Behaviors and Cognitions as Mediators of Psychosocial Variables and Re-hospitalizations in Patients with Heart Failure: A Structural Equation Modeling Approach

by

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Dissertation submitted to the Faculty of the
Medical and Clinical Psychology
Uniformed Services University of the Health Sciences
In partial fulfillment of the requirements for the degree of
Doctor of Philosophy in Clinical Psychology, 2017

APPROVAL OF THE DOCTORAL DISSERTATION IN THE DEPARTMENT OF MEDICAL AND CLINICAL PSYCHOLOGY

Title of Dissertation: "Behaviors and Cognitions as Mediators of Psychosocial Variables and Re-hospitalizations in Patients with Heart Failure: A Structural Equation Modeling Approach"

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Doctor of Philosophy Degree
June 15, 2016

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ACKNOWLEDGMENTS

DEDICATION

This project is dedicated to my friends and family. Those who endured the late hours, moments of frustration, and unreturned phone calls. My mentors, both Dr. Lindsey Buckman and Dr. Sarah Manchak, have left a lasting mark on both my personal and professional identity and have helped mold me into the scientist- practitioner that I am today. They were there to help pick me up when I was down and one day I hope to repay the favor. My mom has always been my rock, and made sacrifices that I cannot even begin to fathom in order to help make my dream a reality. My dad has always been there, never faltering to support me and pushing me to ensure that I didn't settle for anything, that I always reached my greatest potential. And finally this is dedicated to my wife, a woman who fully supported my decision to uproot our lives in sunny Huntington Beach to move across country to Maryland and commission into the United States Air Force for the next 12 years of our lives. Her support and dedication has meant the world to me, it has allowed me to grow and become a better person, and I would not have wanted to take this journey without her.

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ABSTRACT

Behaviors and Cognitions as Mediators of Psychosocial Variables and Re-hospitalizations in Patients with Heart Failure: A Structural Equation Modeling Approach

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Background. Heart failure is a major financial burden to the United States healthcare system, with much of the cost attributable to frequent re-hospitalizations. . Research has shown that psychosocial variables (e.g., depression, anger, social support) are associated with increased risk of re-hospitalizations in patients with heart failure. In a majority African American population, this study used structural equation modeling to determine the structure of Self-Care and Negative Affect, Attitudes, and Social Support, and their relationship to hospitalizations and death in HF patients. **Methods**. This was a secondary analysis of a dataset consisting 150 heart failure patients recruited from the University of Maryland Medical Center. Participants were administered measures of psychosocial measures (depression, anxiety, stress, anger, hostility, social support, optimism and self-efficacy), as measures of self-care (e.g., dietary and medication adherence and physical activity) and a measure of perceived symptom cognitions. Participants were then followed for up to additional 39 months and data on re-hospitalizations and death were collected. **Results**. This study determined that: (1) a construct of Negative Affect was comprised of hostility, state and trait anxiety, total stress, total depression, and state and

trait anger; (2) a construct of Attitudes was comprised of LOT Pessimism, LOT Optimism, KCCQ Self-efficacy subscale, and an ad-hoc measure of self-efficacy; (3) a Social Support construct was comprised of structural (number of people in social network, number of high contact roles, and number of embedded networks) and functional (ISEL total score) support; and (4) the latent construct of Self-Care was comprised of measures of medication and diet adherence, BMI, and smoking status. Results further indicated that Self-Care predicted mortality and perceived symptoms predicted all-cause hospitalizations. However, analyses also revealed that Self-Care and perceived symptoms did not predict any other readmissions. Additionally, none of the psychosocial variables predicted Self-Care or perceived symptoms. Therefore, the construct of Self-Care behaviors and the observed variable of perceived symptoms did not mediate the relationship between these psychosocial variables (e.g., negative affect, positive attitudes, and social support) and hospital readmissions. Exploratory analyses determined that the construct of Hostility and the subcomponents of anger (Trait Anger, and Anger Expression Out) were associated with all cause hospitalizations, but this relationship was not mediated by the construct of Self-Care and perceived symptoms. **Conclusion.** These findings indicate that Self-Care, Negative Affect, Attitudes, and Social Support are useful constructs in the study of heart failure outcomes. However, further research is needed in order to establish the mechanisms linking these constructs to hospitalizations in HF patients.

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CHAPTER 1: Introduction

Heart failure (HF) affects over 5.8 million individuals in the United States, with African Americans disproportionately affected by HF (165; 235). HF places a considerable burden on the United States health care system, with an estimated cost of over $39.2 billion dollars in health care, medications, re-hospitalizations, and lost productivity annually (83; 192). As a result of this large expenditure and onus on the U.S. health care system, reducing hospital re-admissions for patients with HF has been an important goal of physicians and researchers. Previous research suggests that many of the hospitalizations in HF patients result from potentially preventable causes such as medication non-compliance, poor self-care behaviors, and perceived symptoms. Recently data indicate psychosocial constructs such as anger and hostility are related to hospitalizations and negative outcomes in patients with HF (131; 136). Furthermore, the current literature suggests that additional psychosocial factors such as social support and optimism, serve as buffers to re-hospitalizations and negative outcomes in patients with HF (32; 141). Other psychosocial variables, such as depression, stress, and to a lesser extent, anxiety, serve as predictors of re-admissions and negative cardiac outcomes (79; 94; 148; 201). This burgeoning research underscores the importance of understanding the impact and role of psychosocial variables on modifiable risk factors such as self-care, and perceived symptoms.

The purpose of this dissertation was to examine the role of self-care (behaviors) and perceived symptoms (cognitions) in mediating the relationship between psychosocial variables and hospitalizations. This will be examined with a predominately African American sample due to the lack of research within this health disparity (278). This

proposal will begin with a brief overview of HF, followed by a discussion of the current literature surrounding predictors of readmissions, emphasizing the role of psychosocial variables. A discussion of how both self-care and perceived symptoms are influenced by these same psychosocial variables, and their subsequent impact on re-admissions will be presented. Finally, a theoretical model will be proposed to examine study hypotheses.

THE EPIDEMIOLOGY OF HEART FAILURE

Prevalence and Incidence

Each year 670,000 Americans are diagnosed with HF, with an incidence of 2-5 per 1,000 Caucasian individuals each year (161; 192), and 9.1 per 1,000 African American individuals (100). HF risk typically increases with age and incidence approaches 10 per 1000 individuals after the age of 65 (220). However, African Americans are at particular risk for the early development of HF (82). The Framingham Heart Study, conducted by the National Heart, Lung and Blood Institute, found that the risk of developing HF for both men and women is 1 in 5 (220). The National Health and Nutrition Examination Study reported that as of 2006, the prevalence of HF within Caucasian Americans was 2.6% (165). Projections indicate that prevalence of HF will increase approximately 40% from 2012-2030 (115). Approximately, 80% of men and 70% of women under the age of 65 will die within 8 years of diagnosis (220). African Americans are at even greater risk of mortality due to HF (1.8 for men, and 2.4 for women) (99). The incidence, growing prevalence of HF and mortality, underscores the need for a deeper understanding of risk factors, both biological and psychological.

Cost of Re-hospitalizations

HF is one of the largest contributors to re-hospitalization, with rates that near 30% from 60-90 days post discharge (130). Research has found that between 1980-2006, re-hospitalization rates have been on the rise, with an annual increase of 1.20% re-admissions by men and 1.55% by women (164). African Americans have been found to be hospitalized at higher rates than Caucasian Americans, and have worse outcomes than their counterparts (82). Indeed, the United States spends almost 40 billion dollars on HF related costs each year, and re-hospitalizations account for 64% of that total cost (6; 83; 192).

PATHOPHYSIOLOGY OF HEART FAILURE

HF is a chronic disorder in which the heart is unable to pump sufficient blood to supply the body's needs (174). HF is differentiated between ischemic and non-ischemic. Ischemic HF occurs when an individual develops HF due to coronary heart disease, non-ischemic HF is due to other factors (e.g., substance abuse, kidney disorder, hypertension). Non-ischemic HF predominates in African American individuals, compared to Caucasian individuals who are more likely to be diagnosed with ischemic HF (235). The medical literature also differentiates HF by changes in the heart's capacity to pump blood throughout the body, namely: systolic HF and diastolic HF.

Systolic HF

Systolic HF occurs when the left ventricle, the primary pumping chamber of the heart, loses its ability to contract normally and eject adequate blood into the body. A majority of systolic HF cases are a result of coronary artery disease, in which cholesterol, calcium, and fat form hardened plaque deposits, which build up and line coronary arteries, causing fluid buildup within the chambers of the heart and backing up the fluid

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coming in from the lungs (142; 178). The heart loses its ability to contract due to myocardial cell death, dysfunction in myocardial cells, and the dysregulation of neurohormones and inflammatory processes (e.g., catecholamines, interleukin 1, TNF-alpha), which function to hasten the process of cell death and reduce cardiac function (198).

Diastolic HF

Diastolic HF occurs when the left ventricle is unable to relax and refill due to the thickening of the chamber walls, also known as left ventricular hypertrophy (14). When the left ventricle is unable to fill, the result is reduced blood output (97). The main cause of diastolic HF is hypertension (104). Hypertension increases the overall workload of the myocardial muscle, stimulating the local renin-angiotensin system. When the renin-angiotensin system is activated, it increases the release of angiotensin II and aldosterone, which promotes cell growth and collagen production (170).

African Americans experience severe hypertension at a rate at least 3 to 7 times higher than Caucasian Americans, and they also experience left ventricular hypertrophy at 3 times the rate of their white counterparts (227; 278). This higher rate of severe hypertension causes more damage to the heart, cerebral structures, and kidneys and therefore results in a higher mortality rate for African Americans. When treating hypertension in African Americans, studies have found a blunted effect of beta-blockers and angiotensin-converting-enzyme (ACE) inhibitors compared to Caucasian Americans (52; 253). This necessitates the need for a diuretic, which in turn can then lower the efficacy of both the beta-blocker and the ACE inhibitor (46; 52; 253).

Co-morbidities Associated with Hospitalizations in HF Patients

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The major causes of HF are coronary artery disease and hypertension. However, HF may also result from alcoholism, obesity, genetic factors, and other chronic diseases (69; 142; 159; 189). There are numerous comorbidities associated with HF, including other disorders that increase risk (e.g., pneumonia, renal disorders, chronic pulmonary disease, diabetes, and complications of coronary artery disease). A significant number of hospitalizations are a direct result of these comorbidities, and not necessarily a direct result of HF complications (4). Minority populations, such as African Americans, are at greater risk for these health conditions (e.g., obesity and diabetes) and therefore may be at greater risk for hospitalizations due to comorbidities of HF (71). Due to the high rate of comorbidities associated with HF, a large number of hospital readmissions in HF patients result both from HF-related and non-HF related causes (4).

A recent review of Medicare patients reported that 37% of those with HF were re-hospitalized for HF related causes within the first 30 days after their initial visit (130). However, patients with HF were also re-hospitalized for non-HF related causes 63% of the time (70). The remaining non-HF related re-hospitalizations were due to conditions such as: pneumonia, renal failure, nutrition-related or metabolic issues, acute myocardial infarction, chronic obstructive pulmonary disease, arrhythmias, circulatory disorders, gastrointestinal bleeding, and gastrointestinal problems (130; 151). HF also accounts for approximately 4.2% of all inpatient stays (248). In a poll of caregivers, patients, cardiologists, and HF nurses, researchers found that 37-48% of hospital readmissions were due to other medical health problems (e.g., arrhythmia, ischemia, pulmonary disorders, renal insufficiency, and anemia)(8). In a of study of individuals with HF, Forman et al (92) found that 27% of re-hospitalizations were due to complications of

worsening renal function. For this reason, in studying re-hospitalization in HF patients, it is important to examine not only at HF and cardiac hospitalizations, but also at all-cause and non-cardiac reasons comorbidities as well.

Predictors of Re-hospitalizations in HF

Chronic HF accounts for $20 billion dollars (1.5%) of the total health care expenditure in the United States (34). Additionally, approximately half of all individuals with HF are re-hospitalized within six months (154), rendering this time frame as critical for research and reform efforts. Given this cost and utilization of resources, re-hospitalizations have been the focus of much scrutiny and research.

Zaya et al (280) identified four major categories of predictors of re-hospitalizations: clinical indicators, biomarkers, hemodynamic parameters, and psychosocial factors. Clinical indicators included conditions such as angina, extensive edema, high jugular venous pressure, prior pacemaker implementation, previous hospitalization and length of hospital stay (9; 153; 154; 191). Since biomarkers have been found to be independent predictors of re-hospitalizations, some additional useful biomarkers include: decreased glomerular filtration rate (due the activation of the renin-angiotensin-aldosterone system), and cardiac troponin (which, when elevated, indicates cardiomyocyte injury) (143; 171).

Hemodynamic parameters include determining volume status and pressures within the heart; as a result researchers and physicians have relied on B-type natriuretic peptide (BNP), a biomarker secreted from the heart in response to a change in blood pressure, which is a strong independent predictor of re-hospitalizations (81).

In addition to these physiological and biological correlates, behavioral, cognitive and psychosocial factors also contribute to HF re-admissions, mortality, and negative outcomes. Behaviors that impact these outcomes include poor adherence to medication and diet regimens (181; 262). Cognitions, such as perceived symptoms, have also been found to predict re-hospitalizations and mortality (116). Contributing psychological factors include: negative affect, optimism, and social support (141; 149; 173; 204). The current state of the literature suggests that all of these factors (psychosocial, behavioral, and cognitive) play a role in re-hospitalizations in HF patients. This dissertation will propose and test a conceptual model that seeks to determine the relationship between psychosocial factors, behaviors, and cognitions, as they relate to re-hospitalizations in patients with HF.

PSYCHOSOCIAL PREDICTORS OF ADVERSE OUTCOMES IN CORONARY HEART DISEASE AND HEART FAILURE

Psychosocial factors have been found to contribute to re-hospitalizations in both patients with HF and those with coronary heart disease, independently from other risk factors. This section will review the literature for both coronary heart disease and HF, as coronary heart disease is a main contributor to HF and research has focused primarily on the risk factors of coronary heart disease.

Negative Affect

Early work on the link between psychological states and HF, revealed that "emotional factors" (defined as any event or circumstances that represented trauma or elicited a strong emotional reaction) precipitated hospitalizations in 49% of cases (204). Negative affective states, such as depression, stress, anger, and hostility have all been found to predict adverse outcomes in patients with HF and coronary heart disease (79; 94;

131; 136; 148). Negative affect is typically conceptualized as subjective distress and unpleasurable psychological states that includes dimensions such as: distressed, upset, hostile, irritable, scared, afraid, ashamed, and nervous (265). Specifically, depression is an independent risk factor for coronary artery disease, similar to smoking, cholesterol, and hypertension (93). In a meta-analysis Rutledge et al (224) concluded that patients with clinical levels of depression were twice as likely to be re-hospitalized than patients without depression; patients with clinical depression were also at twice the risk for an adverse cardiac event and cardiac death. In one study to be described in more detail in a following section, depression not only predicted re-hospitalizations (132), but also greater length of stay; HF patients with clinical depression were less likely to receive education on the components of HF, referrals to outpatient management programs, and cardiac procedures (3). African Americans have a more chronic course of depression, and are less likely to receive psychotherapy than Caucasian Americans, placing them at higher risk for HF complications (270).

Similar to depression, other negative affect states, such as anger, and hostility have been found to predict all-cause and non-cardiac related hospitalizations in patients with HF (131; 136). In one representative study, Williams et al (271) followed 12,986 men and woman for approximately 53 months and found that those who exhibited "high" trait anger at baseline were 2.20 times more likely to experience negative cardiac events and 1.54 times more likely to develop coronary heart disease than those who exhibited "low" trait anger. Anger proneness (assessed via trait anger) has also been found to predict the development of coronary heart disease and HF. Similarly, Kucharska-Newton et al (156) followed 13,171 individuals over approximately 18.5 years, and found that

individuals with "high" trait anger were 1.44 more likely to develop HF than those who exhibited "low" trait anger at baseline. Anger and hostility may manifest differently in African Americans as compared to Caucasian Americans, and therefore have a different impact on the course and treatment of HF. Research has linked increased anger to increased diastolic blood pressure that persists after exposure to racist stimuli (90). This research suggests that African Americans, due to their minority status, are exposed to culturally unique situations which otherwise may not impact Caucasian Americans, that cause additional strain on the cardiovascular system and thereby possibly increasing their risk for a negative HF outcome.

Negative affect is similar to the construct of neuroticism that has consistently been demonstrated to be a personality component in factor analytic studies (68; 89). Similarly, research in patients with coronary artery disease also indicates that there exists a higher order construct of "negative affect" that encompasses state and trait measures of anxiety, depression, general distress, and panic (201). In 565 HF patients, a factor analysis of components of anxiety, depression, distress, and panic determined that these characteristics were not wholly distinct from one another and often loaded on the same factor (201). The following section will provide a literature review of individual components of negative affect, data documenting the overlap between the constructs and the need for a higher order variable to examine negative psychological states.

Perceived Stress

Perceived stress is inherently intertwined with other negative affective states, such as anxiety, anger and depression, because it can be both the antecedent to these conditions, and the outcome (58). As such, the definition of stress refers to the process

that occurs when an individual perceives that their environmental demands exceed their ability to cope or adapt *(60)*. Individual responses to stress can vary based on genetic factors; however, it is largely due to how an individual perceives a situation and by their current physical health, the latter being a is a result of physiological predispositions and behavioral and lifestyle choices *(160; 177)*. Stress is thought to impact both HF and coronary heart disease through several pathways: it's etiological role in anger, anxiety and depression, and the negative health behaviors that are results of these emotional states (e.g., increased smoking and drinking, reduction in exercise and healthy eating behaviors) (58). Stress also may operate to increase disease risk, through biological channels (e.g., activation of the hypothalamic-pituitary-adrenocortical (HPA) axis, and the activation of the sympathetic-adrenal medullary system, (SAM system)) (58). This direct connection between stress and the activation of the SAM system is evidenced in research that has linked stereotype threat (the fear of confirming stereotypes of a minority social group) in African Americans to increases in mean arterial blood pressure (36).

As noted previously, stress is thought to impact HF and coronary artery disease because it activates both the HPA axis and the SAM system. When an individual is under chronic stress and glucocorticoid hormones are being constantly produced, it can negatively impact an individual's immune response, making them more susceptible to diseases such as coronary heart disease and HF (58; 60; 140). When the SAM system is activated it releases epinephrine and norepinephrine from the adrenal medulla, which then activates the heart and muscles for the "fight or flight" response (which increases heart rate, cardiac output, and blood pressure) (42; 150). Elevated blood pressure is important in HF since it makes the already damaged heart pump harder in order to

provide blood to the body. Catecholamines are important for HF, because they are

elevated in HF patients and can lead to further damage to the myocardium.

Anxiety

Anxiety has been described as an adaptive emotional state that includes feelings

of worry, apprehension, nervousness, and tension, coupled with physiological arousal that

is essential in responding appropriately to stressful situations (244). Anxiety can improve

performance and help motivate needed action, however anxiety can also hinder

performance if it becomes overwhelming (254).

Several studies have found that the presence of anxiety is associated with

increased risk of myocardial infarction and the development of coronary heart disease

(66; 67; 110; 129; 135; 155; 267). As an example, the Normative Aging Study followed

2,280 men for 32 years, and found that those who reported 2 or more symptoms of

anxiety had an elevated risk of sudden cardiac death (OR= 5.73) and fatal coronary heart

disease (OR=3.20), compared to men who reported no anxiety symptoms (135).

Examining this same cohort, Kubzansky et al (155) selected 1,759 men who had no

history of coronary heart disease and administered a scale designed to capture "worry"

(subscales included: social conditions, health, financial, self-definition, and aging). The

authors found that those with the highest amount of reported worry had increased risk for

nonfatal myocardial infarctions (OR=2.41), and for coronary heart disease (both fatal and

nonfatal, OR=1.48), compared to those with the lowest amount of reported worry.

Furthermore, Weissman et al (267) found that those with a diagnosis of a panic disorder

were at twice the risk for stroke than those with any another psychiatric disorder or no

psychiatric disorder. While these studies suggest a link between anxiety and broad

cardiovascular outcomes, the literature on anxiety and its impact on outcomes in HF

patients is scarce. The high comorbidity with depression, construct overlap with stress,

and dearth of literature concerning impacts within a HF population, renders anxiety a

necessary component to examine.

There is a paucity of research on anxiety disorders and anxiety in African

Americans. However, a large epidemiological study found that compared to whites,

Caribbean blacks and African Americans were more likely to meet criteria for PTSD

during adulthood, but whites were at higher risk for panic disorder, generalized anxiety

disorder, social anxiety, and PTSD during childhood. However, when African American

and Caribbean blacks met criteria for an anxiety disorder, they reported higher levels of

symptomatology, distress, and functional impairment compared to Caucasians (121).

This greater level of distress and functional impairment, when an anxiety disorder is

present, among African Americans and Caribbean blacks may cause elevated risk for

cardiovascular disease and subsequently HF. There is currently little known research on

the impact of anxiety on HF within African Americans and this dissertation will seek to

fill that void.

Depression

In addition to anxiety, research has similarly found a strong link between

depression and cardiovascular disease. The prevalence of depression in individuals with

HF ranges from 13-77%, depending on method of diagnosis and treatment setting. HF

patients with depression are more likely to be younger and women (103; 256). In a meta-

analysis of 36 studies of patients with HF and depression, Rutledge et al (224) found that

patients with clinical levels of depression were at twice the risk for any adverse cardiac

event and cardiac death as compared to patients without depression. Furthermore, patients with clinical levels of depression had higher rates of hospitalization and emergency department visits than those without depression.

The relationship between depression and HF is a multifaceted one, as depression and HF share underlying biological mechanisms, meaning that the presence of one can increase the risk of the other (78). Possible mechanisms linking depression and heart failure include reduced parasympathetic activity, increased inflammatory responses, and increased platelet activity.

Particularly relevant for the present study, depression has also been shown to exacerbate HF because of its impact on behavioral variables such as medication and diet non-adherence, decreased participation in physical activity, and decreased smoking cessation (98; 258). Interestingly, in one study, African Americans were less likely to report depressive symptoms than Caucasians, however in patients who did report depression they were significantly less likely to be receiving beta-blockers (103). These behavioral variables, on the part of the patient and the provider, are the subject of considerable recent research (217) and variables play a large role in this proposal. Therefore, their link to depression will be discussed in more detail within the self-care section.

Anger and hostility

Considerable research documents the role of anger and hostility as risk factors for the development and onset of coronary heart disease (180; 271). However, specific links between anger, hostility and HF has not been well studied. Only two studies have investigated the effect of anger on adverse outcomes in patients currently experiencing

HF. Jenner et al (131) found that anger significantly predicted length of stay in the hospital but not readmissions. However, in a study utilizing the same study population as the present study, Keith (136) found that hostility predicted all-cause hospitalizations, and subcomponents of anger (e.g., Anger Expression Out and Trait Anger) predicted non-cardiac and all-cause related re-admissions.

The most recent meta-analysis on anger, hostility and coronary heart disease was conducted by Chida and Steptoe (47). Overall, the review concluded that there is a positive association between hostility and anger and coronary heart disease. The authors noted that studies with longer follow-up periods found higher risks in both the healthy and diseased populations. However, they also found that when studies fully controlled for behavioral covariates, such as smoking, body mass index, physical activity and socioeconomic status, the negative effect of anger and hostility on CHD was no longer significant. The authors contend that other unmeasured factors may have confounded these associations. Overall, this meta-analysis also concluded that the effects of hostility and anger are slightly greater in patients with CHD than healthy populations, indicating that anger and hostility may play a role in accelerating the effects of CHD.

Together, these studies suggest that both anger and hostility play a role in the development of coronary heart disease and subsequent negative outcomes in those with HF. However, the mechanisms through which anger and hostility impact HF are not well understood. Additionally, little known research has been conducted in regards to the expression of anger and hostility in African American patients with HF. This study will aim to inform the literature on the expression of anger and hostility in African American

patients with HF and examine whether hostility and anger may broadly impact and increase negative health behaviors (136).

Overlap of Among Stress, Depression, Anxiety, and Anger

As stated previously, negative affect appears to be a higher order construct in healthy individuals and in cardiac patients. This appears to be a result of the overlap and comorbidity among conditions, for example several systematic reviews of the literature indicate a strong association between stressful life events and the onset of major depressive episodes (111; 138; 175; 199; 255). Additionally, researchers have also found that perceived stress is also highly correlated with trait anger, and expression of anger (257).

The construct of anxiety shares many characteristics with depression and, are viewed by some as different points along the same continuum and as a result are often comorbid conditions (51). For example, the Netherlands Study of Depression and Anxiety found that of individuals diagnosed with depression 67% had a current anxiety diagnosis, and 75% had a history of an anxiety disorder; furthermore, those who were diagnosed with a current anxiety disorder, 63% also had a current depressive disorder and 81% had a history of a depressive disorder (157). Research has also shown that the constructs of anger and depression overlap significantly (251). Baeg et al (15) found individuals who report severe depression symptoms also report higher anger experience and anger expression. Stewart et al (247) found that both hostility and anger may precede and subsequently predict depressive symptoms.

Taken together, stress, anxiety, depression, and anger/hostility are inexorably linked and these constructs have clear associations with re-hospitalizations or negative

cardiovascular outcomes. These complex relationships and correlates of negative outcomes in cardiac patients warrant a higher order variable, comprised of stress, anxiety, depression, and anger/hostility, within one model.

