 4 | 5 |
| 4. Someone to share your most private worries and fears with..... | 1 | 2 | 3 | 4 | 5 |
| 5. Someone to turn to for suggestions about how to deal with a personal problem..... | 1 | 2 | 3 | 4 | 5 |
| 6. Someone who understands your problems..... | 1 | 2 | 3 | 4 | 5 |
| 7. Someone to have a good time with..... | 1 | 2 | 3 | 4 | 5 |

Loneliness Measure

Social Relationships: Circle the number that best fits for each question.

- | | | | | | | | |
|---|---|-------------|-----------|-------|---|---|---|
| | | Hardly Ever | Sometimes | Often | | | |
| 1. How often do you feel that you lack companionship? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. How often do you feel left out? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. How often do you feel isolated from others? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Perceived Stress Measure

The questions in this scale ask about your feelings/thoughts during **the past 30 days**.

Check a circle for each to indicate **how often** you felt/thought a certain way for each question.

	Never	Almost never	Sometimes	Fairly often	Very often
1. How often were you upset because of something that happened unexpectedly?	<input type="radio"/> (0)	<input type="radio"/> (1)	<input type="radio"/> (2)	<input type="radio"/> (3)	<input type="radio"/> (4)
2. How often did you feel that you were unable to control the important things in life?	<input type="radio"/> (0)	<input type="radio"/> (1)	<input type="radio"/> (2)	<input type="radio"/> (3)	<input type="radio"/> (4)
3. How often did you feel nervous or “stressed”?	<input type="radio"/> (0)	<input type="radio"/> (1)	<input type="radio"/> (2)	<input type="radio"/> (3)	<input type="radio"/> (4)
4. How often did you feel confident about your ability to handle personal problems?	<input type="radio"/> (4)	<input type="radio"/> (3)	<input type="radio"/> (2)	<input type="radio"/> (1)	<input type="radio"/> (0)
5. How often did you feel that things were going your way?	<input type="radio"/> (4)	<input type="radio"/> (3)	<input type="radio"/> (2)	<input type="radio"/> (1)	<input type="radio"/> (0)
6. How often did you find that you could not cope with all the things that you had to do?	<input type="radio"/> (0)	<input type="radio"/> (1)	<input type="radio"/> (2)	<input type="radio"/> (3)	<input type="radio"/> (4)
7. How often were you able to control irritations in your life?	<input type="radio"/> (4)	<input type="radio"/> (3)	<input type="radio"/> (2)	<input type="radio"/> (1)	<input type="radio"/> (0)
8. How often did you feel that you were on top of things?	<input type="radio"/> (4)	<input type="radio"/> (3)	<input type="radio"/> (2)	<input type="radio"/> (1)	<input type="radio"/> (0)
9. How often were you angered because of things that happened which were outside of your control?	<input type="radio"/> (0)	<input type="radio"/> (1)	<input type="radio"/> (2)	<input type="radio"/> (3)	<input type="radio"/> (4)
10. How often did you feel difficulties were piling so high that you could not overcome them?	<input type="radio"/> (0)	<input type="radio"/> (1)	<input type="radio"/> (2)	<input type="radio"/> (3)	<input type="radio"/> (4)

Positive and Negative Affect Measure

Instructions: This scale consists of words that describe different feelings and emotions. Read each item and then **write one number** (1, 2, 3, 4, 5 or 6) in each blank to indicate to what extent you have felt this way during **the past two weeks**.

0 = None 1 = A Little 2 = Slightly 3 = Some 4 = Moderately 5 = A Lot 6 = Extremely

_____	Happy	_____	Peppy
_____	Nervous	_____	Blue
_____	Lively	_____	Active
_____	Sleepy	_____	Tired
_____	Stimulated	_____	Cheerful
_____	Anxious	_____	Sad

Depression and Anxiety Measure

Outlook and Feelings: Place a check in the box that best fits for the **past 2 weeks**.