PSYCHOSOCIAL BUFFERS AGAINST NEGATIVE OUTCOMES IN HF AND HEART DISEASE

In addition to the psychosocial risk factors associated with poor HF outcomes, there are psychosocial factors linked to more favorable (or that attenuate poor) outcomes. Concepts such as social support, and optimism have both been associated with improved outcomes in individuals with HF and reduced hospitalizations (32). In light of the evidence indicating the relationship between these psychosocial variables and re-hospitalizations, the present study will examine these constructs and their ability to predict re-admissions. The following section will explore these constructs in further depth.

Social Support

Social support is an umbrella term that is defined as "the social resources that persons perceive to be available or that are actually provided to them by nonprofessionals in the context of both formal supports groups and informal helping relationships" (56). This definition captures a multifaceted construct that is composed of different categories of support, such as: social embeddedness, perceived social support, and enacted support (21). Researchers have focused primarily on perceived social support, as it is has been shown to provide much of the buffering effects associated with social support (61; 62). Functional support refers to the resources gained through social network ties (e.g., favors), and structural support refers to the number of direct and indirect social ties that surround the individual, and the amount of integration amongst those social ties (102).

Additionally, the construct of social support is further differentiated into types of support (e.g., emotional, instrumental, informational, companionate, and esteem support). Among patients, evidence indicates that emotional support seems to be a more powerful predictor of outcomes than other types of support, such as tangible/instrumental support (102; 118). A growing body of literature suggests that social support and its aforementioned subcomponents may play a role in reducing risk for re-hospitalizations and death (48; 168; 261).

Impact of Social Support in HF

Research has found that social support has an impact on HF even prior to diagnosis, as individuals who reported to have sufficient social support were twice as likely to undergo testing for traditional risk factors (e.g., blood pressure and cholesterol), than those who reported insufficient social support (206). With regard to subcomponents of social support, in a study of 75 patients with HF, individuals who reported more emotional support had significantly reduced perceived symptoms and depression, and improved quality of life, compared to individuals who reported more instrumental support (119). Emotional support is conceptualized as relationships that provide intimate expressions of support such as listening and affection (102). Further research has found that emotional support is associated with reduced cardiovascular events in women (152). However, prior research in the present sample failed to find a relationship between functional and structural social support and re-hospitalizations (266).

While research has shown that social support may buffer negative health outcomes, research has also focused heavily on the impact of lack of social support. In a review of the literature, Luttik et al (169) identified seven studies on social support and

readmission and four studies that evaluated social support and mortality in patients with HF. Of the studies that investigated social support and readmission, three found that a lack of social support was correlated with an increased risk for readmission (48; 152; 234). Three of the remaining studies, found indirect evidence that social support influenced hospital re-admissions (112; 262; 276). While the remaining study did not find evidence that social support predicted HF hospitalizations. Studies of African Americans and social support have found that African American men reported higher levels of self-esteem, appraisal, belonging, and total support than African American women and Caucasian men (200). Another study found that African Americans who reported financial and emotional support were at decreased risk for hypertension (29). This difference in reported social support and the subsequent impact (decreased risk for hypertension and possible buffer effects), suggests that social support may play a heightened role in HF for African Americans compared to Caucasians. In fact, in this same dataset, Weiss (266) found that race moderated the effect of social support on HF outcomes such as the Kansas City Cardiomyopathy Questionnaire (a measure of HF symptoms) and the Six-Minute Walk Test (a measure of HF functional status).

Mechanisms Linking Social Support to Cardiovascular Outcomes

While the association of social support to outcomes in patients with HF has largely been supported, the mechanism by which social support impacts HF is not well understood (210). One hypothesis offered by Cohen and Wills (62) is the stress buffering hypothesis, which posits that psychosocial stress will have adverse effects on health for individuals with little or no social support, while these impacts will diminish, if not be completely eliminated, for those with stronger support systems. One of the possible

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mechanisms linking social support with cardiovascular outcomes social support's impact on health behaviors (210).

In general, evidence indicates that increased social support is linked to improved medication adherence, and reduced re-admission rates (239; 277). The relationship between social support and self-care health behaviors will be examined further in depth, later in this proposal.

Attitudes

Attitudes differ from our previous constructs as they are conceptualized as cognitions that have a conceptual reference and are evaluations of said reference, versus emotional states as captured by negative affect, and tangible and emotional support as captured by social support (5; 207). Attitudes offer an important contribution to a model, as research has found that attitudes can drive behavior (2).

Optimism

Optimism is defined as the overall belief that good things will happen, and can generalize to an overall confidence about life (44; 229). Therefore, it is believed, that people who are optimistic will persevere toward an obtainable goal, even under challenging circumstances or when progress is slow (229). This type of attitude and determination is associated with positive health behaviors, such as: not smoking, brisk walking, moderate alcohol use, and vigorous physical activities (in women), after controlling for clinical condition and demographic variables within a community sample (246). Optimism is also associated with improved overall physical health, thereby possibly reducing risk factors for HF (e.g., reduced inflammation, improved blood pressure, heighten endothelial and endocrine function)(85; 126; 209).

Additionally, optimism has also been found to protect against negative mood, brought about by psychological stressors and physical stressors, which may also bolster an individual's capacity to engage in positive health behaviors (38). Optimism, or lack thereof, has been described as one of main difficulties when engaging HF patients in hospice care as it may influence treatment buy-in and social relationships; these associations, among others, may explain the growing literature showing an association between optimism and re-admissions in individuals with HF and coronary heart disease (167).

Recently, Kim et al (141) found that higher levels of optimism are associated with a lower risk of incident HF. Whittaker (269), using this sample of primarily African Americans, also found that dispositional optimism was related to reduced HF symptoms, better functional status, and fewer hospitalizations within a sample of HF patients. Furthermore, optimism has been linked to additional negative outcomes, such as myocardial infarction, stroke, cardiac death, and coronary heart disease (221; 222). This proposal will further explore the mediating effect of self-care variables and perceived symptoms on the relationship between optimism and re-hospitalizations in patients with HF.

Self-efficacy

As part of his Social Cognitive Theory, Bandura (17) conceptualized self-efficacy, as the main motivator behind behavior change, and as such, he separates the construct into two components: outcome expectations and efficacy expectations. Outcome expectancy is an individual's estimate that their behavior will lead to a particular outcome. Efficacy expectancy is the belief or conviction that an individual can

successfully engage in the necessary behaviors to produce a desired outcome. Bandura differentiated between outcome and efficacy expectancy, because he noted that an individual can believe that a behavior will lead to a particular outcome, while entertaining doubts about their ability to complete that necessary behavior. This conceptualization allows individuals to cope if they find themselves unable to complete a particular behavior, and it also allows them to re-evaluate and engage in a different behavior if necessary.

Researchers have explored the extent to which self-efficacy may impact health behaviors, and found have found that higher levels of self-efficacy are related to higher levels of self-care maintenance and management (39). More specifically, a higher sense of self-efficacy is associated with an increased ability to quit smoking, better dietary adherence, and increased physical activity (40; 273). Research has primarily investigated self-efficacy's impact on self-care as an indirect factor that contributes to re-hospitalizations and negative cardiac outcomes (39; 43; 80; 194). Although, a few studies have found self-efficacy is directly associated with mortality and readmissions. One study found that in a survey of 191 patients and their spouses, both patient and spouse level of self-efficacy predicted survival, when levels of self-efficacy were examined independently. However, when entered into the same regression model, only spouse self-efficacy predicted patient survival (219). Furthermore, Sarkar et al (226) found that lower levels of reported self-efficacy predicted re-hospitalizations and all-cause mortality. In a study of hypertensive African Americans, researchers found that self-efficacy was negatively associated with medication adherence and it mediated the relationship between depressive symptoms and medication adherence (231). Taken together, research suggests

that self-efficacy may be a powerful motivator for behavior change and therefore it will be important to investigate its relationship on possible mediating variables, to better understand its mechanism of action.

Self Care as a Possible Mechanism of Action

Modifiable behaviors, such as medication and diet adherence, contribute to the concept of "self-care." Self-care and lack thereof, has been found to heavily contribute to re-hospitalizations and negative outcomes in HF patients (13; 88; 225; 260). Because of the behavioral nature of self-care, psychological processes influence it; this dissertation will examine the extent to which it may be affected by psychosocial variables. The literature suggests that

Definition of Self-Care

Riegel et al (213) define self-care as a: "naturalistic decision making process involving the choice of behaviors that maintain physiologic stability (self-care maintenance) and the response to symptoms when they occur (self-care management)" (pg. 1). Self-care maintenance encompasses the implementation of health behaviors, such as dietary and medication adherence, physical activity, daily weighing, and monitoring oneself for additional signs and symptoms. Self-care management refers to actively making decisions to engage in health enhancing behavior when confronted with signs and symptoms of worsening conditions. In HF, this requires patients to be recognize change, such as recognizing changes in fluid levels (i.e., increasing edema), evaluate the seriousness of that change, decide to take action, implement that action (e.g., take an additional dose of their diuretic), and then evaluate the result of that action.

Self-care within African Americans has been described as including systems such as the family structure and the church, and individual components such as spirituality, social support, and traditional, non-biomedical health and healing practices (25). Within the African American community, 70% reported that their families utilized home remedies and 35% reported that they utilized home remedies themselves (37). However, despite the higher prevalence of African Americans with HF, self-care measures do not include these aspects of self-care, instead they are focused on Western ideals that the individual is the main decision maker (25).

Researchers have used the Revised Heart Failure Self-Care Behavioral Scale (213) to compare self-care behaviors between African Americans and Caucasians. Artinian et al (13) found that when compared to Caucasian Americans, African Americans were more likely to seek medical attention when having difficulty breathing, if they experienced increased fluid retention, or experienced a reduction in appetite. The following sections will describe the differences between African Americans and Caucasian Americans with respect to the main domains of self-care.

Individual Components of Self-Care Maintenance

Dietary Adherence

Reduced dietary sodium intake is one of the most frequent recommendations made to HF patients and is endorsed by multiple HF guidelines (109; 179; 218). The regulation of dietary sodium intake is essential because sodium intake is associated with fluid retention, which puts additional stress on the heart and can increase blood pressure (109). The average American will ingest in excess of 3500 mg of sodium daily, which is above current guidelines of 2,300 mg daily suggested by the *Dietary Guidelines for*

Americans, 2010 (33; 259). The Heart Failure Society of America recommends less than 2000mg of sodium daily for patients with moderate to severe HF (114). Research has found that lack of knowledge about dietary sodium intake increases the risk for HF hospital re-admissions, however the Institute of Medicine found that there was "insufficient and inconsistent" evidence linking reduced sodium intake (below 2,300mg daily) to improved cardiovascular outcomes, including cardiovascular disease and mortality (127; 145; 166). The data are not clear as to the specific mg of sodium recommended, however the research clearly supports a reduced sodium intake for individuals with HF and as a result, these aspects of dietary adherence are essential to include as a part of the overall construct of self-care.

Research has found that older, southern African American females struggle with restricting their sodium intake as they enjoy eating "Southern Cooking" that is high in salt and fat, and deeply entrenched in their culture and an aspect of comfort (237). Within a qualitative study of six focus groups comprised of solely African Americans, researchers found that the general reaction to "eating healthfully" is reluctance because it means giving up their cultural heritage and acquiescing to the dominant culture (128). In addition to this cultural resistance to curb sodium intake, research suggests that sodium is processed differently by African Americans than by Caucasian Americans leading to a salt sensitivity, which ultimately increases risk for hypertension, and other inflammatory and cardiovascular diseases in African Americans (211). Researchers believe that the inadequate suppression of aldosterone within African Americans may be the reason for this salt sensitivity and the subsequent development of chronic diseases (e.g., hypertension) (95). Taken together, the cultural resistance to sodium restriction and the

increased risk of a high sodium diet within African Americans necessitates additional research into psychosocial factors that may impact this crucial aspect of self-care.

Medication Adherence

Medication adherence is an integral component of self-care. Medication adherence is often assessed as the percentage of prescribed medication doses that are taken or taken on time (217). Medication regimens for patients with HF are complex and may include one or more drugs from the following classes: diuretics, angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers, and β-blockers (16; 101). A recent review of the literature found that there is a wide range of medication adherence rates (2-90%) (277). In one study, researchers found that of 756 HF patients, 81.2% refilled their ACE-inhibitors prescription 30 days after discharge, and only 66.3% continued to fill their prescriptions 365 days after discharge (41). In another study, researchers found that only 34% of participants ($n = 202$) took all medications as prescribed (186). Reasons given for medication non-adherence included: not understanding discharge instructions (57%), confusion regarding conflicting instructions between discharging physician and primary care physician (22%), inability to afford prescription (18%), skepticism regarding efficacy of medication (9%), and anxiety about side effects (7%) (186).

As a whole, research has found that medication non-adherence predicts re-hospitalization and mortality in patients with HF. In a study of 42 HF patients, Chui et al (49) found that individuals who had poor medication scheduling (taking their medication at the designated time) had higher incidences of cardiovascular and HF related hospitalizations. When developing a detailed profile of patients who were admitted to the

emergency department for HF treatment, Welsh et al (268) found that 25% of individuals

experienced barriers to their medication adherence, such as confusion regarding self-

administration and memory difficulties. Within a sample of African Americans with

hypertension Ogedegbe et al (196) found that individuals experienced patient-specific,

medication-specific, logistic, and disease-specific barriers to medication and using

reminders, having a routine, disease knowledge (e.g., treatment and complications),

social support, and doctor-patient communication all facilitated medication adherence.

The Candesartan in Heart Failure: Assessment of Reduction in Mortality and Morbidity

(CHARM) program found that individuals who had "good" medication adherence

(defined as those who took their medication 80% of the time or more) was at 35% lower

risk for mortality than those with "poor" adherence (defined as those who took their

medication less than 80% of the time) (105). Taken together, medication adherence plays

a large role in re-hospitalizations and mortality in patients with HF, making it integral to

the construct of self-care.

Physical Activity

While chronic HF will reduce exercise capacity, research has found that exercise

can improve HF symptoms, both physiologically and psychologically (50). Evidence

based guidelines for HF patients report that exercise can: improve aerobic metabolism,

autonomic regulation, peripheral perfusion, and ventilatory control, while decreasing

local inflammation, all physiological results of exercise (1). The psychological impacts of

exercise include: improving quality of life, and reducing depression (1; 217).

These improved physiological and psychological symptoms as a result of

exercise, translate into less hospitalization and reduced mortality risk. When comparing a

group of HF patients who underwent an exercise regime for 8 weeks to a group that did

not exercise, Belardinelli et al (28) found that the former group was associated with lower

mortality risk and fewer hospital readmissions for heart failure than the latter. A recent

meta-analysis and a literature review supported these findings that an exercise routine

significantly reduces mortality and hospital readmissions (75; 240).

In summary, the literature has overwhelmingly supported the overall construct

and individual components of self-care (including dietary adherence, medication

adherence, and physical activity) and their contributions to re-hospitalizations in patients

with HF. For this reason, self-care is an important mediating variable when exploring the

association between psychosocial variables and re-admissions in patients with HF.

Psychosocial Variables that Impact Self-Care

Social Support and Self-Care

This section will review the literature that has found a strong association between

social support and self-care. In an integrative review of the literature, Graven and Grant

(106) found 13 studies that examined the influence of social support on self-care

management and self-care maintenance behaviors. Overall, the authors found that social

support positively influences self-care management and maintenance behaviors in

patients with HF. They also found that all four types of social support, emotional,

tangible/instrumental, informational, and appraisal, were associated with an individual

maintaining self-care behaviors. Additionally, an individual's nuclear family appears to

be the most influential in assisting with self-care maintenance. One critique of this review

was that most of the studies were correlational and no causation could be inferred.

To address this gap in the literature, Khaledi et al (139) examined perceived social support on self-care behaviors in a randomized controlled trial. A group of 64 heart failure patients were randomly sorted into two groups. The treatment group received an educational intervention (which included education on HF, the importance of self-care behaviors, and perceived social support and its significance in regards to HF and self-care) once a week for four weeks, while the control group received treatment as normal. Results indicated that the treatment group's perceived social support was significantly improved, and this increased perceived social support significantly increased self-care behaviors compared to the control group. In sum this literature suggests that the relationship between social support and re-hospitalizations may be explained, at least in part, by self care behaviors.

Social support has been found to be integral for the implementation of self-care among African Americans with chronic diseases (25; 123). In response to institutionalized racism, structural inequalities, and income inequalities, African American communities have looked inward for mutual aid, which shaped self-care behaviors for individuals with chronic illnesses (26). Unfortunately, there still remains a lack of research in regards to the structure and impact of self-care behaviors on HF outcomes in African Americans.

Attitudes and Self Care

Taken together, the data show an association between attitudes (e.g., self efficacy) and HF readmissions, and an association between self-care and HF re-hospitalizations and cardiac outcomes. The literature also suggests that there is an association between these attitudes, and self-care behaviors. In a cross-sectional study of 150 HF patients,

Cene et al (45) found that social support was associated with better self-care, but a sense of self-efficacy mediated that relationship. Furthermore, in a sample of 113 patients surveyed, those with a lower sense of self-efficacy displayed poor adherence to self-care behaviors and less education regarding appropriate self-care behaviors (194). Carlson et al (43) found that in their sample of 139 patients, only 45.7% of the sample felt very or highly confident in their ability to relieve their symptoms via self-care behaviors, and 20% expressed no confidence to alleviate their symptoms. More than half of their sample (59%) reported little to no confidence in their ability to evaluate the effectiveness of their self-care behaviors. The authors explained that this low sense self-efficacy about self-care behaviors might be a function of the patient's many comorbidities, age-related changes, low income, lack of education, and complexity of treatment regimens. Thus far, to our knowledge, no research has looked at the direct link between self-care and optimism within a HF population; therefore this proposal will be a needed addition to the literature.

Negative Affect and Self Care

Only recently has research into the impact of negative affective states and health care emerged. In a qualitative study, Riegel et al (215) interviewed individuals with HF about their mood and how it may impact their self-care behaviors. The researchers found that women reported symptoms of depression more often than men, and this interfered with their ability to differentiate their depressive symptoms from their HF symptoms (e.g., fatigue), which in turn delayed any action in response of those symptoms. Men, reported more feelings of anxiety and fear than women, however this anxiety was protective as it motivated individuals to be hypervigilant and proactive about any possible HF symptom. Young men (age ranged from 35 to 94 years) within the sample reported

feelings of anger, which delayed them from acting in a timely matter to address their symptoms and caused them to struggle with their self-care maintenance (e.g., alcohol use, medication and dietary non-adherence). Additional research has found an association between difficulties in medication adherence, daily weight monitoring, physical activity, and dietary adherence and depressive symptoms in both men and women (77; 183; 214). Furthermore, Williams et al (271) also found anger to be associated with increased alcohol use and smoking.

Research on the effect of anxiety on self-care is lacking, however it is believed that anxiety may impair self-care by impacting cognition, energy and motivation (217). Yet, in a meta-analysis DiMatteo et al (77) did not find a relationship between anxiety and medication adherence. Overall, research on the effect of negative affect on self-care behaviors is limited and, at times, inconsistent, this proposal will seek to provide additional information on the effect of negative affect on self-care and how this may impact re-hospitalizations.

Perceived Symptoms

In an attempt to produce a disease specific, examination of self-reported symptoms in HF, Green et al (107) identified the following domains of HF symptoms: physical limitations, symptoms (including frequency, severity and change over time), self-efficacy (to include self-care knowledge), social interference, and quality of life. Heart failure physical symptoms include: shortness of breath with exertion, difficulty breathing when lying flat, waking up from sleep out of breath, swelling in the feet or ankles, fatigue, weight gain, overall weakness, dry cough, poor appetite, nausea, palpitations, dizziness, and chest pain (272). While psychological symptoms include, but

are not limited to depression and anxiety. Both psychological symptoms and physical

symptoms are apart of a larger conceptual domain known as a patient's perceived health

status, which has been found to be a powerful predictor of re-hospitalizations in patients

with HF (87).

There is little known research on the differences of perceived physical symptoms

between African Americans and Caucasian Americans with HF. However, research on

perceived symptoms in patients with osteoarthritis, found that there was no significant

difference of amount or type of perceived symptoms between African Americans and

Caucasian Americans (7). This is surprising, given that African Americans must contend

with systematic racism and discrimination that has been consistently found to be

associated with negative mental and physical health symptoms and negative health

behaviors (e.g., smoking) (158). This study will aim to better inform the literature

regarding symptom perception of African Americans with HF.

Components of Perceived Symptoms

Psychological Symptoms

While psychological symptoms as a result of HF can vary from person to person,

the literature suggests that depression and anxiety are two common psychological

symptoms that are present in HF patients, but that depression is also an effect of living

with HF (78; 93).

Anxiety as an outcome of HF has received less attention in the literature

compared to depression. However, some evidence suggests that the prevalence of anxiety

within HF patients may be as high as 63% (72; 146). Other studies have found that

anxiety levels are higher in patients with HF than healthy elders and approximately 40%

of HF patients may suffer from major anxiety (74; 188). Anxiety has also found to impact outcomes in HF patients. In a study of 91 post myocardial infarction patients, researchers found that anxiety was associated with increased negative cardiac events (73). Furthermore, additional studies have found an association between anxiety and morality and subsequent ischemic events (120; 187).

Psychosocial Variables that Impact Perceived Symptoms

The Psychology of Physical Symptoms, Pennebaker describes how patients often equate their internal sensations as a one-to-one correspondence with physiological change (202). However, he argues that an individual's awareness of their physiological state and their subsequent symptom reports are subject to a number of perceptual biases and cognitive distortions. In other words, symptom report is dependent on a myriad of psychological processes; it is not merely a reflection of a physiological state.

Relationships between Perceived Symptoms and Social Support, Attitudes, and Negative Affect in HF

Overall, the literature regarding social support's impact on perceived symptoms within individuals with HF is focused primarily on quality of life, and there is relatively little research on social support and physical symptoms. Yet, when examining the broader population, the National Center for Health Statistics found that those who have never been married report more health related symptoms and perceive their health status to be worse, compared to individuals who are married. Additionally, those living with between one and three individuals report fewer symptoms and perceive themselves to be in better health than individuals who live alone or with four or more people (193; 264). In a previous study of this cohort, Weiss (266) found that better social support (e.g., tangible

social support and participation in religious networks) was associated with a reduction of total HF symptoms (as captured by the Kansas City Cardiomyopathy Questionnaire) in African Americans. Additionally, Conaway et al (63) found that when HF symptoms improved, so did a patients sense of self-efficacy. However, there is a need for further research investigating social support and self-efficacy's impact on physical symptoms/physical limitations (10; 22; 30; 117).

Research has found a strong association between negative psychological states and perceived symptoms. For example, the Heart and Soul Study found that in HF patients who reported depressive symptoms were more likely to report: at least mild symptom burden, mild physical limitation, mildly diminished quality of life, and either fair or poor overall health, compared to those who did not report depressive symptoms (223). Bekelman et al (27) found that more severe depressive symptoms were associated with a greater number of symptoms. Additionally, Strine et al (249) found that individuals who reported frequent anxiety symptoms were more likely to report fair or poor health, physical distress, sleep inefficiency, physical activity limitations, mental distress, and more pain, than those who reported less anxiety symptoms, even when controlling for depression. Furthermore, in a study of 273 patients Eisenberg et al (84) found that anxiety was associated with poorer physical functioning. Little research has been done on stress and anger's direct effect on perceived symptoms, therefore this proposal will seek to fill this gap within the existing literature.

SUMMARY AND RATIONALE

In summary, the literature has suggested that there are individual associations between psychosocial variables (e.g., negative affect, social support, and attitudes) and

behaviors (self-care), and cognitions symptoms that may play a role in hospitalizations in patients with chronic diseases. Research also supports the relationship between most of these variables (e.g., negative affect, social support, attitudes, and self-care) and re-hospitalizations in patients with HF. This proposal's main goal will be to examine these individual aspects as a part of a larger model to better understand relationships among psychosocial variables self-care behaviors, symptom cognitions, and re-hospitalizations in patients with HF (see Figure 1 and Figure 2). Since many of these variables are clustered together and since many of these clusters act together to affect re-hospitalization outcomes, it is important to develop a broader perspective that takes into account these relationships. This proposal will also seek to inform the literature on: the effect of emotional symptoms on HF outcomes and self-care, the mechanism through which anger/hostility works to impact HF re-hospitalizations, the effect of anger/hostility and perceived stress on perceived symptoms, and the relationship of perceived symptoms to HF outcomes. Finally, from an applied or clinical perspective, by comparing two models, this proposal will help to identify which mediating variables have the largest impact on re-hospitalizations, and may therefore be better to target in attempts to reduce HF re-admissions.

The present aims and hypotheses will first test four measurement models: "Negative Affect" will be comprised of depression, anxiety, stress, anger, and hostility, "Attitudes" will contain optimism, and self-efficacy, "Social Support" will involve number of individuals within a social network and level of interpersonal support, and "Self-Care" will include measures of dietary and medication adherence and physical activity level. By utilizing measurement models, instead of regressions, this allows for

the construction of higher order variables, instead of being confined by individual scale scores. It also provides the ability to ensure convergent validity of the selected measures. Next, relationships among psychosocial variables, Self-Care, and attitudes and re-hospitalizations in HF patients will be established. Then it will be determined whether Self-Care and Attitudes (i.e., optimism and self-efficacy) mediate the relationships between psychosocial variables and hospital readmissions. Finally, this study will compare and contrast the proposed mediating models to determine which better predicts re-hospitalizations.

CHAPTER 2: Aims and Hypothesis

The specific aims and hypotheses of this proposal are:

AIM ONE:

To determine the extent to which the constructs of Negative Affect, Attitudes (self-efficacy, optimism), Social Support, and Self-Care are higher order constructs within patients with HF. Specifically, this study will a) determine if Negative Affect is a higher order construct comprised of: depression, stress, anxiety, and anger/hostility; b) examine whether Attitudes is a higher order variable comprised of: optimism and self-efficacy, within a HF population; c) examine whether Social Support is comprised of social network size, and interpersonal support; d) examine whether Self-Care is comprised of dietary and medication adherence and physical activity.

Hypothesis 1a:

Negative affect is a higher order variable within the HF population that is comprised of depression, stress, anxiety, and anger/hostility.

Hypothesis 1b:

Attitudes is a higher order construct within the HF population and is comprised of optimism and self-efficacy.

Hypothesis 1c:

Social support is a higher order construct within the HF population and is comprised of interpersonal support and social network size.

Hypothesis 1d:

Self-care is a higher order variable within patients with HF and is comprised of medication adherence, dietary adherence, and physical activity.

AIM TWO:

Aim two has two parts. The first is to determine if there is a relationship between psychosocial variables (e.g., Negative Affect, Positive Attitudes, and Social Support), and outcome variables (re-hospitalizations).

The second is to determine whether cognitions (perceived symptoms) and Self-Care behaviors mediate this relationship between psychosocial variables (Negative Affect, Social Support and Positive Attitudes) and re-hospitalizations in patients with HF.

Hypothesis 2a:

There will be a relationship between psychosocial variables (Negative Affect, Positive Attitudes, and Social Support) and re-hospitalizations.

Hypothesis 2b:

Levels of perceived symptoms will mediate the relationship between psychosocial variables and re-hospitalizations.

Hypothesis 2c:

Self-Care behaviors will mediate the relationship between psychosocial variables and re-hospitalizations.

AIM THREE:

To determine which mediating model (perceived symptom cognitions or self-care behaviors) is better predictor of re-hospitalizations.

Hypothesis 3:

Symptoms and self-care behaviors will be comparable predictors of re-hospitalizations.

CHAPTER 3: Methods

This study is a secondary data analysis of a larger study called BETRHEART. BETRHEART is a longitudinal study examining the impact of psychosocial variables on adverse HF outcomes over a period of 36 months.

STUDY PARTICIPANTS

As part of the longitudinal BETRHEART study, which examines psychological predictors of hospitalizations and death in patients with HF, 150 study participants were recruited in the Heart Failure Clinic at the University of Maryland Hospital in Baltimore, MD. Patients were tested at an initial baseline assessment visit and, again, at a 3-month follow-up session as well as a 36 month follow-up after the 3 month session. For purposes of this study, data from the 36-month follow-up was analyzed. Inclusion criteria were left ventricular ejection fraction (LVEF) $\leq$40% as assessed by echocardiography, age >18 years, and symptomatic HF (NYHA class II-IV) for $\leq$3 months. Exclusion criteria were: myocarditis in the last six months, clinically significant mitral valve disease, thyroid dysfunction as primary HF etiology, alcohol abuse either current within the last six months, left ventricular assist device, prior heart transplantation, or active cancer treatment, nursing home residence, and/or severe cognitive impairment (see Table 1).

PROCEDURES

Patients were screened at the UMMC Heart Failure Clinic based on the exclusion and inclusion criteria and, if eligible, were invited to participate in the study. Informed consent was obtained and the participants completed a packet of psychosocial

questionnaires including the measures of anger, hostility, depression, perceived stress, anxiety and a detailed medical history was taken along with measures of heart rate, blood pressure. The patient's contact information was then obtained and a follow-up interview (via phone) was scheduled. A telephone interview was conducted every two weeks between the baseline and the 3-month clinic visit. During the telephone follow-up interviews additional psychosocial factors were assessed, including measures of optimism, self-efficacy, and social support. At the 3-month clinic visit, participants repeated the same measures administered at baseline, including psychosocial and health questionnaires, to include self-care behaviors and perceived symptoms. Hospitalizations and death were also recorded and then independently verified. If the participant had died, their next of kin or spouse was interviewed for cause of death and date of death. Participants were then contacted every six months for 36 months following baseline and the 3-month study period, for continued psychosocial measures and hospitalization/death updates. The Institutional Review Boards at both the Uniformed Services University and University of Maryland Medical Center approved this study.

STUDY MEASURES

The following section outlines the measures chosen to be included in the overall models. When available, validated scales were used to capture some domains. However, in other cases we were interested in choosing items that were most relevant to our hypotheses, rather than using the entire scale. In some cases, we were limited to questions and instruments used in the primary study that this secondary data analyses is based on.

Self-care

Since this study is a secondary analysis of data collected from a larger study, our construct of self-care contained components of the Riegel model, but it utilized existing questions and instruments from the BETRHEART study to that are similar to those used in the Riegel et al (213) Self-Care of Heart Failure Index. The Riegel model is frequently used within the literature to measure aspects of self-care and is comprised of three domains, self-care maintenance, self-care management, and self-care confidence (216). The present study focused on these self-care maintenance activities (which includes questions about daily weighing, low sodium diet, regular physical activity, and weight management), and will not include Riegel et al (213) self-care management dimension. The self-care management dimension (that consists of symptom recognition, evaluation, and self-confidence) will be explored in other aspects of our model (e.g., perceived symptoms observed variable, and positive attitudes construct). The utilization of questions derived from several sources in the present study has both advantages and disadvantages. On the one hand, using non-validated items and questions is a shortcoming. However, using the Structural Equation Modeling approach we can improve the parsimony of the project by only including the questions that directly address our aims, rather than an entire measure. Furthermore, Structural Equation Modeling assures that the chosen measures have appropriate convergent validity by ensuring that they represent an aspect of the same construct. All self-care variables were collected at the 3-month follow-up, when available.

While the Self-Care of Heart Failure Index (213) has not been directly examined for it's reliability and validity among African Americans, it has been used in previous studies to examine self-care in African Americans with HF (13; 96).

Diet

In this study, dietary consumption of sodium was assessed through an adaptation of the Dietary Compliance Survey (242) and includes series of questions such as: "How often in the past week did you avoid salty foods?" and "How often in the past week did you read food labels for sodium content when buying or eating food?" Both of these variables were entered into our measurement model of Self-Care. This provided validity data, as there is not any currently in the literature.

Exercise

Exercise was captured through a question that asks: "Have you been physically active within the last 30 days?" This question is similar to Riegel et al (213) question capturing exercise adherence: "Did you take part in regular physical activity?" Therefore these questions should be adequate at measuring an individual's physical activity levels. There is no validity or reliability estimates regarding this question within the literature, however it was entered into a measurement model, with other self-care behaviors (e.g., diet and medication adherence), to ensure that it captures an aspect of the self-care construct.

Medication Compliance

The total score of the 8-item Morisky Adherence Scale (185) was used to capture the medication compliance domain within self-care behaviors (see Figure 3).The 8-item Morisky Medication Adherence Scale has been found to have an acceptable internal reliability (Cronbach's α=.697), good test-re-test reliability, and good convergent validity with blood pressure (182). Within a sample of predominately African American, low-

income patients with hypertension, the Morisky Adherence Scale was found to be reliable and have good concurrent and predictive validity (184).

Body Mass Index

Body mass index was used as a proxy for a question on daily weighing. While this is not ideal, it is an attempt to capture the participant's attention and maintenance of their weight. All participants reported their weight at baseline, however approximately half of the participants reported their weight at 3-months. Therefore, a paired samples t-test was run to determine if there were significant differences between time points. There were no significant differences between BMI at each time point; therefore BMI at baseline was included in the model.

Smoking

The question "Are you currently a smoker?" was used to assess for smoking status at baseline, as there are no assessments for smoking at 3-months. A baseline measure of smoking was adequate to address this risk factor due to the long-term effects of smoking (147).

Perceived symptoms

Kansas City Cardiomyopathy Questionnaire (KCCQ)

The KCCQ is a 23-item self-report measure that is designed to capture the perceived symptoms of HF and overall functional status (107). The KCCQ includes questions such as: "Compared to two weeks ago my heart failure symptoms have become…" and "how much has your heart failure symptoms limited your ability to dress yourself?" (see Figure 4). Overall, the KCCQ has been found to have high internal

consistency (Cronbach's alpha of .92) and has demonstrated criterion validity (70). The total score of the KCCQ includes subscales such as: physical limitations, symptoms (including frequency, severity and change over time), self-efficacy/knowledge, social interference, and quality of life. Given that we are primarily interested in symptoms, we only utilized the Total Symptom subscale of the KCCQ symptoms in our analyses. This subscale has demonstrated high test-retest reliability (≥0.81)(70). The Total Symptoms score was entered into our Structural Equation Model as an observed variable, which allows for a single scale to be used. In a sample that consisted of 32.6% African Americans, Flynn et al (91) found that the KCCQ was predictive of functional status (the Six-Minute Walk test) in patients with HF. No known study has examined the reliability and validity of the KCCQ for African Americans. This measure was also collected at the 3-month follow up.

Negative Affect

All Negative Affect observed variables were collected at baseline.

State Trait Anger Expression Inventory, Second Edition (STAXI-2)

The STAXI-II is a 57-item instrument measuring anger and its subcomponents (see Figure 5). It consists of 5 anger scales: State Anger, Trait Anger, Anger Expression In, Anger Expression Out, Anger Control Out, and Anger Control In (243). Items that are coded on a 4-point Likert scale (ranging from "almost never", "sometimes", "often", and "almost always"). The STAXI has been found to be both internally reliable (Cronbach's alpha ranging from .79 to .88), and valid (86). The STAXI-II has been found to be reliable and valid in samples of African Americans and is widely used in the literature (243).

Cook-Medley Hostility Scale.

The Cook-Medley Hostility Scale is a 50 item instrument designed to measure hostility (64). Factor analyses indicate that it is composed of six subscales: Cynical Hostility, Hostile Attributions, Hostile Affect, Social Avoidance, Aggressive Responding and Other (19). Each question requires a dichotomous true or false answer. Examples of questions included on each scale are as follows: Cynical Hostility Scale: "I have often had to take orders from someone who did not know as much as I did"; Hostile Attribution: "someone has it in for me", Hostile Affect "some of my family have habits that bother me and annoy me very much", Aggressive Responding: "I don't blame anyone for trying to grab everything he can get in this world", Social Avoidance: "I am likely not to speak to people until they speak to me", and Other: "I am against giving money to beggars" (see Figure 6). The measure has shown to have both convergent and discriminant validity and reliability (241). The Cook-Medley has been found to demonstrate internal consistency, and concurrent and construct validity within a sample of black, African American, and Hispanic individuals (163).

Beck Depression Inventory-II (BDI)

The Beck Depression Inventory-II (24) contains 21 items, each listing a symptom of depression and four statements increasing in depression severity (see Figure 7). Higher scores indicate more severe depression symptomology, mild depression scores are in the 14-19 range, moderate depression is captured with a 20-28, and severe is 29 and above (24). Beck et al (23) reported an alpha of .91 in a sample of 140 psychiatric outpatients. The Beck Depression Inventory-II been found to be one of the most commonly used instruments in research and practice to measure the severity and presence of depression

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and has been extensively validated (212). Grothe et al (108) found that the BDI-II demonstrated high internal consistency (Cronbach's alpha=.90), good item-total intercorrelations, and criterion related validity in a sample of African Americans.

Perceived Stress Scale (PSS)

The Perceived Stress Scale (PSS; see Figure 8) contains 10 items and was designed to measure the degree to which individuals perceive their daily situations and life events as stressful (59). The measure ranges from 0-40 with a higher score indicating more perceived stress. The Perceived Stress Scale has good convergent and divergent validity. It has also been found to be associated with: the inability to quit smoking, the inability to control blood sugar among diabetics, increased colds, and a greater vulnerability to depressive symptoms (53). Additionally, the PSS demonstrates good internal reliability (Cronbach's α= .86) and good test-retest reliability (59). Within a sample of African Americans with low literacy levels and a chronic disease, researchers have found that the PSS demonstrates acceptable psychometric properties (236).

State-Trait Anxiety Inventory (STAI)

The State-Trait Anxiety Inventory (244) is composed of 40 items, and was designed to measure the extent to which an individual manifests anxiety as a personality trait, compared to those who only manifest anxiety during specific events (see Figure 9). In a factor analysis, Bieling et al (35) found that items appeared to assess anxiety, worry, as well as sadness and self-deprecation. Barnes et al (20) observed that the average internal consistency of the state domain was good (Cronbach's α=.91), as was the trait domain (Cronbach's α=.89). The test-retest reliability for State Anxiety was acceptable, and good for the trait domain. The State-Trait Anxiety Inventory also has good predictive

validity (197). In a study of black and Latino men and women, researchers found that the STAI demonstrated internal consistency, and discriminate and convergent validity (195).

Positive Attitudes

All Positive Attitude variables were collected at baseline.

Life Orientation Test (LOT)

The Life Orientation Test (LOT) (228) is a 16 item measure that was developed to assess whether an individual is more optimistic or more pessimistic (see Figure 10). The LOT has been found to have acceptable internal validity (Cronbach's α= .76) and good test-retest reliability (228). The LOT has also has demonstrates acceptable convergent validity (e.g., positively correlated with self-mastery, active coping, and self-esteem) and divergent validity (e.g., significantly negatively correlated with depression, trait anxiety, and neuroticism) (230). The LOT was found to have acceptable internal consistency (Cronbach's α=.69), good test-retest, and criterion validity within a multiethnic sample (122).

Self-efficacy

The self-efficacy/self-knowledge subscale that is a part of the KCCQ was used to measure level of self-efficacy within this study. The self-efficacy domain within the KCCQ was designed to measure the extent to which a HF patient feels confident about their abilities and knowledge to manage their disease (11). The internal reliability for the self-efficacy subscale was found to be acceptable (Cronbach's α= .63) (172). The questions include: "How sure are you that you know what to do, or whom to call, if your HF gets worse?" and "How well do you understand what things you are able to do to

keep your HF from getting worse?" Furthermore, this subcomponent was shown to have good predictive utility, as those with lower self-efficacy scores were more likely to be re-admitted to the hospital, compared to individuals with higher scores (107).

To supplement the self-efficacy scale from the KCCQ, we constructed an ad hoc self-efficacy scale using several self-efficacy items that were separately administered to participants in the study (e.g., How certain are you that you will be able to communicate effectively with your clinician? (see Figure 11). The items were be chosen based on their face validity and in correspondence with items from another existing validated disease-specific self-efficacy scale (the Cardiac Self-Efficacy Scale) (250). We tested the internal reliability and it demonstrated good internal reliability (Cronbach's α=.90).

Social Support

All Social Support variables were collected at baseline.

Social Network Index (SNI)

The Social Network Index (see Figure 12) (54) was used to assess the social support component of breadth of social network. This scale was designed to assess all elements on an individual's social sphere, including relationships across domains such as family, friends, work, and community supports. The SNI also includes number of network members, and consistency of contact within traditional support groups. This measure has demonstrated good predictive utility, including health outcomes and vulnerability (54; 55). This index has been used previous studies to study African Americans (279), however there is no known research that has examined the applicability of this tool to an African American sample.

Interpersonal Support Evaluation List (ISEL)

The Interpersonal Support Evaluation List (ISEL, see Figure 13) is a 14 item

measure that was used to measure perceived social support (57). The ISEL captures

domains such as tangible support, sense of belonging, self-esteem, and appraisal (61).

The ISEL provides an in-depth look at perceived social support, and depth of social

relationships, above and beyond that of the SNI (which primarily reports on social

network size). Each subcomponent of the ISEL has been found to have acceptable

internal reliability (Tangible: Cronbach's $\alpha = .71$; Belonging: Cronbach's $\alpha = .75$; Self-

esteem: Cronbach's $\alpha = .60$; Appraisal: Cronbach's $\alpha = .77$), as well as the total scale

(Cronbach's $\alpha = .77$)(57). The ISEL has also demonstrated good convergent and divergent

validity with the Socially Supportive Behaviors (ISSB) scale and its subcomponents (it

was divergent with a scale of social anxiety and was found to moderate the relationship

between stress from negative life events and depressive symptomatology (57). The ISEL

has been found to be a valid measure of interpersonal support within African American

samples (65; 200).

Hospitalizations

Hospitalizations were recorded during the 3-month initial study period and at

subsequent six-month follow-up telephone interviews for up to 36-months follow-up.

Hospitalizations were self-reported by participants and then verified with hospital record

review. Hospitalizations were also categorized into four categories: HF related

hospitalizations, cardiac related hospitalizations, hospitalizations for non-cardiac reasons

(e.g., non-cardiac surgeries, acute illness, injuries), and all-cause hospitalizations. HF

hospitalizations were characterized by pump failure or fluid overload. Cardiovascular

related hospitalizations consisted of a diagnosis of myocardial infarction, angina, myocardial ischemia, and for cardiac revascularization procedures including coronary angioplasty or bypass. Cardiac hospitalizations were a composite variable, subsuming HF related hospitalizations. Non-cardiac hospitalizations included any other hospitalizations for any non-cardiac reason. All-cause hospitalization was a composite variable containing all three types of hospitalizations (HF, cardiac, and non-cardiac). A clinical research specialist at the UMMC Heart Failure Clinic adjudicated the category for each hospitalization. We did not create a composite variable of hospitalization and death.

DATA ANALYTIC PLAN

We used Structural Equation Modeling to address our aims in this study. Structural Equation Modeling provided an advantage over regressions and other more traditional analyses because it allowed for the examination of latent constructs. Latent constructs are representations of phenomena that cannot be directly measured; instead researchers select indicators that they believe are representative of the underlying construct, based on theory or prior literature. The Structural Equation Modeling process begins with measurement models. Measurement models ensure that the observed variables chosen by the researcher capture the underlying construct. Once the measurement model is fit (through a process of modifications), these latent constructs can then be used in further analyses as a unitary variable, rather than a compilation of multiple scales. This provided us a particular advantage in this study as it allowed for the use of specific questions, rather than full scales where they were not available. It also allowed for more sophisticated analyses of psychological phenomena, as it captured the

multidimensionality of psychosocial variables, above and beyond the capability of traditional statistical methods.

MPlus Version 7.3 was used to address our aims. More specifically, MPlus was used to fit four measurement models, was used to determine best fit for two structural equation mediation models, and then compared the best fit models to one another, and determined whether: 1) perceived symptom cognitions and Self-Care behaviors mediated the relationship between psychosocial variables and re-hospitalizations in patients with HF and 2) determined which mediating model best predicts re-hospitalizations, after accounting for the contribution of age, race, sex, and time in the study. For a complete list of each latent variable (including variable composition), observed variable, and dependent variables please see Table 2.

To investigate Aim 1, we fit four measurement models. The first measurement model determined the appropriate fit for our latent variable of "Negative Affect." Specifically we entered the total scores for depression, anger, hostility, anxiety, and stress measures and determined model fit based on a comparative fit index (CFI) of >.90 (31), a Tucker-Lewis index (TLI, or otherwise known as the Non-Normed Fit Index) of >.09 (125), and a root-mean square error of approximation (RMSEA) of <.08 (245). We then modified the model based on modification indexes supplied by MPlus. This process was then repeated for the following three measurement models: "Attitudes", "Social Support", and "Self-Care." The second measurement model of "Attitudes" initially contained: total score optimism, total score pessimism and total score self-efficacy (KCCQ and ad-hoc measure). The third model of "Social Support" initially contained: the subscale scores of the SNI to include total network size, number of embedded networks, and number of

people in the church/temple, friends, neighbors, and family embedded networks) and ISEL total score and subscales to include overall support, appraisal support, belonging, and tangible support. The fourth model of "Self-Care" was initially composed of: number of times of dietary adherence, total score of medication adherence, yes/no physical activity, Body Mass Index (BMI), and yes/no current smoker.

To investigate Aim 2 (hypothesis 2a), we entered our fit measurement models of "Negative Affect", "Social Support", and "Attitudes" into a mediation structural equation model with our observed mediating variable of perceived symptoms (the total score of the KCCQ) and re-hospitalizations (cardiac, non-cardiac, and all-cause hospitalizations) and death as our dependent variables. To investigate hypothesis 2b, we entered our fit measurement models of "Negative Affect", "Social Support", and "Attitudes" into a mediation structural equation model with our other fit measurement model of "Self-Care" (serving as the mediating variable) and our re-hospitalizations (cardiac, non-cardiac, and all-cause hospitalizations) and death as our dependent variables. Covariates were entered into both of these models based on prior literature. These covariates included sex, age, race, and time in the study.

To investigate Aim 3, attempted to compare the two mediating models based on their Chi-Square statistic and *p* value, to determine which model was better at predicting re-hospitalizations and death in patients with HF.

Missing Data

There are several missing data points within the current data set due to participant death, and individuals being lost to follow-up. Inherently, MPlus corrects for missing data by using maximum likelihood (FIML). Maximum likelihood method assumes that

the missing data is missing at random and uses all other available data to estimate missing values (190).

Variable Reduction Strategy

Fitting measurement models are the first step to any structural equation model, and inherent in fitting a measurement model is ensuring every variable used captures an aspect of the latent construct. If a variable does not converge with other variables in the measurement model, the researcher is provided a modification indice, indicating that their model may fit the construct better if that variable is removed. Once the variable is removed, the process is repeated until the measurement model fits the specifications listed above.

Power Analysis

Within the literature there is no consensus on how to run a power analysis for a structural equation model (144; 232). Some researchers suggest using the Monte Carlo method that requires a series of simulations, with varied model properties, including number of indicators, factors, and amount of missing data. However, these simulations are limited in their usefulness, as they estimate a large sample size range (e.g., from 30 to over 400 cases) (274). While others suggest running an autoregressive model, followed by a series of simulations by generating data from existing participants, this method recommended anywhere between 20 and 1,000 participants (238). However, there appears to be a general consensus that approximately 10 participants are needed for each observed variable (144; 232). Within our model there are 14 observed variables (for a list of all exact observed variables used, see Table 3) and we have 146 participants within our study, which therefore should provide adequate power.

CHAPTER 4: Results

Of the 150 participants originally recruited for this study, 146 participants completed their packet of baseline demographic information, and were therefore retained in the final sample. The participants were mostly male (*n*=113, 75%) and *n*=37 were female (25%). The mean age for the sample was 56.82 years (SD=11.43) and a majority was African American (70%). Forty-three participants identified as Caucasian (29%), and 1 individual identified as American Indian/Alaskan Native (1%). Approximately one third of the participants reported a household income of less than $15,000 a year (*n*=51, 35%), *n*=39 individuals made $15-30,000 a year (26%), *n*=43 individuals reported a household income of $30-70,000 a year (30%), and *n*=13 individuals reported a household income of $70,000 a year (9%) (see Table 4 for additional demographics). Notable within this sample is the severity of HF. As seen in Table 4, this sample reported a mean ejection fraction (EF) of 23.14%, a mean creatinine of 1.38mg, and a mean blood urea nitrogen (BUN) of 23.72. An EF of less than 35% can cause sudden cardiac death (124). A serum creatinine of larger than 1.5mg is considered elevated and places individuals at risk of complications in HF (263). A normal BUN ranges from 7-20mg and an elevated BUN places patients with HF at elevated risk of mortality (12). The percentage of patients with ICDs (49%) may have kept the death rate down to approximately 7% yearly.

FOLLOW-UP

Participants were followed for up to 3 years; the mean length of follow-up was 24.76 months (SD= 13.40). Nineteen participants were either unable to be contacted

(*n*=3), withdrew (*n*=13), or died (*n*=4) before the 3-month follow-up. Fifteen participants

were unable to be contacted, and subsequently dropped from the follow-up, between the

3 and 6-month follow-up period (*n*=9 died, *n*=5 were unable to be contacted, and *n*=1

withdrew). Twelve participants were unable to be contacted in between the 6-12 month

follow-up (*n*=7 died, *n*=4 were lost to phone follow-up [defined as unable to contact the

participant after 1 year, but hospitalization data was still collected], and *n*=1 withdrew).

Fourteen participants were unable to be contacted between the 12-18 month follow up

(*n*=6 died, and *n*=8 were lost to phone follow-up). Fourteen participants were unable to

be contacted between the 18-24 month follow up (*n*=5 died, *n*=8 were lost to follow-up,

and *n*=1 withdrew). Four participants were unable to be contacted between the 24-30

months, and *n*=13 were lost between the 30-36 month for the follow up (*n*=2 died, *n*=11

were lost to phone follow-up). Overall, 16 participants who were lost to follow-up had no

recorded hospitalizations, 28 participants who were lost to follow-up had hospitalization

data collected, and 11 who withdrew had no recorded hospitalizations.

Thirty-two of the original 150 (21.3%) participants died during the duration of the

study. Death was included as a separate dependent variable within the analyses. The

death rate found in this study is consistent and on the lower end (Levy et al., reports the

death rate at approximately 5% yearly when on standard of care, and this study found a

7% mortality rate) of the death rates reported within the larger literature (162). This low

mortality rate is also consistent with the high standard of care that the participants in this

sample are receiving; the high standard of care is evidenced by the high percentage of

medication recommended by the American Heart Association that the participants

reported being prescribed (e.g., 92% of the sample reported being prescribed beta-

blockers, 83% of the sample reported being prescribed a diuretic, see Table 4 for more medications). This high level of care provides confidence that the findings of this study are not the result of substandard care.