- | | |
|--|---|
| <p>1. I felt tense or wound up.</p> <p>(3) <input type="radio"/> Most of the time</p> <p>(2) <input type="radio"/> A lot of the time</p> <p>(1) <input type="radio"/> From time to time, occasionally</p> <p>(0) <input type="radio"/> Not at all</p> | <p>8. I felt as if I was slowed down.</p> <p>(3) <input type="radio"/> Nearly all the time</p> <p>(2) <input type="radio"/> Very often</p> <p>(1) <input type="radio"/> Sometimes</p> <p>(0) <input type="radio"/> Not at all</p> |
| <p>2. I enjoyed the things I used to enjoy.</p> <p>(0) <input type="radio"/> Definitely as much</p> <p>(1) <input type="radio"/> Not quite as much</p> <p>(2) <input type="radio"/> Only a little</p> <p>(3) <input type="radio"/> Hardly at all</p> | <p>9. I got a sort of frightened feeling like "butterflies" in the stomach.</p> <p>(0) <input type="radio"/> Not at all</p> <p>(1) <input type="radio"/> Occasionally</p> <p>(2) <input type="radio"/> Quite often</p> <p>(3) <input type="radio"/> Very often</p> |
| <p>3. I got a sort of frightened feeling as if something awful was about to happen.</p> <p>(3) <input type="radio"/> Very definitely and quite badly</p> <p>(2) <input type="radio"/> Yes, but not too badly</p> <p>(1) <input type="radio"/> A little, but it didn't worry me</p> <p>(0) <input type="radio"/> Not at all</p> | <p>10. I have lost interest in my appearance.</p> <p>(3) <input type="radio"/> Definitely</p> <p>(2) <input type="radio"/> I don't take so much care as I should</p> <p>(1) <input type="radio"/> I may not take quite as much care</p> <p>(0) <input type="radio"/> I take just as much care as ever</p> |
| <p>4. I could laugh and see the funny side of things.</p> <p>(0) <input type="radio"/> As much as I always could</p> <p>(1) <input type="radio"/> Not quite so much now</p> <p>(2) <input type="radio"/> Definitely not so much now</p> <p>(3) <input type="radio"/> Not at all</p> | <p>11. I felt restless as if I had to be on the move.</p> <p>(3) <input type="radio"/> Very much indeed</p> <p>(2) <input type="radio"/> Quite a lot</p> <p>(1) <input type="radio"/> Not very much</p> <p>(0) <input type="radio"/> Not at all</p> |
| <p>5. Worrying thoughts went through my mind.</p> <p>(3) <input type="radio"/> A great deal of the time</p> <p>(2) <input type="radio"/> A lot of the time</p> <p>(1) <input type="radio"/> From time to time but not too often.</p> <p>(0) <input type="radio"/> Only occasionally</p> | <p>12. I looked forward with enjoyment to things.</p> <p>(0) <input type="radio"/> As much as I ever did</p> <p>(1) <input type="radio"/> Rather less than I used to</p> <p>(2) <input type="radio"/> Definitely less than I used to</p> <p>(3) <input type="radio"/> Hardly at all</p> |
| <p>6. I felt cheerful.</p> <p>(3) <input type="radio"/> Not at all</p> <p>(2) <input type="radio"/> Not often</p> <p>(1) <input type="radio"/> Sometimes</p> <p>(0) <input type="radio"/> Most of the time</p> | <p>13. I got sudden feelings of panic.</p> <p>(3) <input type="radio"/> Very much indeed</p> <p>(2) <input type="radio"/> Quite a lot</p> <p>(1) <input type="radio"/> Not very much</p> <p>(0) <input type="radio"/> Not at all</p> |
| <p>7. I could sit at ease and feel relaxed.</p> <p>(0) <input type="radio"/> Definitely</p> <p>(1) <input type="radio"/> Usually</p> <p>(2) <input type="radio"/> Not often</p> <p>(3) <input type="radio"/> Not at all</p> | <p>14. I could enjoy a book/radio/TV program.</p> <p>(0) <input type="radio"/> Often</p> <p>(1) <input type="radio"/> Sometimes</p> <p>(2) <input type="radio"/> Not often</p> <p>(3) <input type="radio"/> Very seldom</p> |

Type D Personality Measure

General Characteristics – (continued)

Use the following scale and **circle** the number for each statement to indicate how False or True the statement is for you.

1 = False 2 = Rather false 3 = Neutral 4 = Rather true 5 = True

- | | | | | | |
|--|---|---|---|---|---|
| 1. I make contact with others easily..... | 1 | 2 | 3 | 4 | 5 |
| 2. I worry about unimportant things..... | 1 | 2 | 3 | 4 | 5 |
| 3. I often talk to strangers..... | 1 | 2 | 3 | 4 | 5 |
| 4. I often feel unhappy..... | 1 | 2 | 3 | 4 | 5 |
| 5. I am easily irritated..... | 1 | 2 | 3 | 4 | 5 |
| 6. I am inhibited in social interactions..... | 1 | 2 | 3 | 4 | 5 |
| 7. I take a gloomy view of things..... | 1 | 2 | 3 | 4 | 5 |
| 8. I have difficulties starting a conversation.... | 1 | 2 | 3 | 4 | 5 |
| 9. I am often in a bad mood. | 1 | 2 | 3 | 4 | 5 |
| 10. I am a closed kind of person..... | 1 | 2 | 3 | 4 | 5 |
| 11. I keep others at a distance..... | 1 | 2 | 3 | 4 | 5 |
| 12. I often worry about something..... | 1 | 2 | 3 | 4 | 5 |
| 13. I am often down in the dumps..... | 1 | 2 | 3 | 4 | 5 |
| 14. I don't find things to talk about..... | 1 | 2 | 3 | 4 | 5 |