NUMBER AND CAUSES OF HOSPITALIZATIONS

Table 5 presents a breakdown of number and cause of hospitalizations. During the course of this study, 10 participants had *only* cardiac-related hospitalizations (e.g., angina, ICD related, and/or cardiac-related shortness of breath), 10 patients had *only* HF related hospitalizations, and 15 patients had *only* non-cardiac hospitalizations. Approximately one third of participants ($n= 51$) had hospitalizations for both cardiac and non-cardiac reasons, and overall, 92 participants (~63%) had been hospitalized at least once for any reason. Among those 92 participants hospitalized during the study, there were 291 cardiac related hospitalizations (183 of these were HF related hospitalizations and 108 non-HF cardiovascular-related hospitalizations), and 284 hospitalizations for non-cardiac causes (e.g., non-cardiac surgeries, acute illness, and injuries). For this entire sample, the mean number of HF hospitalization was 1.95 (SD=2.93), the mean of cardiac related hospitalizations was 3.10 (SD=3.66), the mean non-cardiac hospitalization was 3.02 (SD=9.19), and the mean all-cause hospitalization was 3.83 (SD=9.40). Among the patients who were hospitalized, the mean hospitalization for HF was 3.11 (SD=2.19), the mean hospitalization for cardiac hospitalizations was 3.31 (SD= 2.57), the mean hospitalization for non-cardiac hospitalization was 3.16 (SD= 3.26), and the mean hospitalization for all-causes was 4.87 (SD=4.3). In sum, approximately half of all-cause hospitalizations were attributable to cardiac causes ($n=291$) and half were attributable to non-cardiac causes ($n= 284$).

AIM ONE

The first study aim was to determine the extent to which the constructs of

Negative Affect, Attitudes (self-efficacy and optimism), Social Support, and Self-Care

represent coherent higher order variables within our participants with HF. Hypothesis 1

posited that Negative Affect would be a higher order variable within this sample, and that

it would be comprised of depression, stress, and anxiety/hostility. A confirmatory factor

analysis (CFA) fully supported this hypothesis ($\chi^2 = 557.65, df = 21, p < .001$). The

CFA consisted of total hostility (from the Cook-Medley), state and trait anxiety (from the

STAI), total stress (from the PSS), total depression (from the BDI), and state and trait

anger (from the STAXI-II), and required minimal modifications (see Table 6 for means

and standard deviations, and Table 7 for the correlation matrix). Within this model, all

paths were significant at a $p < .001$ level. The necessary modifications for improved

model fit were covariances between the following variables: state anger and state anxiety

(Est=15.5, $p < .001$) and state anger and trait anger (Est=10.2, $p < .001$). This model

demonstrated good fit based on multiple indices. It demonstrated excellent fit with a

comparative fit index (CFI) of .98 (31), based on the Tucker-Lewis Index (also known as

the non-normed fit index, TLI=.97) (125), and based on the root mean square error of

approximation (RMSEA=.07)(245). See Figure 14 for factor loadings and structure.

Hypothesis 2 proposed that Attitudes would be a higher order construct within our

sample, and that it would be comprised of traits of optimism and self-efficacy. Overall,

the CFA was comprised of the LOT pessimism subscale, the LOT optimism subscale, the

KCCQ self-efficacy subscale, and our ad hoc measure of self-efficacy (see Table 8 for

means and standard deviations, and Table 9 for zero-order correlations of these

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subscales). A CFA supported this hypothesis ($\chi^2 = 75.18$, $df = 6, p < .001$). This model demonstrated good fit based on three fit indices with few necessary modifications (CFI=1.0, TLI=1.04, and RMSEA=0.0). Within this model, all paths were significant at a $p< .01$ level, except for the path between the construct and KCCQ self-efficacy (p=.64). The only modification for improved model fit was a covariance between KCCQ self-efficacy and our ad-hoc self-efficacy scale (Est= 41.4, p= .001). See Figure 15 for factor loadings and structure.

       Hypothesis 3 proposed that Social Support would be a higher order construct within our sample and would be comprised of measures of functional and structural support. A CFA supported this hypothesis with no necessary modifications ($\chi^2 = 375.39$, $df = 6, p < .001$). Measures of structural social support (to include number of people within a social network, number of high contact roles within a social network, and number of embedded networks) and functional social support (ISEL total score) were used for the CFA (see Table 10 for means and standard deviations and Table 11 for zero order correlations among observed variables). This model demonstrated good overall fit based on three fit indices (CFI=.99, TLI=.99, and RMSEA=.03). See Figure 16 for factor loadings and structure.

       Hypothesis 4 proposed that Self Care would be a higher order construct composed of measures of medication adherence, dietary adherence, physical activity, BMI, and current smoking status. A CFA partially supported this hypothesis. The question that addressed physical activity was removed from the analyses because it did not correlate with the other measures of Self Care (see Table 12 for means and standard deviations of all observed variables and see Table 13 for zero-order correlations between all observed

variables). Once physical activity was removed, this model demonstrated good fit based on three fit indices (CFI=.97, TLI=.92, RMSEA=.03, $\chi^2 = 24.41$, $df = 10, p = .006$). In this final model, all paths were significant at $p< .001$.

BMI at baseline was used in the model, this was done because more data were available at baseline than at 3-month follow-up and based on a paired t-test there were no significant differences between the data at these two time points. Therefore, the resulting model was comprised of: current smoking status (yes/no), BMI (collected at baseline), two questions regarding salt intake ("how many times in the last week have you avoided salty foods?" and "how many times in the last week have you read food labels for sodium content?"), and the total score for the 8-item Morisky Medication Adherence scale. Even though this model fit, no paths were significant at $p<.05$. The only needed modification for improved model fit was a covariance between avoid salty foods and reading the nutritional label (Est= .97, $p=.004$). See Figure 17 for factor loadings and structure.

History of diabetes was added as an exploratory analysis within the correlation matrix; however, due to lack of correlation with multiple other measures of Self Care (see Table 13), it was not included in the CFA. There were no physiological markers of diabetes available within the existing dataset.

AIM TWO

The purpose of the second aim was to determine if self-care behaviors or perceived symptoms mediated the relationship between psychosocial variables (Negative Affect, Social Support, and Attitudes) and negative outcomes (HF, cardiac, non-cardiac, all-cause hospitalizations, and death). Due to data skew in re-hospitalizations, we truncated any hospitalizations that were more than 2 standard deviations above the mean

and the models included the following covariates: age, gender, time enrolled in the study, and race. Specific covariates were removed from the analyses as necessary for model fit (please see Figures 19-44 for presence of covariates). Factor loadings from the observed variables to the constructs changed as a result of being re-estimated when a new outcome variable was entered into the model. This does not change the coherence of the constructs because it still had to meet criteria based on the three fit indices (TLI, CFI, and RMSEA) in order to warrant interpretation.

The first model run examined perceived symptoms as a potential mediator of the relationship between psychosocial variables and negative outcomes (HF, cardiac, non-cardiac, all-cause hospitalizations and death). Analyses revealed that perceived symptoms did not significantly predict HF hospitalizations (see Figure 19), cardiac hospitalizations (see Figure 20), non-cardiac hospitalizations (see Figure 21), or death (see Figure 22).

We found that perceived symptoms significantly predicted all-cause hospitalizations ($\chi^2 = 1414.28$, $df = 204$, $p < .001$, RMSEA=.07, CFI=.91, TLI=.90, B=-.04, p=.03, see Figure 18). In this model, the only significant covariate was time enrolled in the study (B=.07, p=.006), not surprisingly indicating that individuals followed for a longer time in the study were more likely to be re-hospitalized. However, there were no significant paths between the latent psychosocial variables and perceived symptoms (see Table 14 for Est. and S.E.), or between the latent variables and all-cause hospitalizations (see Table 15 for Est. and S.E.). This indicates that perceived symptoms did not mediate the relationship between the psychosocial variables and all-cause hospitalizations. All necessary modifications to this model needed to improve fit were covariances between error terms associated with the following variables: LOT Pessimism

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Subscale with Cook-Medley Hostility Total State Anxiety, Trait Anger with State Anger, Self-Efficacy Score (ad-hoc scale) with LOT Optimism Subscale, and Beck Depression Inventory Scale Score with Cook-Medley Hostility Total Score.

The second model run tested whether our latent Self-Care variable successfully mediated the relationship between psychosocial variables and outcomes (HF, cardiac, non-cardiac, all-cause hospitalizations, and death). Analyses revealed that Self-Care did not significantly predict HF hospitalizations (see Figure 24), cardiac hospitalizations (see Figure 25), non-cardiac hospitalizations (see Figure 26), or all-cause hospitalizations (see Figure 27).

We found that Self-Care successfully predicted death ($\chi^2 = 175.97, df = 29, p < .001$, RMSEA=.06, CFI=.91, TLI=.93, Estimate=.17, Est. S.E.=1.39, see Figure 23). The only significant covariate within this model was age (Estimate=.01, Est. S.E.=2.38), suggesting that older individuals were more likely to be hospitalized. There were no significant paths between our latent psychosocial variables and Self-Care (see Table 16), or any significant paths between our latent psychosocial variables and death (see Table 17). This indicated that while the latent construct of Self-Care successfully predicted death, it did not mediate the relationship between our psychosocial variables and death. All necessary modifications to this model needed to improve fit were covariances between error terms associated with the following variables: LOT Optimism Subscale with KCCQ Self-efficacy score, LOT Optimism with State Anger, Efficacy (ad hoc scale) with Cook-Medley Hostility, High Contact Roles with Number of Embedded Networks, LOT Pessimism subscale with KCCQ Self-Efficacy, Avoid Salty Foods with

LOT Pessimism and Read Food Labels, and LOT Pessimism with Cook-Medley Hostility.

AIM THREE

The purpose of our third aim was to determine which mediating model is the best predictor of negative outcomes. However since neither perceived symptoms nor Self-Care mediated the relationship between our latent psychosocial predictors and our outcomes, this aim cannot be tested since the conditions needed to establish mediation are not fulfilled.

EXPLORATORY ANALYSES

To further examine whether the relationship between hostility, anger, and hospitalizations were mediated by Self-Care and perceived symptoms, we examined these constructs separately from the other psychosocial variables. We first fit a measurement model of hostility based on the model in Keith (136), which included Cynicism, Hostile Attribution, Hostile Affect, and Aggressive Responding. This model demonstrated an excellent fit (RMSEA=.02, CFI=.99, TLI=.99, see Figure 28 and Table 18 for zero order correlations). We then ran a structural model examining if perceived symptoms mediated the relationship between Hostility and outcomes. We found that perceived symptoms did not predict non-cardiac (see Figure 31) or all-cause hospitalizations (see Figure 32). Analyses revealed that perceived symptoms significantly predicted: HF hospitalizations (RMSEA=.005, CFI=.99, TLI=.99, see Figure 29), and Cardiac hospitalizations (RMSEA=.03, CFI=.98, TLI=.97, see Figure 30). However, Hostility did not significantly predict HF hospitalizations (Est= -.002, p=.87) or Cardiac Hospitalizations (Est= .003, p=.60), indicating that perceived symptoms did not mediate

this relationship. However, as reported previously Keith (136), Hostility did predict All-Cause Hospitalizations (Est= -3.3, $p \leq .001$).

We then ran a structural model to investigate the relationship between Hostility, Self-Care, and outcomes. None of these models were significant (see Figures 33-36), indicating that Self-Care did not mediate the relationship between Hostility and re-hospitalizations.

Next we ran a path model between Anger Expression Out, Trait Anger, perceived symptoms and outcomes. Our analyses revealed that perceived symptoms significantly predicted HF hospitalizations, cardiac hospitalizations (see Figures 37 and 38, respectively). These analyses also indicated that there was a trend toward demonstrating a relationship between Trait Anger and perceived symptoms ($p=.06$), when predicting HF hospitalizations. As observed previously in this data set, both Trait Anger and Anger Expression Out did not significantly predict HF hospitalizations (Est= .002, $p=.78$ and Est=.006, $p=.39$, respectively) or cardiac hospitalizations (Est= -.001, $p=.71$ and Est= .002, $p=.50$, respectively). Results indicate that there is a relationship between perceived symptoms and HF and Cardiac hospitalizations, and a trending relationship between Trait Anger and Perceived Symptoms. However, perceived symptoms do not appear to mediate the relationship between Trait Anger and hospitalizations, because there was no relationship between Trait Anger and HF and cardiac hospitalizations. Additionally, in models there was no relationship between perceived symptoms and non-cardiac hospitalizations (see Figures 39).

When examining all-cause hospitalizations, analyses revealed that there was a trend toward demonstrating a relationship between Trait Anger and perceived symptoms

(p=.06), when predicting all-cause hospitalizations. Within this same model there was a trend toward demonstrating a significant relationship between perceived symptoms and all-cause hospitalizations (p=.07). However, Trait Anger did not significantly predict all-cause hospitalizations, indicating that there is no significant mediation.

Finally, we ran additional path models to investigate the relationship between Trait Anger, Anger Expression Out, Self-Care, and the hospitalization outcomes. None of these models were significant (see Figures 41-44), indicating that Self-Care did not mediate the relationship between anger variables and hospitalizations.

CHAPTER 5: Discussion

Results of the present study indicated that the latent construct of Negative Affect was comprised of hostility, state and trait anxiety, total stress, total depression, and state and trait anger. The latent construct of Attitudes was comprised of LOT Pessimism, LOT Optimism, KCCQ Self-efficacy subscale, and an ad-hoc measure of self-efficacy. Social Support was comprised of structural (number of people in social network, number of high contact roles, and number of embedded networks) and functional (ISEL total score) support. Finally, the latent construct of Self-Care was comprised of measures of medication and diet adherence, BMI, and smoking status (physical activity had to be removed from this confirmatory factor analysis in order to improve model fit).

Although the construct of Self-Care predicted death, and perceived symptoms predicted all-cause hospitalizations, neither Self-Care nor perceived symptoms mediated the relationship between psychosocial variables and re-hospitalizations and death. There was no mediating relationship because none of the psychosocial variables predicted perceived symptoms, Self-Care or re-hospitalizations and death.

Within the exploratory analyses, perceived symptoms predicted both HF and cardiac hospitalizations. However, perceived symptoms and Self-Care did not mediate the relationship between the construct of Hostility, and individual subcomponents of Anger Expression Out, or Trait Anger. In one model Trait Anger demonstrated trending significance toward perceived symptoms, in the same model in which perceived symptoms demonstrated trending significance of all-cause hospitalizations. However, Trait Anger did not predict all-cause hospitalizations. Additionally, in the model where perceived symptoms significantly predicted HF hospitalizations, there was a trend toward

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a significant relationship between Trait Anger and perceived symptoms. Similar to analyses conducted by Keith (136), Anger Expression Out significantly predicted all-cause hospitalizations and non-cardiac hospitalizations.

The purpose of the current study was to examine whether Self-Care and perceived symptoms mediate the relationship between psychosocial variables and re-hospitalizations and death in patients with HF. In a prior study using this sample, Keith (136) found that Hostility (as a construct) and subcomponents of Anger (Anger Expression Out and Trait Anger) predicted all-cause and non-cardiac hospitalizations.. These findings prompted the in-depth look at the relationship between psychosocial variables and re-hospitalizations and death. Therefore, the current study expanded on the original study to examine the role of several psychosocial variables (Negative Affect, Social Support, and Attitudes) and their relationship with the behavioral variables involved in self-care and the cognitions of perceived symptoms. The results of each study aim will be discussed, along with broader implications of these findings. Study limitations and strengths, clinical significance and future directions will also be addressed within this discussion.

AIM 1

Aim 1 sought to determine the structure of the following higher order variables: Negative Affect, Social Support, Attitudes, and Self-Care, within a HF population. Consistent with prior literature conceptualizing Negative Affect being composed of variables representing variables related to subjective distress, the higher order variable of Negative Affect in this study was comprised of measures of state and trait anger, hostility, state and trait anxiety, depression, and perceived stress (265). This finding is

supported not only by the results obtained from confirmatory factor analysis, but also by significant correlations among the individual components of the higher order construct. The use of previously validated scales within this higher order variable provides additional confidence of the construct validity of this higher order variable. Since most research in this area has utilized predominantly Caucasian samples, results of this study confirm the structural consistency and validity of Negative Affect in a majority African American HF population.

Similar to Negative Affect, the higher order variable of Social Support is consistent with literature that describes Social Support as a multifaceted construct, comprised of both structural and functional components (21; 102; 118). This finding was supported by the confirmatory factor analysis, and significant Pearson correlations among the individual components of Social Support (total network size, number of embedded networks, number of people in embedded networks, and ISEL total score). The use of previously validated scales to construct this higher order variable increases the confidence for construct validity of Social Support within a HF population.

While this study captured the higher order variable of Attitude in a novel manner, it is consistent with Social Cognitive Theory (17). There are two aspects of the Social Cognitive Theory, outcome expectations and efficacy expectations, which is hypothesized to drive the motivation for behavior change. Outcome expectancy is an individual's belief or estimate that their behavior will lead to a particular outcome. This is theoretically similar to optimism (or inversely, pessimism) which is defined as the overall belief that good things (or bad things) will happen and can generalize to an overall confidence about life (44; 229). Efficacy expectation is the conviction or belief that an

individual can successfully engage in the necessary behaviors to produce a desired outcome, which is the basis of self-efficacy that is widely used within the literature. In sum, outcome expectancy can be conceptualized as optimism or pessimism regarding one's behavior, while efficacy expectation is an individual's sense of self-efficacy. The similarity between Social Cognitive Theory and the construct of Attitudes in this study indicates that the construct of Attitudes has a theoretical grounding.

While the convergent validity of our construct was confirmed by the confirmatory factor analysis, the content validity of our ad-hoc self-efficacy scale (Figure 11) is a limitation to our construct. However, measures of internal consistency (Cronbach's $\alpha=.90$), and convergent validity (significant Pearson's correlations seen in Table 9 and contributing to good model fit as seen in Figure 15) suggest that the ad-hoc self-efficacy scale is consistent with well validated measures of self-efficacy and theoretically grounded within the Social Cognitive Theory. Future research with this ad-hoc measure should include more formalized procedures to test its validity and reliability for use in HF research.

The construct of Self-Care was validated as a construct by the confirmatory factor analysis, however physical activity was not related to any of the measures in the zero-order analyses. Therefore, it was dropped to improve model fit. This finding indicates that the measurement of physical activity ("Have you been physically active within the last 30 days?") may not have been adequate to capture this component of self-care. Theoretically, physical activity should have remained within the model because its inclusion was grounded within Riegel et al (213) Self-Care of Heart Failure Index, which has been used widely within the literature and shown strong psychometric properties.

However, the question used to capture physical activity ("Have you been physically active within the last 30 days?") did differ from the question used in Riegel et al ("Did you take part in regular physical activity?"), which may explain why it did not remain in the model. A previously validated measure of physical activity may have more adequately captured this domain and remained within the confirmatory factor analysis, as such the absence of physical activity within our construct of Self-Care is a limitation.

In addition to physical activity, the use of BMI was a limitation in the attempt to capture the Self-Care construct in a group of patients with HF. BMI was included in our analyses as a proxy for a question on daily weighing, which is included in Riegel et al (213). The intent of including BMI was to capture whether or not patients are cognizant of their weight, as excess weight can cause complications in HF and ultimately is an important aspect of self-care (217). However it fails to capture whether patients engage in routine weight monitoring, as rapid fluctuations in weight are indicative of exacerbations in HF. Overall, BMI appears to be a poor proxy for daily weighing, which is supported by limited Pearson's correlations with additional measures of Self-Care (see Table 13). In sum, measures of physical activity and BMI appear to be inadequate measures of aspects of Self-Care within this model and have seemingly impacted the findings in our next aim. Future research should examine the construct of Self-Care with previously well-established scales.

One caveat of this conclusion is the cultural impact on self-care. Previous literature has noted that minority populations, more specifically African-American populations, are notoriously poor at self-care as measured by Riegel et al (213) Self-Care of Heart Failure Index (13; 76). However the concept of self-care within African

Americans may warrant a different conceptualization as HF has a unique progression in African Americans compared to Caucasian Americans (278). While the tenants of self-care may remain the same (e.g., low salt diet, physical activity, medication adherence), these tenants may not capture the construct of self-care as a whole and may need to include additional aspects such as the role of spirituality (76).

Despite these limitations, establishing higher order variables of Negative Affect, Attitudes, Social Support, and Self-Care within a sample that is mainly African Americans contributes significantly to a literature that is largely devoted to Caucasian samples. It also confirms that we have both reliable and valid measures with which to test the mediation models in our next aim.

AIM 2

The validation of the constructs in Aim 1 allowed us to test mediation models in Aim 2 knowing that these constructs are largely conceptually and empirically consistent. The results of these analyses did not support any mediation, because the assumptions needed to test mediation were not met. That is, there was no significant relationship between the psychosocial variables (Negative Affect, Social Support, and Attitudes) and the outcome variables (death, and re-hospitalizations). This lack of a relationship between psychosocial variables and outcomes not consistent with literature that has found a relationship between depression, anxiety, anger, functional and structural social support, optimism, and self-efficacy and negative cardiovascular outcomes such as death and re-hospitalizations (131; 135; 136; 224; 226; 234; 269). The present finding is especially surprising because previous research, using the same sample, found an association between dispositional optimism, anger, hostility, and fewer hospitalizations (136; 269).

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However, this discrepancy could be explained by the use of the latent constructs of Attitudes and Negative Affect in this study, rather than the individual components (e.g., optimism, anger) and construct (e.g., Hostility) used in the previous studies.

Additionally, there was not a significant relationship between the psychosocial variables and the mediating variables of perceived symptoms and Self-Care. This finding is also inconsistent with the broader literature, as previous studies have found an association between social support, depression, and anger with Self-Care (106; 194; 215). This finding may be attributable to limitations in the measurement of the Self-Care construct in this study, as it was found that BMI was a poor proxy for daily weighing, and physical activity failed to load in the construct. Lack of consideration of appropriate cultural factors (e.g., religion) may also play a role in the lack of association between psychosocial variables and Self-Care. Previous literature had not examined the relationship between some psychosocial variables (e.g., anxiety, optimism) and Self-Care, and one of the goals of this study was to fill this gap in the literature. However, due to the aforementioned limitations of our Self-Care construct, this study does not allow us to address this issue. It is notable that the Self-Care construct did predict death, as this is contrary to literature that has found global Self-Care to not be predictive of mortality (134; 176). However, the literature included in these reviews mainly consisted of Caucasian rather than African American samples. This may indicate that Self-Care is not only constructed but also works to impact mortality for African Americans, unlike Caucasians.

Additionally, we found that perceived symptoms predicted all-cause hospitalizations. This is consistent with prior research that found that non-cardiac death

shared similar risk factors to cardiac mortality in individuals with HF (203). The number of perceived symptoms reported by African Americans did not significantly differ from symptoms reported by Caucasians (*M*=72.58 SD=23.83 and *M*=72.74 SD=23.74, respectively). This may indicate that, in a population with multiple comorbidities, perceived symptoms are a better indicator of overall health rather than cardiovascular health alone for both African Americans and Caucasians.

The lack of association between psychosocial variables and perceived symptoms is also inconsistent with previous literature that has found a relationship between depressive and anxious symptoms and perceived symptoms (27; 84; 223; 249). However, many prior studies have largely focused on either quality of life measures (which is an aspect of perceived symptoms) (27; 249) or other measures of symptoms such as the Seattle Angina Questionnaire (that focuses on coronary artery disease) (223), which may explain the discrepancy in findings. Eisenberg et al (84) used the Minnesota Living with HF Questionnaire, which may be more accurate at capturing a wider range and a greater impact of symptoms than the KCCQ (which was used in this study) because it prompts participants to think about their symptoms over the last month compared to the KCCQ which only asks about symptoms over the last 2 weeks. Another possibility is that the disease process is so advanced in these patients and symptoms measured by the KCCQ are less susceptible to psychological influences.

Within our mediation analyses we did find that perceived symptoms predicted all-cause hospitalizations. There is little or no research examining the relationship between the KCCQ Total Symptoms score (as opposed to the Summary Score) and hospitalizations or death specifically. Therefore one goal of this study was to fill this gap

in the literature. The finding that perceived symptoms significantly predicts all-cause hospitalizations fills that gap, as it follows that individuals who perceive more physical symptoms are more likely to not only return, but be readmitted to the hospital, compared to individuals who perceive fewer physical symptoms. It is interesting that perceived symptoms only predicted all-cause hospitalizations, and not cardiac or HF related hospitalizations. This could indicate that the symptoms captured by the KCCQ are related to HF but are also largely represent the multiple co-morbidities that often accompany HF (130; 151). In sum, these symptoms appear to be capturing general health status, rather than HF symptoms alone.

Analyses also revealed that the Self-Care construct predicted death. This is consistent with the larger literature that has found a strong association between individual Self-Care components and death (e.g., sodium restriction, medication adherence) (105; 137). However, this finding is inconsistent with a study that found that a global score of self-care did not predict mortality (137). While this finding and the literature conflict, it may suggest that individual components of Self-Care, such as sodium restriction and medication adherence, may be conceptually distinct from other components, making them more powerful predictors of adverse outcomes when studied individually rather than as a construct. This is supported by the lack of individual Pearson correlations among the individual variables within our Self-Care construct and the inability of our construct to predict the readmission variables.

The overall finding of Aim 2 is that perceived symptoms and Self-Care did not mediate the relationship between psychosocial variables and negative outcomes. Although Self-Care has been shown to be directly associated with outcomes, this study is

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the first to examine whether or not perceived symptoms and Self-Care are mechanisms of action (i.e., mediators) capable of explaining the relationship between psychosocial variables and negative outcomes in a sample of HF patients. Our construct of Self-Care used different measures than have been used in previous research. Therefore this study was unable to replicate findings in the literature that suggest relationships among psychosocial variables, the proposed mediating variables, and re-hospitalizations and death.

As aforementioned, HF is a major health disparity within the United States, with African Americans displaying higher incidence, worse prognosis, and early development compared to Caucasian Americans (82; 99; 100). Despite the presence of this health disparity, there remains a shortage of research committed to examining psychosocial and biological risk factors of African Americans with HF. This study, despite its limitations, has provided an in-depth look at the interplay of psychosocial risk factors in African Americans with HF. This study has also raised questions about the applicability of previously established constructs to an African American sample.

EXPLORATORY ANALYSES

This study also sought to replicate the findings reported by Keith (120), and determine if Self-Care and perceived symptom mediated these relationships. Specifically, using the present data set, Keith (136) found that Anger Expression Out significantly predicted all-cause and cardiac hospitalizations, that Trait Anger significantly predicted non-cardiac hospitalizations, and that the construct of Hostility significantly predicted all-cause hospitalizations. The present study was successful at replicating the Keith (136) findings indicating relationships between the construct of

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Hostility, Trait Anger, Anger Expression Out, and hospitalizations. However, the findings did not support the notion that Self Care and perceived symptoms mediated these relationships because the assumptions needed to test mediation were not met. Specifically, there was no association between Hostility, the subcomponents of anger (Anger Expression Out, and Trait Anger), and both Self-Care and perceived symptoms.

While the finding that Hostility and anger subcomponents were not related to Self-Care is inconsistent with the existing literature indicating that individuals who report higher anger scores display less self-care behaviors, there has been relatively little research done in this area. In one previous study, Riegel et al (215) found that young men (aged 35-94 years) who reported high anger scores, also reported a delay in addressing their HF symptoms and difficulties with self-care maintenance (e.g., alcohol use, medication and dietary non-adherence). The lack of relationship between the subcomponents of anger and the construct of Hostility and Self-Care may be attributable to the limitations of the Self-Care construct as measured in the present study. Specifically, the limitations include the lack of physical activity within the construct and the use of BMI as a proxy for daily weighing. However, research has only begun to explore the extent to which negative affective states, such as anger and hostility, impacts Self-Care, and future research should continue to explore this relationship using the validated and reliable measure of the Self-Care construct (216).

The relationships between the subcomponents of anger, the construct of Hostility, and perceived symptoms have largely been unexamined within the literature. Instead research has primarily focused on the robust relationship between depression and perceived symptoms (27; 223). Evidence indicates that depression and HF (78), and

thereby perceived HF symptoms, share biological, psychological, and behavioral

mechanisms (e.g., self-care, social support, cytokines, sleep disruption). The lack of

relationship between anger, hostility, and perceived symptoms in the present study may

be explained by the fact that anger, hostility, and HF may have a different relationship.

Furthermore, the sample used in this study may have been too ill to have their symptom

reports significantly impacted by reports of anger or hostility. Future research should

continue to explore this relationship in a sample that is in the beginning stages of HF,

rather than the end stages.

The relationship between individual anger components and hospitalizations, is

consistent with studies that found a relationship between Anger Expression Out, Trait

Anger, and high blood pressure levels, which is a known risk factor for HF (233; 252).

Additionally, these findings are also consistent with research reporting that African

American individuals who are of lower socioeconomic status (as in the present sample)

may display above average anger are at higher risk of negative health outcomes (133).

Surprisingly, our sample displayed higher mean scores for Trait Anger and lower mean

scores for Anger Expression Out than have been found previously within the normative

sample and additional literature (205; 243). For example, Peters (205) found in sample of

82 African Americans older than 40 with a history of hypertension, that the mean score

for Spielberger (243) Trait Anger was 15.1 and the mean score for Anger Expression out

was 25.6, compared to this sample which found a mean score of 16.34 for Trait Anger

and a mean score of 14.22 for Anger Expression Out. The sample in the Peters (205)

study was significantly healthier (the participants only had a history of hypertension,

rather than a history of HF) than the sample in this study, and as a result the participants

in our sample may have been contending with more salient feelings of depression rather than anger. Additionally, the severity of illness experienced by the participants in our sample may take precedent as a determinate of symptoms, as opposed to psychological state.

One interesting aspect of the present findings is the fact that none of the anger or hostility variables were predictive of cardiac related hospitalizations. Instead, these variables predicted either all-cause or non-cardiac hospitalizations. These findings are consistent with studies that indicate that hostility is predictive of total mortality and all hospitalizations, and not just cardiovascular related events (18; 19; 208; 275). This suggests that these associations involve mechanisms common to a variety of health problems, not only cardiovascular disease. Although this study examined Self-Care and perceived symptoms as this possible mechanism, other mechanisms may be involved. These include the impact of negative affect on social support and provider relationships, risky behavior, and pathophysiological markers (e.g., cytokines).

LIMITATIONS

The findings of this study should be interpreted in light of some limitations. The largest limitation of this study is the ad-hoc nature of the Attitude and Self-Care constructs. The BETRHEART protocol was not originally designed to measure the constructs of Attitudes, or Self-Care, therefore this study made use of specific measures that were then combined using confirmatory factor analyses. For example, following the theoretical outline provided by Riegel et al (216) we included measures such as BMI, and physical activity into our original confirmatory factor analyses of Self-Care. However, modification indices indicated that physical activity did not fit with the additional

variables of Self-Care (e.g., smoking, dietary and medication adherence) and Pearson's correlations indicated that BMI was a poor proxy for daily weighing, both of which were included in the Self-Care Heart Failure Index (216). The lack of physical activity within our Self-Care construct and the lack of correlation of BMI with the other Self-Care measures, indicates that our Self-Care construct may have been measuring a different construct than Riegel's Self-Care Heart Failure Index. These findings calls into question our findings or lack thereof. Overall, the confirmatory factor analyses do provide some level of convergent validity and were largely grounded in theory, however they are limited to the pre-existing study variables, rather than previously validated and normed variables available in tools designed to measure constructs such as Attitudes, and Self-Care.

An additional limitation of this study was the advanced stage and severity of HF in this sample. The severity of this sample is evidenced by the elevated levels of BUN, creatinine, and ejection fraction, which increase HF complications and risk for mortality (12; 124; 263). Ideally research into risk factors would take place longitudinally, beginning when individuals are first diagnosed with HF, rather than during its later stages. By not examining the participants beginning at the initial diagnosis, our findings may have obscured any nuanced impact of psychological variables due to the participant's level of decompensation and disease severity. The constructs of Negative Affect, Social Support, Attitudes, and Self-Care may have shown a stronger relation to hospitalizations had the sample's physical symptoms and comorbidities not have been as severe. In other words, our sample may have been so physically decompensated that no psychosocial variable could have altered or impacted hospitalizations or death.

Another limitation of this study is the underrepresentation of females within our sample. While HF is more prevalent in men, women continue to be understudied even though their prevalence rates are increasing. Due to the lack of females within this sample, it would be inappropriate to generalize these findings to female HF patients. In addition to gender, the prevalence of African Americans also limits the generalizability of this study.

While this study represents an important step forward in helping reduce health disparities in African Americans in HF, it cannot be generalized to most other HF studies that have primarily Caucasian samples. Inherently, due to the lack of previous research into African Americans with HF, the constructs used in this study were based on models largely used with Caucasian samples, particularly the Self-Care construct. As a result, this Self-Care construct lacked appropriate cultural considerations (e.g., the role of religion in Self-Care) and cultural equivalence that may have improved not only the fit of the construct, but also revealed more relationships between Self-Care and hospitalizations. Cultural equivalence is a prerequisite for a cross-cultural comparison and acts to reduce bias inherent in psychometric tools (113). While our SEM criteria indicated good model fit in our constructs, it does not indicate best model fit, which may have been achieved with culturally equivalent measures.

Research has shown that generally, African Americans report less symptoms than Caucasians, this presents an issue when measures are used that have not been determined to be culturally equivalent (103). As a result of the underreporting of psychological symptoms and lack of cultural equivalence, measures with built in validity indicators are needed. However, there is a lack of psychological screeners that include validity

indicators designed to capture response biases. Future research should include measures with built in validity indicators (e.g., PAI, MMPI) in order to control for response bias. Furthermore, the overall lack of cultural norms for the measures used within this study, limits generalizability and the ability to draw conclusions from the results. While every study measure demonstrated good reliability and validity within a multiethnic sample, few of these studies have been replicated.

Additionally, the low socio-economic status and education level of this sample may have impacted the extent to which this sample knew what Self-Care behaviors to engage in, or had access to the appropriate Self-Care mechanisms and behaviors (e.g., access to a nearby grocery store, a safe neighborhood to exercise in, easy transportation and/or access to a pharmacy).

Lack of power is another limitation that must be taken into consideration. While there is no consensus within the literature in regards to completing a power analysis for SEM, experts do agree that there should be approximately 10 participants for every observed variable (144). Unfortunately, in some of the analyzed models (e.g., the models with Self-Care) the ratio of observed variables to participants is too large for adequate power.

Furthermore, due to the limitations of study resources, study staff did not verify any hospitalizations that occurred at hospitals other than the Baltimore Veterans Association Hospital and the University of Maryland Medical Center. The hospitalizations and their causes were self-reported by participants, and not adjudicated by a trained medical researcher. This may have impacted the correct cause of the hospitalization and resulted in less hospitalizations recorded. However, study personnel

made every attempt to verify hospitalizations with outside providers by faxing signed

release of information forms to hospitals and providing pre-paid envelopes for

transmission of hospital records. As a result, the impact of these hospitalizations on the

overall results of the study should not be significant.

CLINICAL APPLICATIONS

This study reproduced the results in Keith (136) which found that the construct of

Hostility, and the subcomponents Trait Anger, and Anger Expression Out were all

predictive of either all-cause or non-cardiac re-hospitalizations. This suggests that these

psychological variables may have broader health consequences, rather than impacting

just cardiovascular events. Instead, anger and hostility may work by negatively

influencing health care provider attitudes, biomarkers, or risky health behavior, driving

broad negative patient care outcomes. By identifying and addressing both anger and

hostility, health care providers may be able to identify those individuals at greatest risk

for re-hospitalizations and apply appropriate interventions in order to reduce

readmissions. These results suggest that health care providers should focus on the patient

as a whole, rather than the specific diagnosis of HF.

In addition to the findings related to Hostility, Trait Anger, and Anger Expression

Out, this study also found that the construct of Self-Care predicted death and the

observed variable of perceived symptoms predicted all-cause hospitalizations. The

finding that Self-Care predicts mortality, is inconsistent with previous meta-analytic and

systematic reviews that found no relation between Self-Care behaviors and mortality

(134; 176). However, these reviews primarily used studies with Caucasian samples,

rather than African American samples. This may indicate that Self-Care works differently

for African Americans than Caucasian Americans and may be an area of emphasis for health providers to focus on in order to reduce mortality. More research on the make-up of the construct of Self-Care and its impact on both hospitalizations and death is needed, with an emphasis on cultural distinctions. In regards to our finding that perceived symptoms predicted all-cause hospitalizations, it may be that within such a severely ill population, perceived symptoms are a better predictor of overall health, rather than cardiovascular health alone.

In this population with severe HF symptoms, there were no relationships among psychosocial variables, outcomes, and perceived symptoms. This suggests that psychosocial variables might only play a predictive role in outcomes when physical symptoms are of lesser severity. This might suggest that in order for physicians and behavioral health providers to lessen the negative impact of psychosocial variables, they must intervene at earlier stages of the HF process (e.g., at the time of diagnosis of hypertension or coronary heart disease).

FUTURE RESEARCH

Because of the ad hoc nature of our Self-Care measure, before reaching a firm conclusion about the role of self-care, research using a pre-established and better validated measure of Self-Care (216) is warranted. The fact that perceived symptoms and Self-Care were not mediators of outcomes in this study suggests that future research should explore other possible mechanisms of action that explain the relationship between psychosocial variables (e.g., Hostility, Anger Expression Out, Trait Anger) and hospitalizations. A possible alternative mechanism of action includes the role of physiological markers that adversely impact HF outcomes (e.g., pro-inflammatory

cytokines such as IL-6, IL-10, TNF-alpha) that are related to psychosocial variables. An

additional alternative mechanism of action might include the behaviors and/or attitudes of

health care providers, which may be impacted by patients' negative affect and

subsequently impact HF outcomes. Additionally, to fully understand the role of

psychosocial factors and their mechanisms of action, it is important for researchers to

identify a population earlier in the HF process (i.e., when they are at risk or when they are

initially diagnosed) and follow them longitudinally through the progression of the

disease.

Future research should also examine other casual paths that may better support the

data. For example, it may be that social support affects HF outcomes through decreasing

negative affect and increasing positive attitudes, suggesting a model of double mediation.

This study only examined the possibility of two causal models, however many

combinations of these constructs were left unexamined.

In summary, the present study confirmed the structure of the constructs of

Negative Affect, Social Support, Attitudes, and Self-Care within a primarily African

American HF sample. Subject to the limitations noted above, the study also revealed that

Self-Care and perceived symptoms do not appear to mediate the relationship between

psychosocial variables and hospitalizations and death. Furthermore, it also found that

perceived symptoms and Self-Care were not significant mediators of the previously

established relationships between Hostility, Anger Expression Out, Trait Anger, and re-

hospitalizations in this sample. This study's strength was the multi-racial population

containing a large percentage of African Americans. This study also provided an in-depth

look at the complex psychosocial landscape of HF patients, and examines issues not

widely studied in the broader literature.
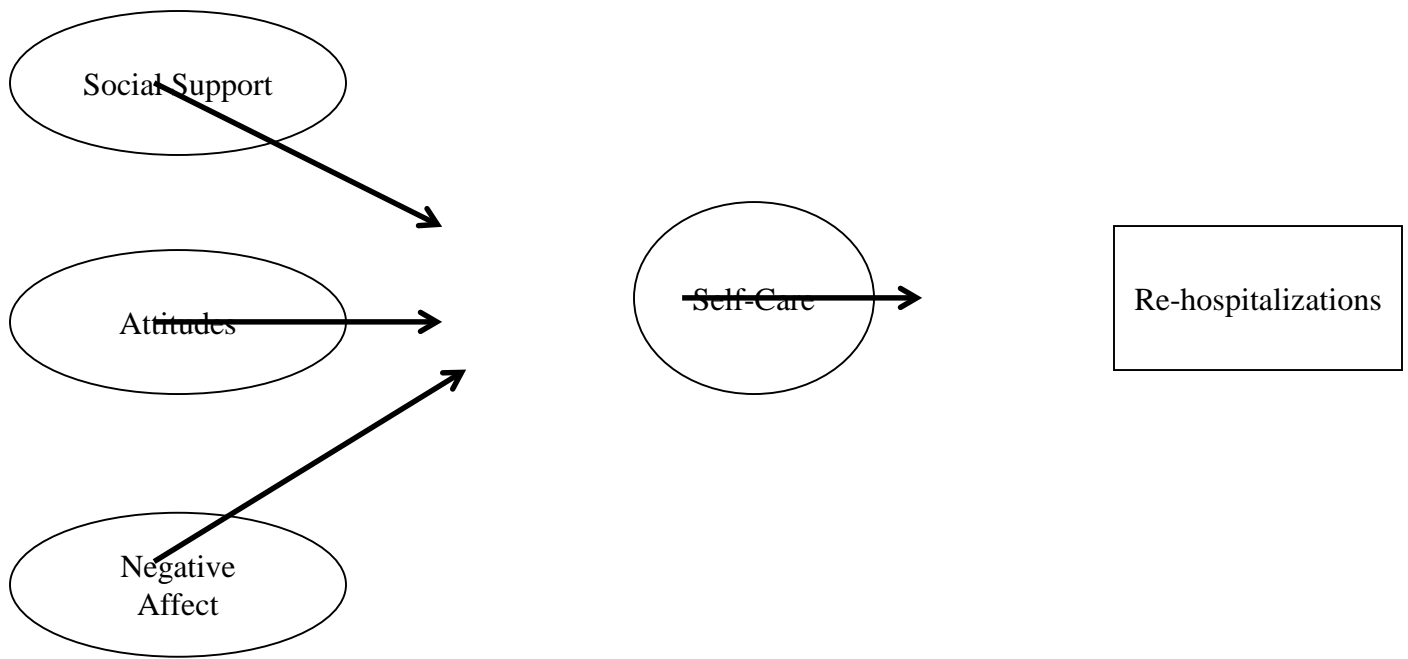
Figure 1. Proposed Model with Behaviors (Self-Care) as Mediator. All structural
equation models depict latent variables with circles and observed variables with
squares.
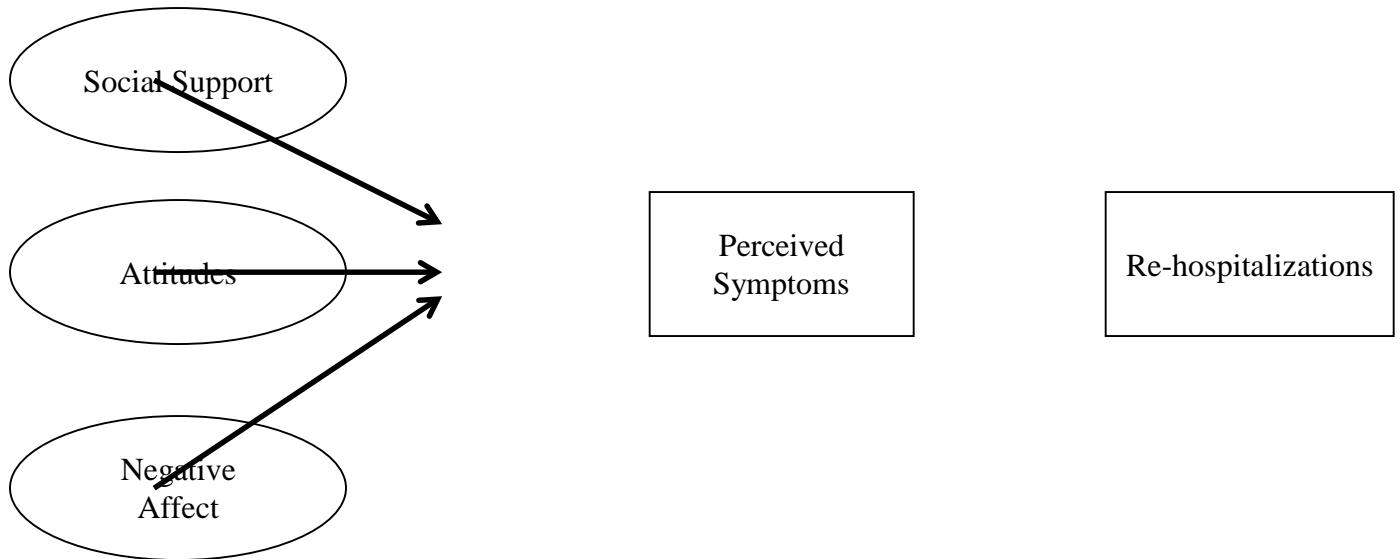
Figure 2. Proposed Model with Cognitions (perceived symptoms) as Mediator. All structural equation models depict latent variables with circles and observed variables with squares.

Figure 3. Appendix 1: Morisky Adherence Scale/BMQ (modified from Svarstad)

Did you sometimes forget to take your pills?   Yes   No

People sometimes miss taking their medications for reasons other than forgetting.
Thinking over the past two weeks, were there any days when you did not take your
medication?   Yes   No

Have you ever cut back or stopped taking your medication without telling your doctor,
because you felt worse when you took it?   Yes   No

When you travel or leave home, do you sometimes forget to bring along your
medication?   Yes   No

Did you take all of your medications yesterday?   Yes   No

When you feel like your problem is under control, do you sometimes stop taking your
medication?   Yes   No

Taking medication everyday is a real inconvenience for some people. Do you ever feel
hassled about sticking to your treatment plan?   Yes   No

How often do you have difficulty remembering to take your medications? Rarely/never
          Once in awhile   Sometimes   Usually   Always

Do you find your medication regimen confusing?   Yes   No

Do you find it difficult to remember to take your medicines?   Yes   No

How much problem or concern are you having in the following areas?
My medication causes side effects.   None   A little   A lot
It is hard to remember all the doses.   None   A little   A lot
It is hard to pay for the medication.   None   A little   A lot
It is hard to open the container.   None   A little   A lot
It is hard to get my refill on time.   None   A little   A lot
It is hard to read the print on the container.   None   A little   A lot
The dosage times are inconvenient.   None   A little   A lot
My medication causes other problems or concern.   None   A little   A lot

Do any of your medications bother you in any way?   Yes   No

Figure 4. Appendix 2: Kansas City Cardiomyopathy Questionnaire (KCCQ)

Heart failure affects different people in different ways. Some feel shortness of breath while others feel fatigue. Please indicate how much you are limited by heart failure (shortness of breath or fatigue) in you ability to do the following activities over the past 2 weeks.

Dressing yourself:

Extremely Limited	Quite a bit Limited	Moderately Limited	Slightly Limited	Not at all Limited	Limited for other reasons

Showering/Bathing:

Extremely Limited	Quite a bit Limited	Moderately Limited	Slightly Limited	Not at all Limited	Limited for other reasons

Walking 1 block on level ground:

Extremely Limited	Quite a bit Limited	Moderately Limited	Slightly Limited	Not at all Limited	Limited for other reasons

Doing yardwork, housework, or carrying groceries:

Extremely Limited	Quite a bit Limited	Moderately Limited	Slightly Limited	Not at all Limited	Limited for other reasons

Climbing a flight of stairs without stopping:

Extremely Limited	Quite a bit Limited	Moderately Limited	Slightly Limited	Not at all Limited	Limited for other reasons

Hurrying or jogging (as if to catch a bus):

Extremely Limited	Quite a bit Limited	Moderately Limited	Slightly Limited	Not at all Limited	Limited for other reasons

Compared with 2 weeks ago, have your symptoms of heart failure (shortness of breath, fatigue, or ankle swelling) changed? My symptoms of heart failure have become:

Much Worse	Slightly Worse	Not Changed	Slightly Better	Much Better	No Symptoms

Over the past 2 weeks, how many times did you have swelling in your feet, ankles or legs when you woke up in the morning?

Every Morning	3 or more times a week, but not every day	1-2 times a week	Less than once a week	Never over the past 2 weeks

Over the past 2 weeks, how much has swelling in your feet, ankles or legs bothered you? It has been…

Extremely bothersome	Quite a bit bothersome	Moderately bothersome	Slightly bothersome	Not at all bothersome	I've had no swelling

Over the past 2 weeks, on average, how many times has fatigue limited your ability to do what you want?

All of the time	Several times per day	At least once a day	3 or more times per week but not every day	1-2 times per week	Less than once a week	Never over the past 2 weeks

Over the past 2 weeks, how much has your fatigue bothered you? It has been..

Extremely bothersome	Quite a bit bothersome	Moderately bothersome	Slightly bothersome	Not at all bothersome	I've had no swelling

Over the past 2 weeks, on average, how many times has shortness of breath limited your ability to do what you wanted?

All of the time	Several times per day	At least once a day	3 or more times per week but not every day	1-2 times per week	Less than once a week	Never over the past 2 weeks

Over the past 2 weeks, how much has your shortness of breath bothered you? It has been…

Extremely bothersome	Quite a bit bothersome	Moderately bothersome	Slightly bothersome	Not at all bothersome	I've had no swelling

Over the past 2 weeks, on average, how many times have you been forced to sleep sitting up in a chair or with at least 3 pillows to prop you up because of shortness of breath?

Every night	3 or more times a week, but not every day	1-2 times a week	Less than once a week	Never over the past 2 weeks

Heart failure symptoms can worsen for a number of reasons. How sure are you that you know what to do, or whom to call, if your heart failure gets worse?

Not at all sure	Not very sure	Somewhat sure	Mostly sure	Completely sure

How well do you understand what things you are able to do to keep your heart failure symptoms from getting worse? (for example, weighing yourself, eating a low salt diet, etc.)

Do not understand at all	Do not understand very well	Somewhat understand	Mostly understand	Completely understand

Over the past 2 weeks, how much has your heart failure limited your enjoyment of life?

It has extremely limited my enjoyment of life	It has limited my enjoyment of life quite a bit	It has moderately limited my enjoyment of life	It has slightly limited my enjoyment of life	It has not limited my enjoyment of life at all

If you had to spend the rest of your life with your heart failure the way it is right now, how would you feel about this?

Not at all satisfied	Mostly dissatisfied	Somewhat satisfied	Mostly satisfied	Completely satisfied

Over the past 2 weeks, how often have you felt discouraged or down in the dumps because of your heart failure?

I felt that way all of time	I felt that way most of the time	I occasionally felt that way	I rarely felt that way	I never felt that way

How much does your heart failure affect your lifestyle? Please indicate how your heart failure may have limited your participation in the following activities over the past 2 weeks:

Hobbies, recreational activities

Severely limited	Limited quite a bit	Moderately limited	Slightly limited	Did not limit at all	Does not apply did not do for other reasons

Working or doing household chores

Severely limited	Limited quite a bit	Moderately limited	Slightly limited	Did not limit at all	Does not apply did not do for other reasons

Visiting family or friends out of your home

Severely limited	Limited quite a bit	Moderately limited	Slightly limited	Did not limit at all	Does not apply did not do for other reasons

Intimate relationships with loved ones

Severely limited	Limited quite a bit	Moderately limited	Slightly limited	Did not limit at all	Does not apply did not do for other reasons

Figure 5. Appendix 3: State-Trait Anger Inventory-II

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate value to the right of the statement to indicate how you feel *right now*. There are no right or wrong angers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Almost Never	Sometimes	Often	Almost Always
I am furious	1	2	3	4
I feel irritated	1	2	3	4
I feel angry	1	2	3	4
I feel like yelling at somebody	1	2	3	4
I feel like breaking things	1	2	3	4
I am mad	1	2	3	4
I feel like banging on the table	1	2	3	4
I feel like hitting someone	1	2	3	4
I feel like swearing	1	2	3	4
I feel annoyed	1	2	3	4
I feel like kicking somebody	1	2	3	4
I feel like cursing out loud	1	2	3	4
I feel like screaming	1	2	3	4
I feel like pounding somebody	1	2	3	4
I feel like shouting out loud	1	2	3	4

A number of statement which people have used to describe themselves are given below. Read each statement and then circle the appropriate value to the right of the statement to indicate how *you generally feel*. There are no right or wrong answers. Do no spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Almost Never	Sometimes	Often	Almost Always
I am quick tempered	1	2	3	4
I have a fiery temper	1	2	3	4
I am a hotheaded person	1	2	3	4
I get angry when slowed down by others' mistakes	1	2	3	4

I feel annoyed when not given recognition for doing good work	1	2	3	4
I fly off the handle	1	2	3	4
I say nasty things when mad	1	2	3	4
I feel furious when criticized in front of others	1	2	3	4
I feel like hitting someone when frustrated	1	2	3	4
I feel infuriated when I do a good job and get a poor evaluation	1	2	3	4

A number of statement which people have used to describe themselves are given below. Read each statement and then circle the appropriate value to the right of the statement to indicate how you *generally react when angry or furious*. There are no right or wrong answers. Do no spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Almost Never	Sometimes	Often	Almost Always
I control my temper	1	2	3	4
I express my anger	1	2	3	4
I take a deep breath and relax	1	2	3	4
I keep things in	1	2	3	4
I am patient with others	1	2	3	4
If someone is annoying, I am apt to tell him or her	1	2	3	4
I try to calm down as soon as possible	1	2	3	4
I pout or sulk	1	2	3	4
I control my urge to express angry feelings	1	2	3	4
I lose my temper	1	2	3	4
I try to simmer down	1	2	3	4
I withdraw from people	1	2	3	4
I keep cool	1	2	3	4
I make sarcastic remarks to others	1	2	3	4
I try to sooth angry feelings	1	2	3	4

I boil inside, but don't show it	1	2	3	4
I control my behavior	1	2	3	4
I do things like slam doors	1	2	3	4
I endeavor to become calm again	1	2	3	4
I tend to harbor grudges that I don't tell anyone about	1	2	3	4
I can stop from losing my temper	1	2	3	4
I argue with others	1	2	3	4
I reduce anger as soon as possible	1	2	3	4
I am secretly quite critical of others	1	2	3	4
I try to be tolerant and understanding	1	2	3	4
I strike out at whatever is infuriating	1	2	3	4
I do something relaxing to calm down	1	2	3	4
I am angrier than I am willing to admit	1	2	3	4
I control my angry feelings	1	2	3	4
I say nasty things	1	2	3	4
I try to relax	1	2	3	4
I am irritated a great deal more than people are aware of	1	2	3	4

Figure 6. Appendix 4: Cook-Medley Hostility Scale

Reach each statement and decide whether each is <u>true as applied to you or false as applied to you</u>. If a statement is <u>true or mostly true</u>, as applied to you, circle the T following the statement. If a statement is <u>false or not usually true</u>, as applied to you, circle the F following the statement. If a statement does not apply to you, or if it is something you do not know about, make no mark.

Remember to give your own opinion of yourself. <u>Do not leave any spaces blank if you can avoid it.</u>

When someone does me wrong I feel I should pay him back if I can, just for the principle of the thing.	T	F
I prefer to pass by school friends, or people I know but have not seen for a long time, unless they speak to me first.	T	F
I have often had to take orders from someone who did not know as much as I did.	T	F
I think a great many people exaggerate their misfortune in order to gain the sympathy and help from others.	T	F
It takes a lot of argument to convince most people of the truth.	T	F
I think most people would lie to get ahead.	T	F
Someone has it in for me.	T	F
Most people are honest chiefly through fear of being caught.	T	F
Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it.	T	F
I commonly wonder what hidden reason another person may have for doing something nice for me.	T	F
It makes me impatient to have people ask for my advice or otherwise interrupt me when I am working on something important.	T	F
I feel that I have often been punished without cause.	T	F

I am against giving money to beggars.	T	F
Some of my family have habits that bother and annoy me very much.	T	F
No one cares much what happens to you.	T	F
My relatives are nearly all in sympathy with me.	T	F
My way of doing things is apt to be misunderstood by others.	T	F
I don't blame anyone for trying to grab everything he can get in this world.	T	F
Most people make friends because friends are likely to be useful to them.	T	F
I am sure I am being talked about.	T	F
I am likely not to speak to people until they speak to me.	T	F
Most people inwardly dislike putting themselves out to help other people.	T	F
I tend to be on my guard with people who are somewhat more friendly than I had expected.	T	F
I have sometimes stayed away from another person because I feared doing or saying something that I might regret afterwards.	T	F
People often disappoint me.	T	F
I like to keep people guessing what I'm going to do next.	T	F
I frequently ask people for advice.	T	F
I am not easily angered.	T	F
I have often met people who were supposed to be experts who were no better than I .	T	F

I would certainly enjoy beating a crook at his own game.   T   F

It makes me feel like a failure when I hear of the success
of someone I know well.   T   F

I have at times had to be rough with people who were
rude or annoying.   T   F

People generally demand more respect for their own
Rights than they are willing to allow for others.   T   F

There are certain people whom I dislike so much that
I am inwardly pleased when they are catching it for
something they have done.   T   F

I am often inclined to go out of my way to win a point
with someone who has opposed me.   T   F

I am quite often not in on the gossip and talk of the group
I belong to.   T   F

The man who had the most to do with me when I was a
child (such as my father, stepfather, etc.) was very
strict with me.   T   F

I have often found people jealous of my good ideas, just
because they had not thought of them first.   T   F

When a man is with a woman he is usually thinking about
things related to her sex.   T   F

I do not try to cover up my poor opinion or pity of a
person so that he won't know how I feel.   T   F

I have frequently worked under people who seem to have
things arranged so that they get credit for good work but
are able to pass off mistakes onto those under them.   T   F

I strongly defend my own opinions as a rule.   T   F

People can pretty easily change me even though I
thought that my mind was already made up on a subject.   T   F

Sometimes I am sure that other people can tell me what
I am thinking.   T   F

A large number of people are guilty of bad sexual conduct.   T   F

When I take a new job, I like to be tipped off on who
should be gotten next to.   T   F

I have often felt that strangers were looking critically at me.   T   F

I can be friendly with people who do things which
I consider wrong.   T   F

It is safer to trust nobody.   T   F

I do not blame a person for taking advantage of
someone who lays himself open to it.   T   F

Figure 7. Appendix 5: Beck-Depression Inventory (II)

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

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

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

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

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

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

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

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

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

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

Agitation
    0   I am no more restless or wound up than usual.
    1   I feel more restless or wound up than usual.
    2   I am so restless or agitated that it's hard to stay still.
    3   I am so restless or agitated that I have to keep moving or doing something.

Loss of Interest
    0   I have not lost interest in other people or activities.
    1   I am less interested in other people or things than before.
    2   I have lost most of my interest in other people or things.
    3   It's hard to get interested in anything.

Indecisiveness
    0   I make decisions about as well as ever.
    1   I find it more difficult to make decisions than usual.
    2   I have much greater difficulty in making decisions than I used to.
    3   I have trouble making any decisions.

Worthlessness
    0   I do not feel I am worthless.
    1   I don't consider myself as worthwhile and useful as I used to.
    2   I feel more worthless as compared to other people.
    3   I feel utterly worthless.

Loss of Energy
    0   I have as much energy as ever.
    1   I have less energy than I used to have.
    2   I don't have enough energy to do very much.

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

Changes in Sleeping Pattern
0 I have not experienced any change in my sleeping pattern.
1a I sleep somewhat more than usual.
1b. I sleep somewhat less than usual.
2a. I sleep a lot more than usual.
2b. I sleep a lot less than usual.
3a. I sleep most of the day.
3b. I wake up 1-2 hours early and can't get back to sleep.

Irritability
0 I am no more irritable than usual.
1 I am more irritable than usual.
2 I am much more irritable than usual.
3 I am irritable all the time.

Changes in Appetite
0 I have not experienced any change in my appetite.
1a. My appetite is somewhat less than usual.
1b. My appetite is somewhat greater than usual.
2a. My appetite is much less than before.
2b. My appetite is much greater than usual.
3a. I have no appetite at all.
3b. I crave food all the time.

Concentration Difficulty
0 I can concentrate as well as ever.
1 I can't concentrate as well as usual.
2 It's hard to keep my mind on anything for very long.
3 I find I can't concentrate on anything.

Tiredness or Fatigue
0 I am no more tired or fatigued than usual.
1 I get more tired or fatigued more easily than usual.
2 I am too tired or fatigued to do a lot of things I used to do.
3 I am too tired or fatigued to do most of the things I used to do.

Loss of Interest in Sex
0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.

Figure 8. Appendix 6: Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts during the **last month.** In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

0 = Never   1 = Almost never   2 = Sometimes   3= Fairly Often   4 = Very Often

In the last month, how often have you been upset
because of something that happened unexpectedly?..................................0   1   2   3   4

In the last month, how often have you felt that you were unable
to control the important things in your life? 0   1   2   3   4

In the last month, how often have you felt nervous and "stressed"?.........0   1   2   3   4

In the last month, how often have you felt confident about your ability
to handle your personal problems? 0   1   2   3   4

In the last month, how often have you felt that things
were going your way? 0   1   2   3   4

In the last month, how often have you found that you could not cope
with all the things that you had to do?...0   1   2   3   4

In the last month, how often have you been able
to control irritations in your life? 0   1   2   3   4

In the last month, how often have you felt that you were on top
of things? 0   1   2   3   4

In the last month, how often have you been angered
because of things that were outside of your control? 0   1   2   3   4

In the last month, how often have you felt difficulties
were piling up so high that you could not overcome them? 0   1   2   3   4

Figure 9. Appendix 7: State Trait Anxiety Inventory

A number of statement which people have used to describe themselves are given below. Read each statement and then circle the appropriate value to the right of the statement to indicate how you feel right now, that is, *at this moment.* There are no right or wrong answers. Do no spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at all	Somewhat	Moderately So	Very Much So
I feel calm	1	2	3	4
I feel secure	1	2	3	4
I am tense	1	2	3	4
I feel strained	1	2	3	4
I feel at ease	1	2	3	4
I feel upset	1	2	3	4
I am presently worrying over possible misfortunes	1	2	3	4
I feel satisfied	1	2	3	4
I feel frightened	1	2	3	4
I feel comfortable	1	2	3	4
I feel self-confident	1	2	3	4
I feel nervous	1	2	3	4
I am jittery	1	2	3	4
I feel indecisive	1	2	3	4
I am relaxed	1	2	3	4
I feel content	1	2	3	4
I am worried	1	2	3	4
I feel confused	1	2	3	4
I feel steady	1	2	3	4
I feel pleasant	1	2	3	4

A number of statement which people have used to describe themselves are given below. Read each statement and then circle the appropriate value to the right of the statement to indicate how you *generally feel*. There are no right or wrong answers. Do no spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at all	Somewhat	Moderately So	Very Much So
I feel pleasant	1	2	3	4
I feel nervous and restless	1	2	3	4
I feel satisfied with myself	1	2	3	4
I wish I could be as happy as others seem to be	1	2	3	4
I feel like a failure	1	2	3	4

I am "calm, cool, and collected"	1	2	3	4
I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
I worry too much over something that really doesn't matter	1	2	3	4
I am happy	1	2	3	4
I have disturbing thoughts	1	2	3	4
I lack self-confidence	1	2	3	4
I feel secure	1	2	3	4
I make decisions early	1	2	3	4
I feel inadequate	1	2	3	4
I am content	1	2	3	4
Some unimportant thoughts runs through my mind and bothers me	1	2	3	4
I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
I am a steady person	1	2	3	4
I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

Figure 10. Appendix 8: Life Orientation Test (LOT)

Please rate each of the following items on the following scale:

    0 = strongly disagree
    1 = disagree
    2 = neutral
    3 = agree
    4 = strongly agree

Circle one number for each item:

In uncertain times, I usually expect the best.	0 1 2 3 4
It's easy for me to relax.	0 1 2 3 4
If something can go wrong for me, it will.	0 1 2 3 4
I always look on the bright side of things.	0 1 2 3 4
I'm always optimistic about my future.	0 1 2 3 4
I enjoy my friends a lot.	0 1 2 3 4
It's important for me to keep busy.	0 1 2 3 4
I hardly ever expect things to go my way.	0 1 2 3 4
Things never work out the way I want them to.	0 1 2 3 4
I don't get upset too easily.	0 1 2 3 4
I'm a believer in the idea that "every cloud has a silver lining."	0 1 2 3 4
I rarely count on good things happening to me.	0 1 2 3 4
I can learn to live with my heart problems.	0 1 2 3 4
Problems with my heart will ease in due course.	0 1 2 3 4
My state of health is gradually getting better.	0 1 2 3 4
My heart problems will always limit me whatever I do.	0 1 2 3 4

Figure 11. Appendix 9: Self-efficacy Scale

The following questions ask about whether you believe you can control different areas in your life. Use the following scale for each question: 1= Not at all; 5= Completely, you can circle any of the 5 numbers; please choose what best applies to you.

How certain are you that you will be able to:

1. Perform physical activities necessary for your job or housework

| 1 | 2 | 3 | 4 | 5 |
| Not at all | | | | Completely |

2. Control the practical consequences of your disease.

| 1 | 2 | 3 | 4 | 5 |
| Not at all | | | | Completely |

3. Stop yourself from thinking about your disease.

| 1 | 2 | 3 | 4 | 5 |
| Not at all | | | | Completely |

4. Control your emotions when reminded of your disease.

| 1 | 2 | 3 | 4 | 5 |
| Not at all | | | | Completely |

5. Communicate efficiently with your physician.

| 1 | 2 | 3 | 4 | 5 |
| Not at all | | | | Completely |

6. Understand your illness.

| 1 | 2 | 3 | 4 | 5 |
| Not at all | | | | Completely |

7. Avoid negative emotions about your illness.

| 1 | 2 | 3 | 4 | 5 |
| Not at all | | | | Completely |

8. Comply with the dietary advice to reduce risk of disease.

| 1 | 2 | 3 | 4 | 5 |

Not at all   Completely

9. Take medications at the right times.

1   2   3   4   5
Not at all   Completely

10. Exercise regularly.

1   2   3   4   5
Not at all   Completely

11. Positively influence the course of your disease.

1   2   3   4   5
Not at all   Completely

12. Maintain a healthy life-style.

1   2   3   4   5
Not at all   Completely

13. Avoid thinking about possible recurrences of your health problems.

1   2   3   4   5
Not at all   Completely

14. Take time to relax.

1   2   3   4   5
Not at all   Completely

Figure 12. Appendix 10: Social Network Index

This questionnaire is concerned with how many people you see or talk to on a regular basis including family, friends, workmates, neighbors, etc. Please read and answer each question carefully. Answer follow-up questions where appropriate.

1. Which of the following best describes your martial status?
      1) currently married and living together, or living with someone in martial-like relationship
      2) never married and never lived with someone in a martial-like relationship
      3) separated
      4) divorced or formerly lived with someone in a martial-like relationship
      5) widowed

2. How many children do you have? (If you don't have any children, check '0' and skip to question 3)

0   1   2   3   4   5   6   7or more

2a. How many of your children do you see or talk to on the phone at least once every 2 weeks?

0   1   2   3   4   5   6   7or more

3. Are either of your parents living? (If neither is living, check '0' and skip to question 4)
      0) neither   1) mother only 2) father only 3) both

3a. Do you see or talk on the phone to either of your parents at least once every 2 weeks?
      0) neither   1) mother only 2) father only 3) both

4. Are either of your in-laws (or partner's parents) living? (If you have non, check the appropriate space and skip to question 5)
      0) neither   1) mother only 2) father only 3) both 4)N/A

4a. Do you see or talk on the phone to either of your partner's parents at least once every 2 weeks?
      0) neither   1) mother only 2) father only 3) both

5. How many other relatives (other than your spouse, parents and children) do you feel close to? (If '0', check that space and skip to question 6)

0   1   2   3   4   5   6   7or more

5a. How many of these relatives do you see or talk to on the phone at least once every 2 weeks?

0   1   2   3   4   5   6   7or more

6. How many close friends do you have? (meaning people that you feel at ease with, can talk to about private matters, and can call on for help)

0   1   2   3   4   5   6   7or more

6a. How many of these friends do you see or talk to at least once every 2 weeks?

0   1   2   3   4   5   6   7or more

7. Do you belong to a church, temple, or other religious group? (If not, check 'no' and skip to question 8)

No   Yes

7a. How many members of your church or religious group do you talk to at least once every 2 weeks? (This includes at group meetings and services.)

0   1   2   3   4   5   6   7or more

8. Do you attend any classes (school, university, technical training, or adult education) on a regular basis? (If not, check 'no' and skip to question 9.)

No   Yes

8a. How many fellow students or teachers do you talk to at least once every 2 weeks? (This includes at class meetings.)

0   1   2   3   4   5   6   7or more

9. Are you currently employed either full or part-time? (if not, check 'no' and skip to question 10.)

No   Yes, self-employed   Yes, employed by others

9a. How many people do you supervise?

0   1   2   3   4   5   6   7or more

9b. How many people at work (other than those you supervise) do you talk to at lest once every 2 weeks?

0   1   2   3   4   5   6   7or more

10. How many of your neighbors do you visit or talk to at least once every 2 weeks?

0   1   2   3   4   5   6   7or more

11. Are you currently involved in regular volunteer work? (If not, check 'no' and skip to question 12.)

No   Yes

11a. How many people involved in this volunteer work do you talk to about volunteering-related issues at least once every 2 weeks?

0   1   2   3   4   5   6   7or more

12. Do you belong to any groups in which you talk to one or more members of the group about group-related issues at least once every 2 weeks? Examples include social clubs, recreational groups, trade unions, commercial groups, professional organizations, groups concerned with children like the PTA or Boy Scouts, groups concerned with community

service, etc. (If you don't belong to any such groups, check 'no' and skip the section below.)

   No Yes

Consider those groups in which you talk to a fellow group member at least once every 2 weeks. Please provide the following information for each such group: the name or type of group and the total number of members in that group that you talk to at least once every 2 weeks.

1.

2.

3.

4.

5.

6.

Figure 13. Appendix 11: Interpersonal Support Evaluation List (ISEL)

This scale is made up of a list of statement each of which may or may not be true about you. For each statement circle "definitely true" if you are sure it is true about you and "probably true" if you think it is true but are not absolutely certain. Similarly, you should circle "definitely false" if you are sure the statement is false and "probably false" if you think it is false but are not absolutely certain.

If I wanted to go on a trip for a day (for example, to the country or mountains), I would have a hard time finding someone to go with me.

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

I feel that there is no one I can share my most private worries and fears with.

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

If I were sick, I could easily find someone to help me with my daily chores.

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

There is someone I can turn to for advice about handling problems with my family.

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

If I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me.

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

When I need suggestions on how to deal with a personal problem, I know someone I can turn to.

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

I don't often get invited to do things with others.

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

If I had to go out of town for a few weeks, it would be difficult to find someone who would look after my house or apartment (the plants, pets, garden, etc.).

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

If I wanted to have lunch with someone, I could easily find someone to join me.
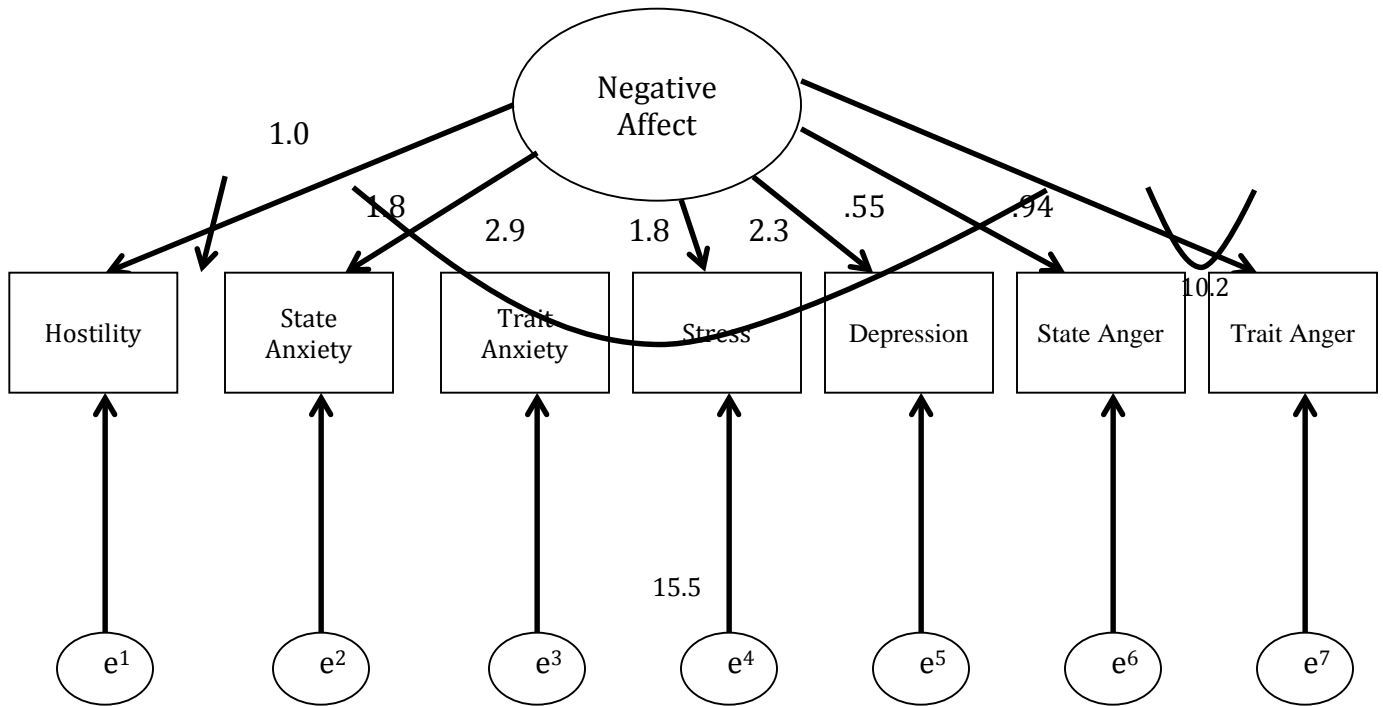
1	2	3	4

Definitely False   Probably False   Probably True   Definitely True

If I was stranded 10 miles from home, there is someone I could call who could come and get me.

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it.

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

If I needed some help in moving to a new house or apartment, I would have a hard time finding someone to help me.

1	2	3	4
Definitely False	Probably False	Probably True	Definitely True

Figure 14. Confirmatory Factor Analysis of Negative Affect.
Negative Affect is the latent variable and the observed variables are represented with boxes. The path loadings presented above are estimates and all paths above are significant to $p<.05$ level.
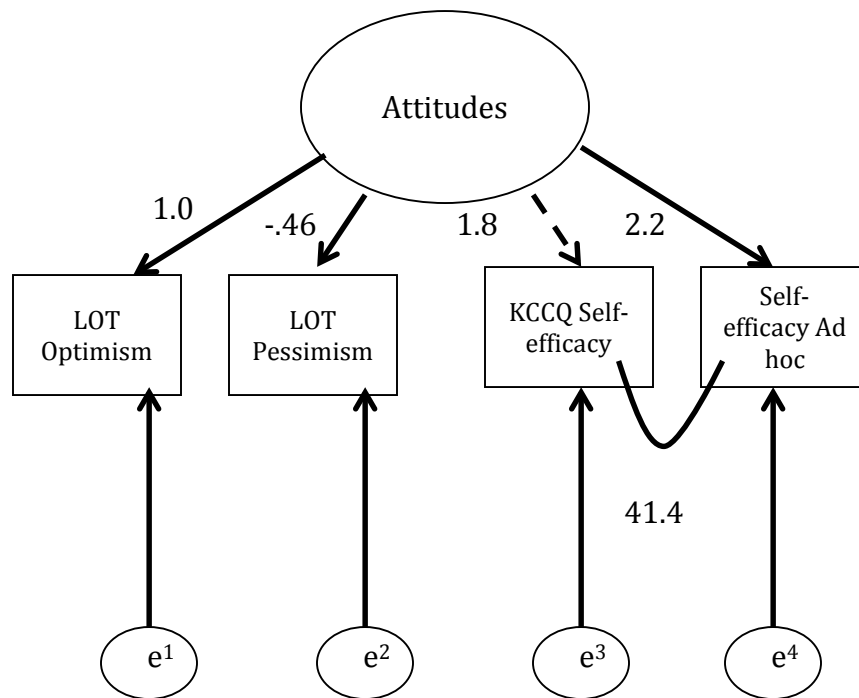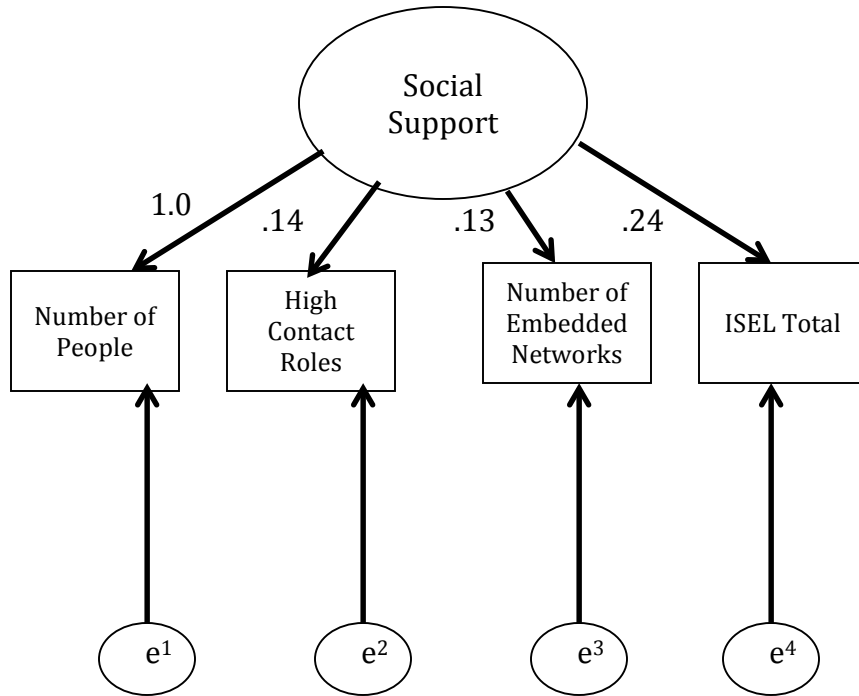
Figure 15. Confirmatory Factor Analysis of Attitude.
Attitude is the latent variables and the boxes represent all of the observed variables. The path loadings presented above are estimates and the solid lines represent significant paths at $p<.05$. The dashed line represents a non-significant path.
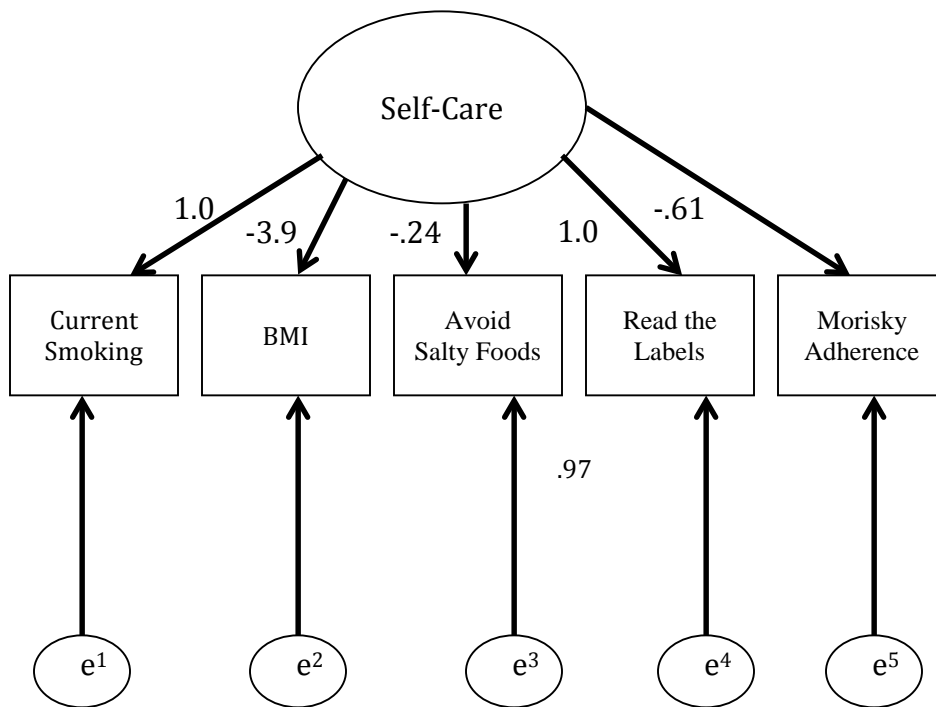
Figure 16. Confirmatory Factor Analysis of Social Support.
Social Support is the latent variable and boxes represent all of the observed variables.
The path loadings presented above are estimates and the solid lines represent significant
paths at $p<.05$.

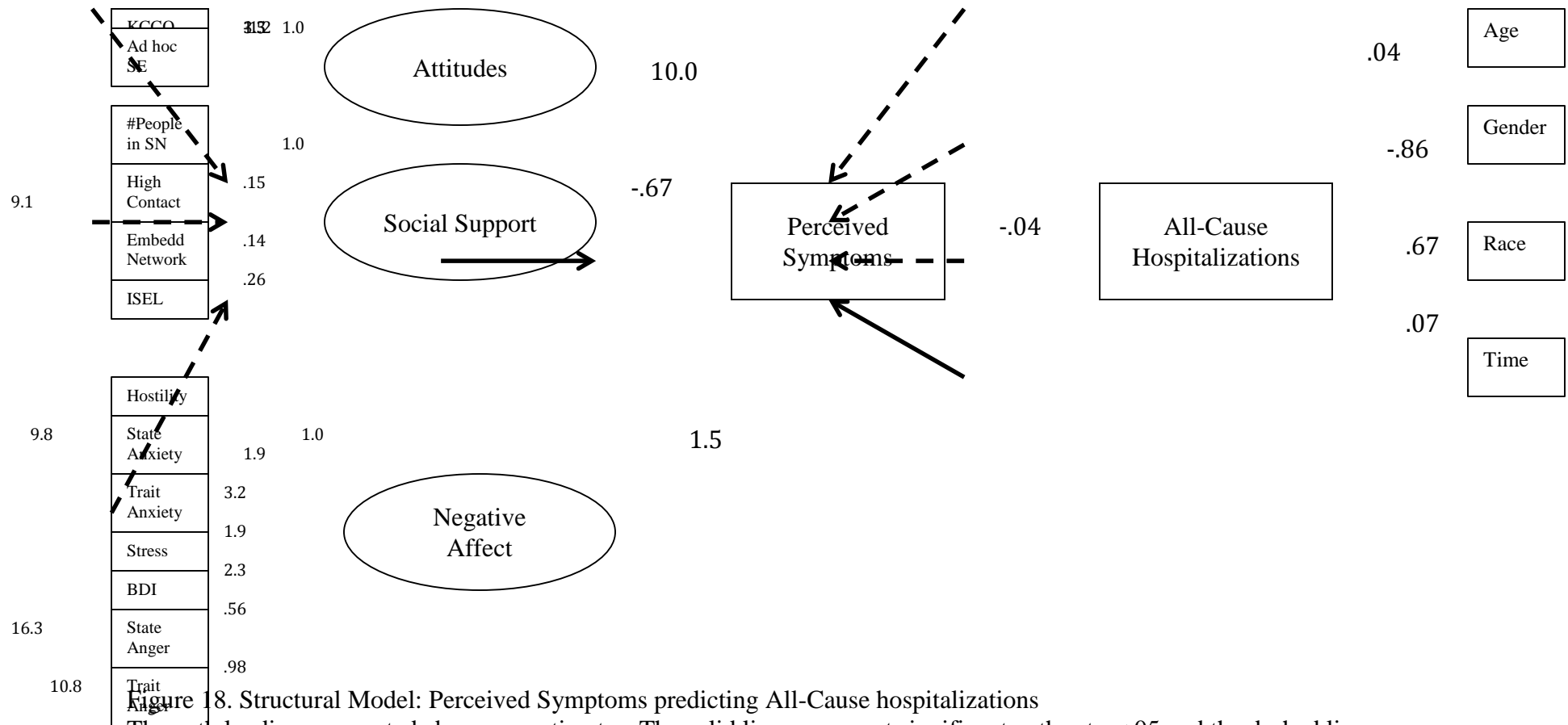Figure 17. Confirmatory Factor Analysis of Self-Care.
Self-Care is the latent variable and boxes represent all of the observed variables. The path loadings presented above are estimates and the solid lines represent significant paths at *p*<.05.

Figure 18. Structural Model: Perceived Symptoms predicting All-Cause hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at *p*<.05 and the dashed lines represent all non-significant paths. All-cause hospitalization *n*=484 (data winsorized).
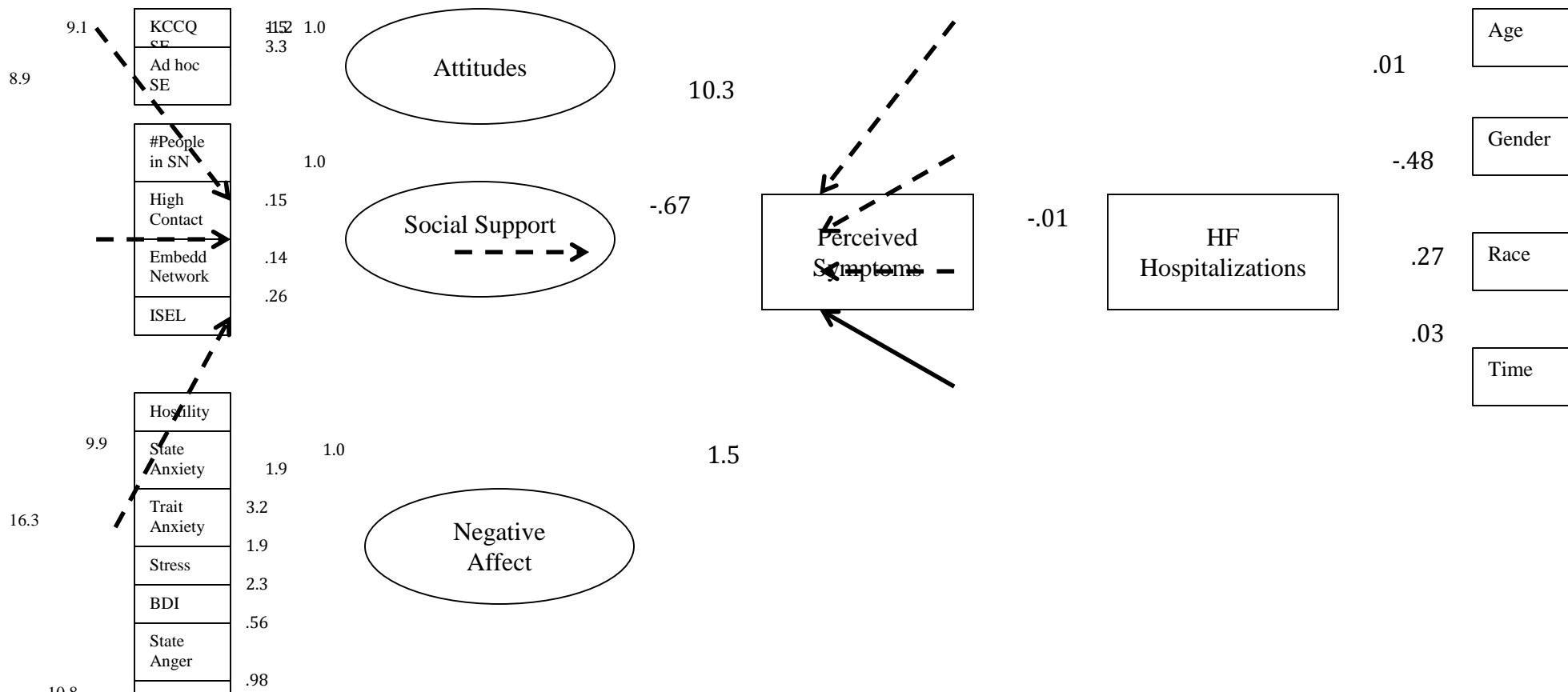
Figure 19. Structural Model: Perceived Symptoms predicting HF hospitalizations

The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. HF hospitalization *n*=165 (data winsorized).
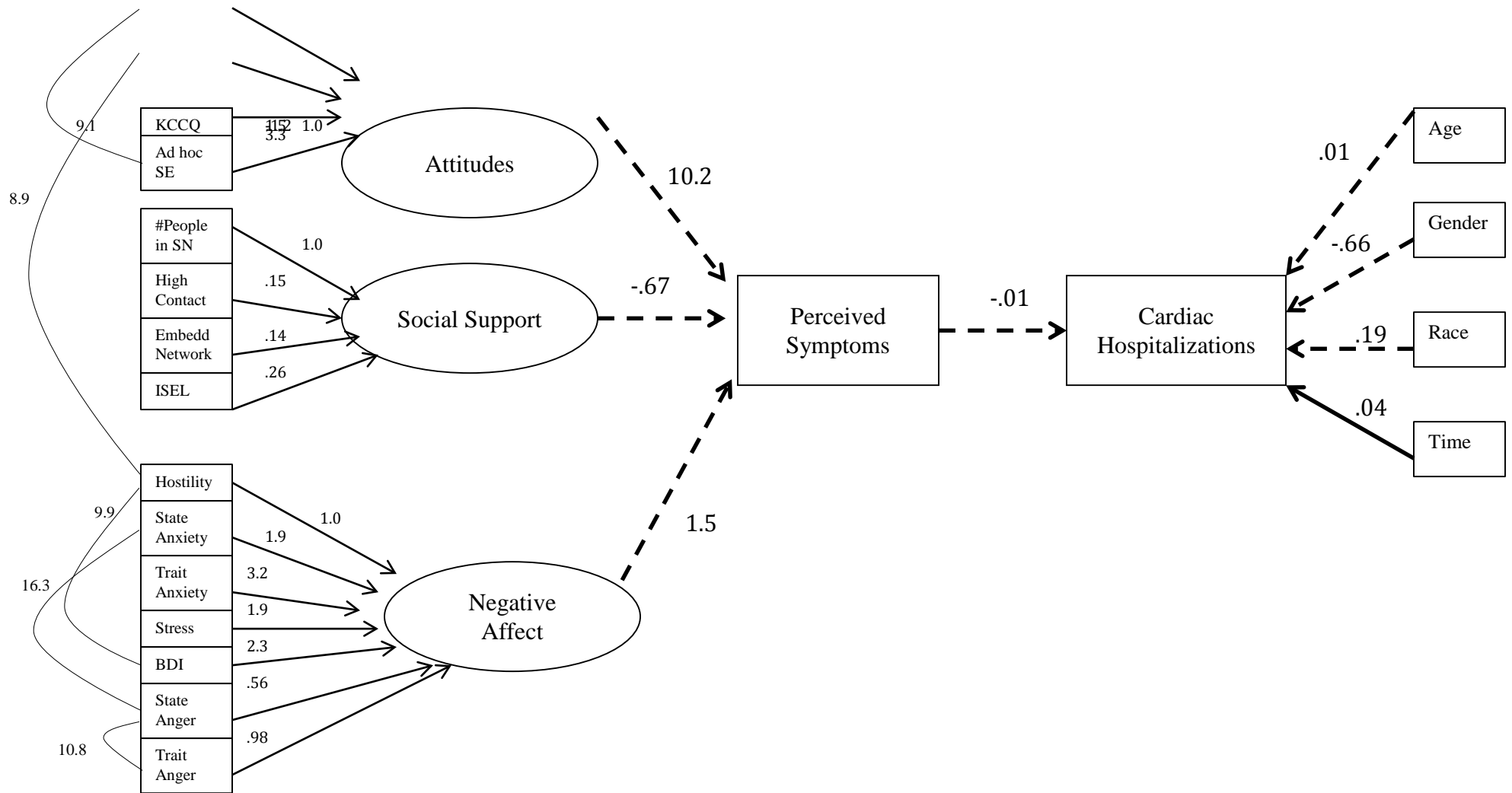
Figure 20. Structural Model: Perceived Symptoms predicting Cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. Cardiac hospitalization *n*=248 (data winsorized).
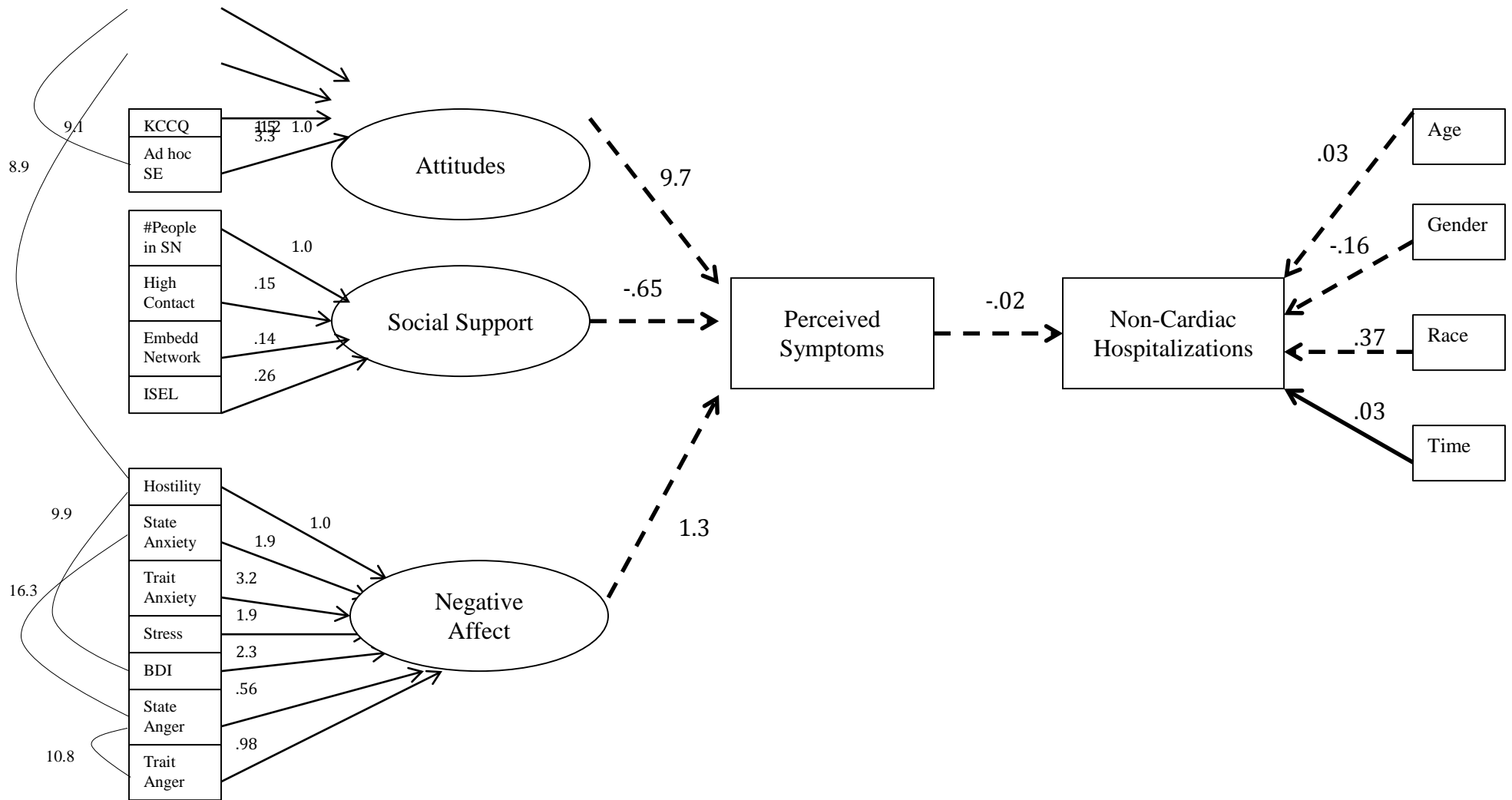
Figure 21. Structural Model: Perceived Symptoms predicting Non-cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. Non-cardiac hospitalization *n*=215 (data winsorized).
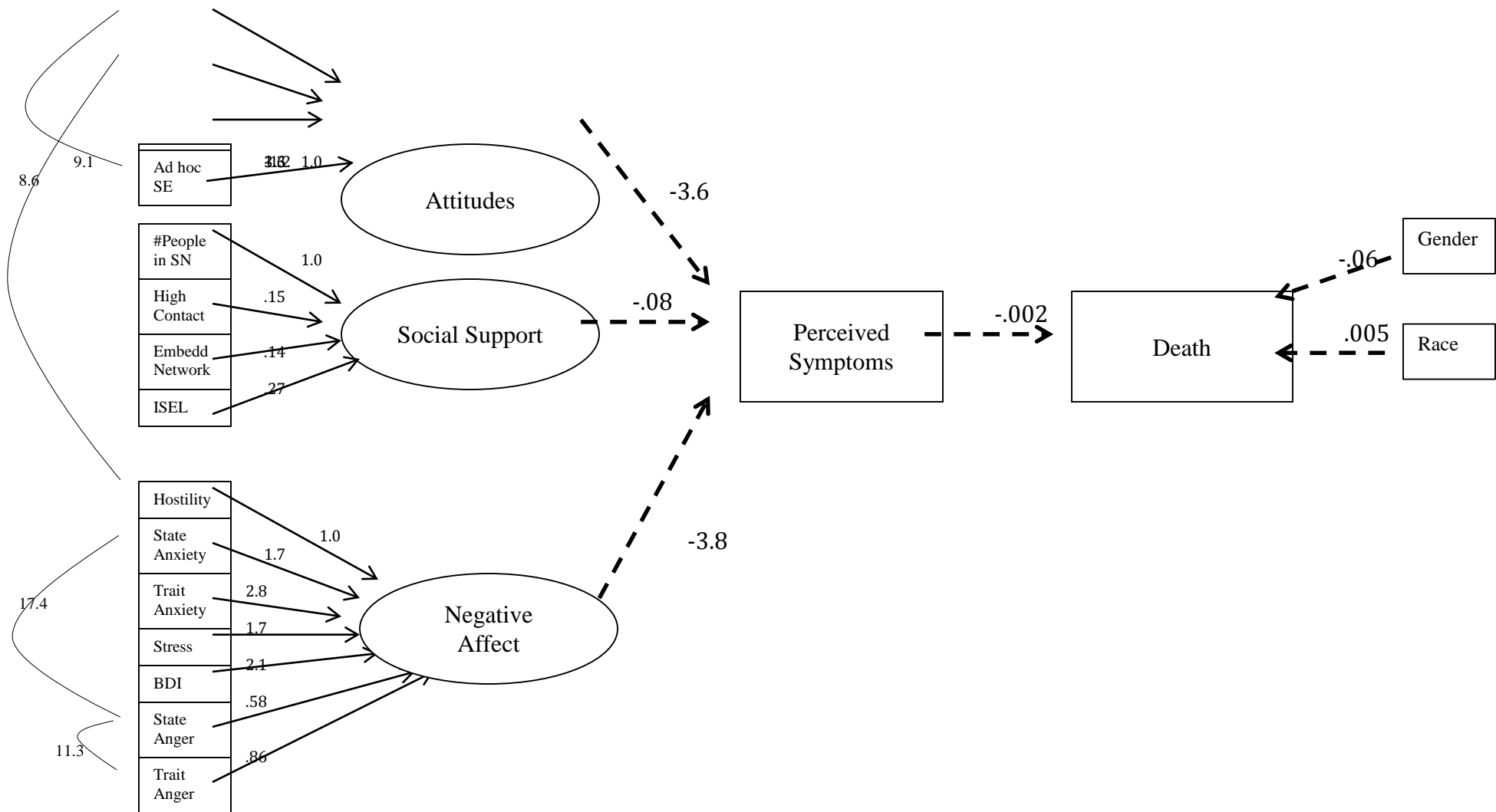
Figure 22. Structural Model: Perceived Symptoms predicting Death
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. Death *n*=32.
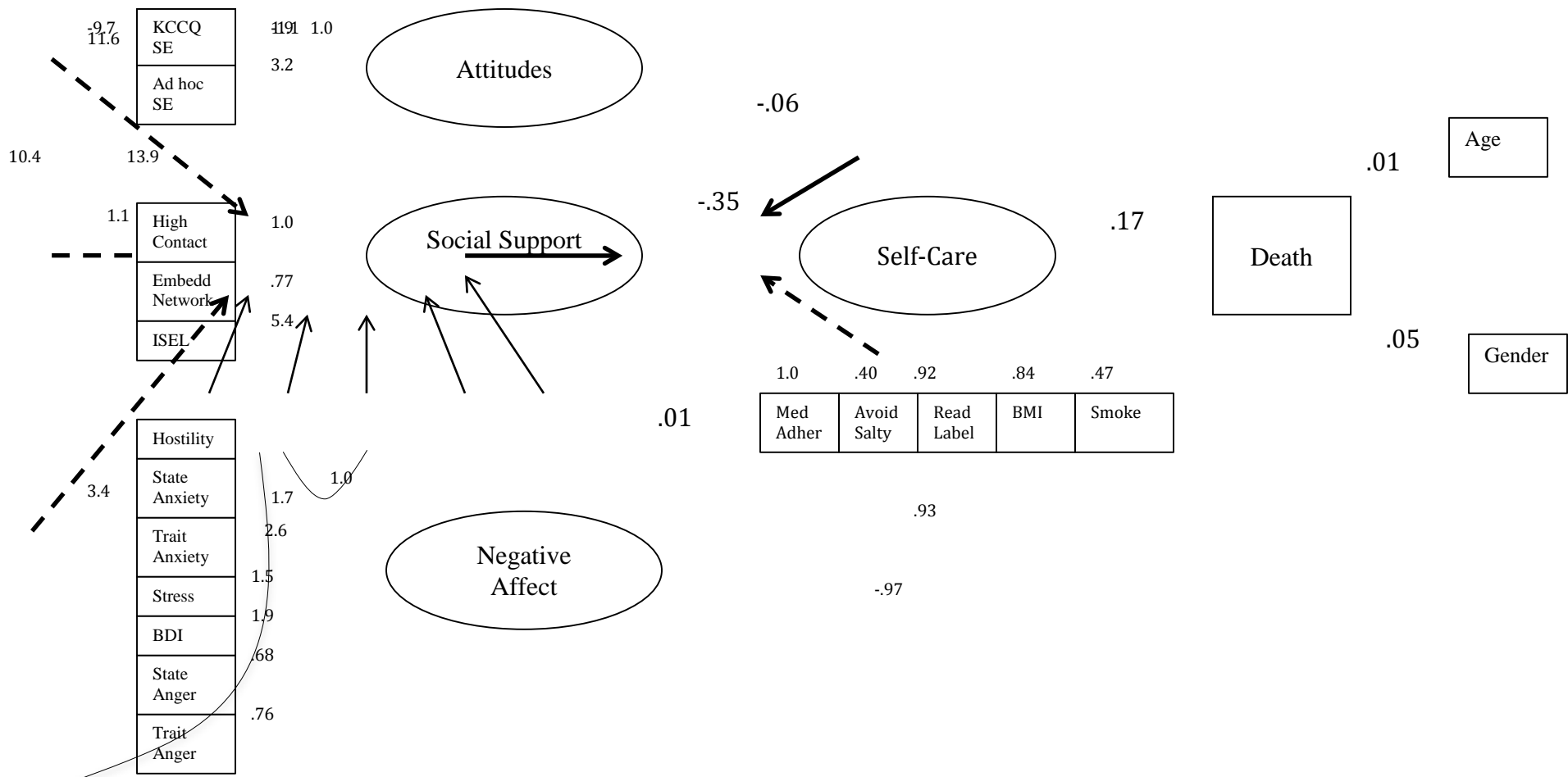
Figure 23. Structural Model: Self-Care predicting Death
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. Death *n*=32.
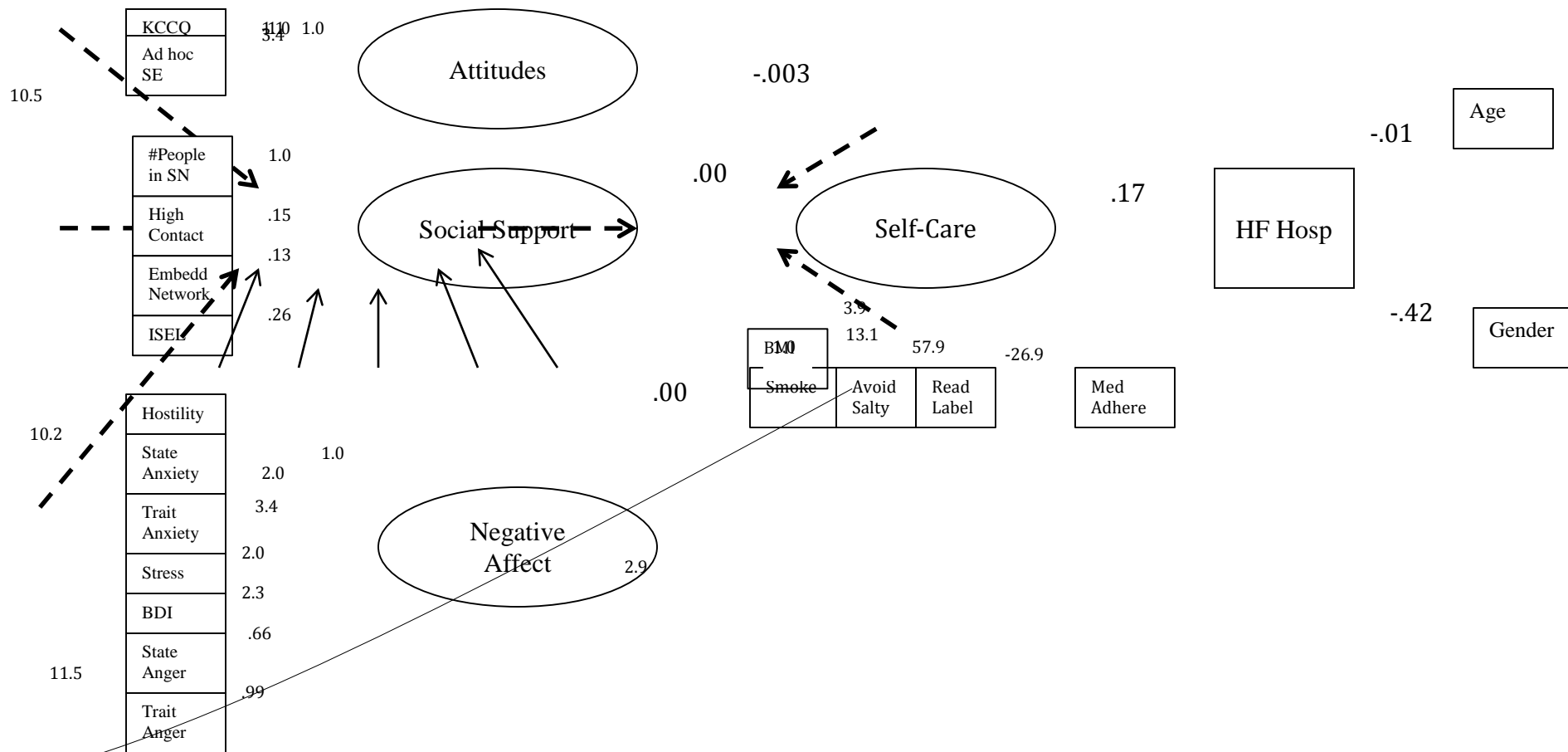
Figure 24. Structural Model: Self-Care predicting HF hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. HF hospitalization *n*=165 (data winsorized).

Figure 25. Structural Model: Self-Care predicting Cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. Cardiac hospitalization *n*=248 (data winsorized).

Figure 26. Structural Model: Self-Care predicting Non-cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. Non-cardiac hospitalization n=215 (data winsorized).

Figure 27. Structural Model: Self-Care predicting All-cause hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. All-cause hospitalizations *n*=448 (data winsorized).

Figure 28. Measurement Model for Hostility
The path loadings presented above are estimates, all paths are significant at p<.05.

Figure 29. Structural Model: Hostility and Perceived Symptoms with HF hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. HF hospitalizations *n*=165 (data winsorized).
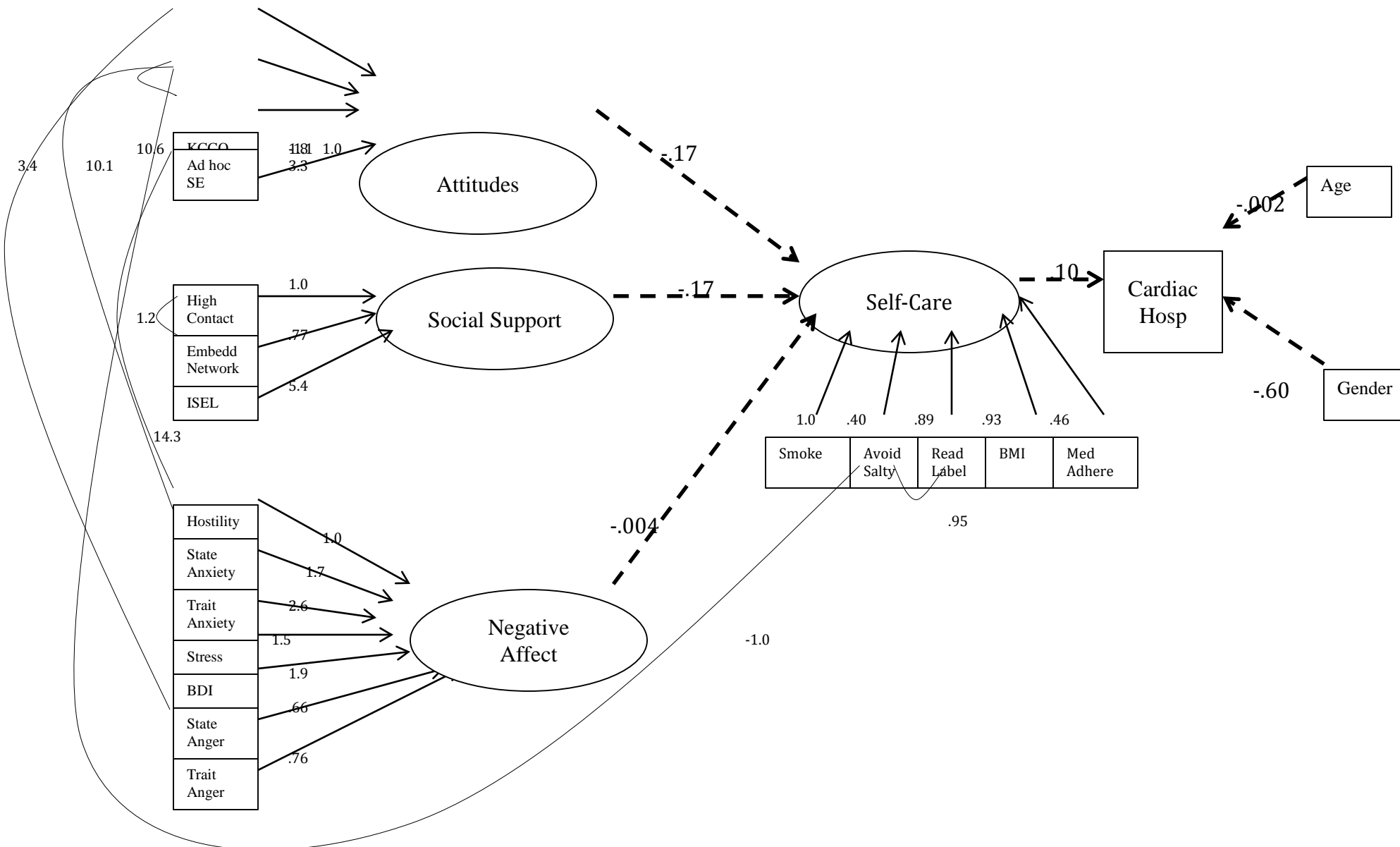
Figure 30. Structural Model: Hostility and Perceived Symptoms with Cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. Cardiac hospitalizations n=248 (data winsorized).
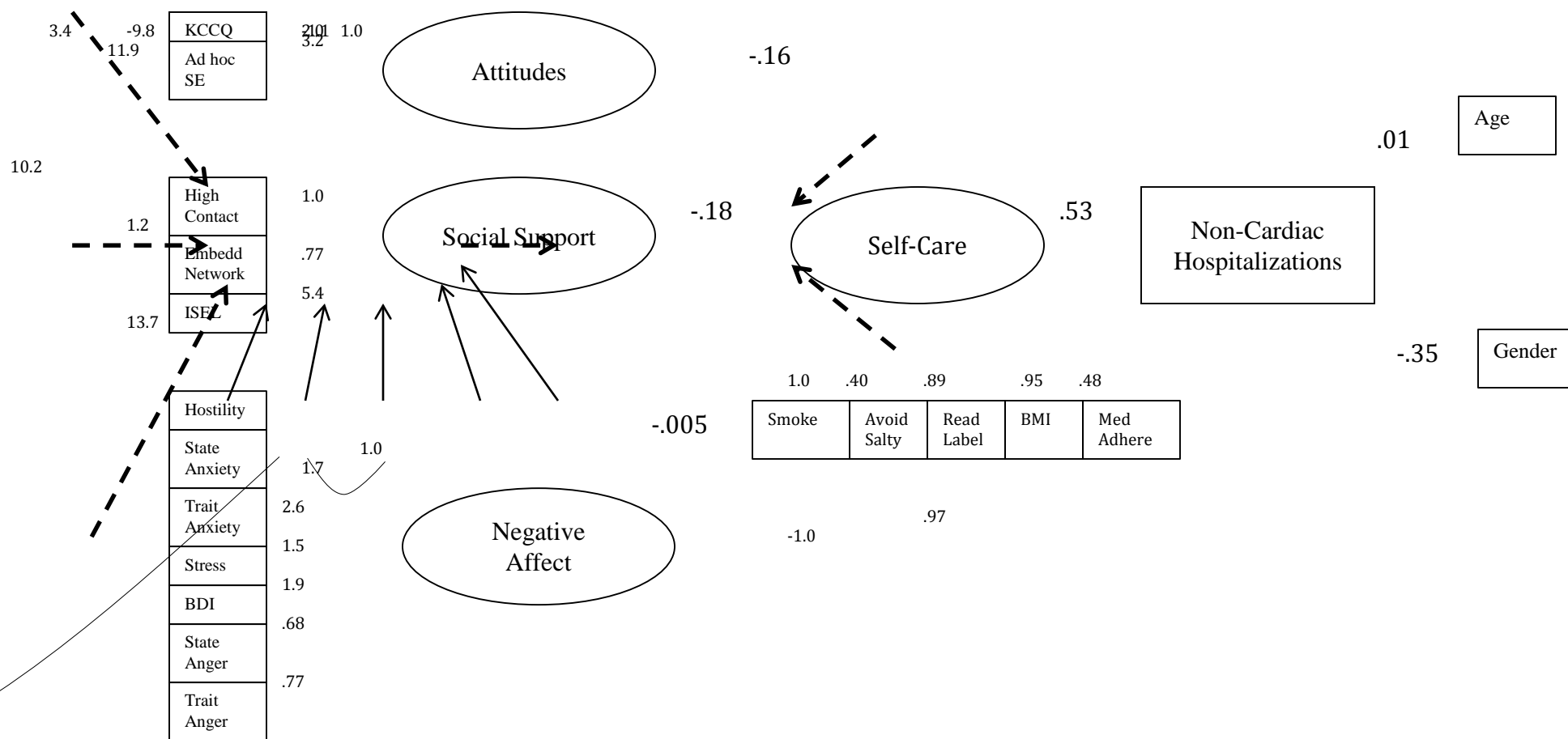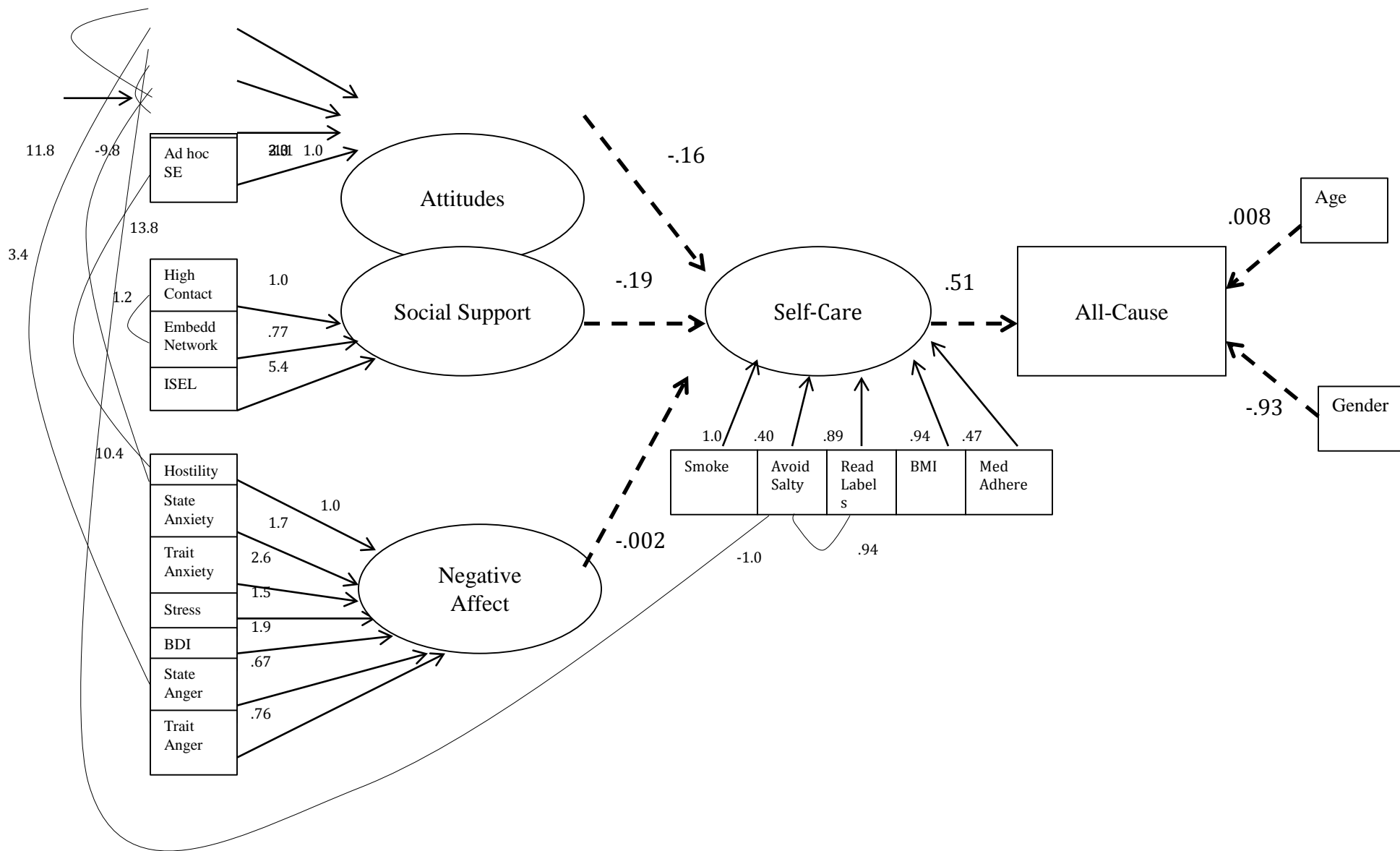
Figure 31. Structural Model: Hostility and Perceived Symptoms with Non-cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. Non-cardiac hospitalizations *n*=215 (data winsorized).

Figure 32. Structural Model: Hostility and Perceived Symptoms with All-cause hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. All-cause hospitalizations *n*=448 (data winsorized).
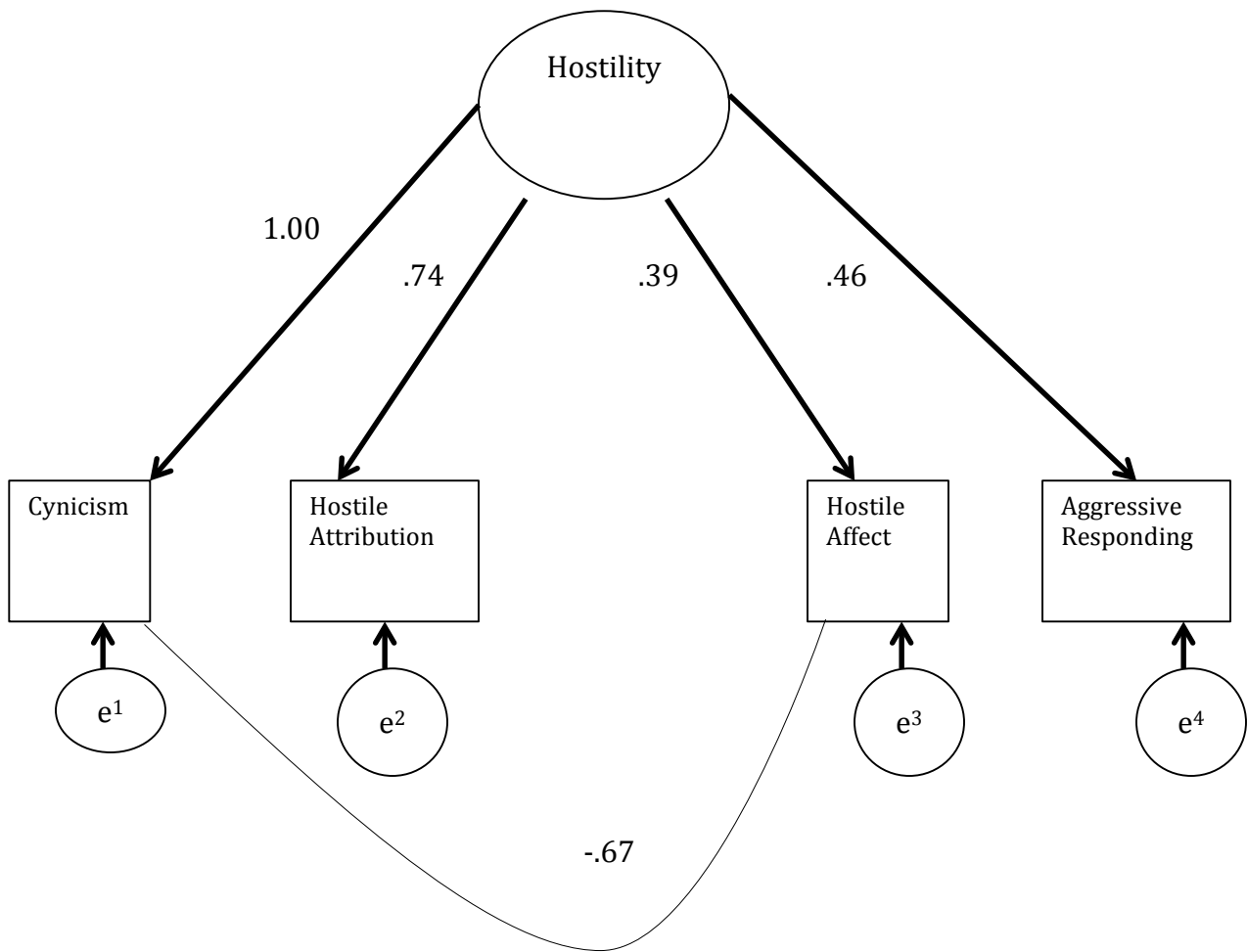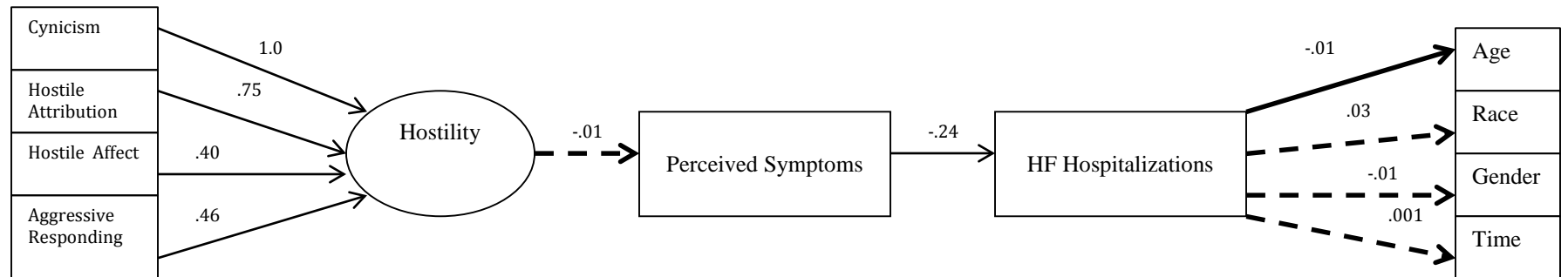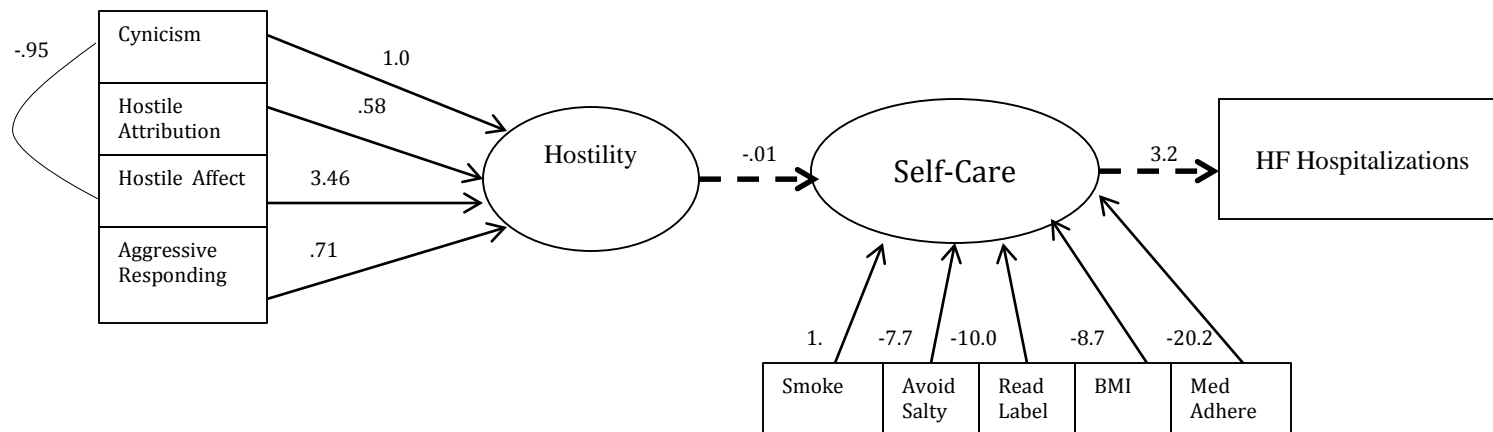
Figure 33. Structural Model: Hostility and Self-Care with HF hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. HF hospitalizations *n*=165 (data winsorized).

Figure 34. Structural Model: Hostility and Self-Care with Cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. Cardiac hospitalizations *n*=248 (data winsorized).
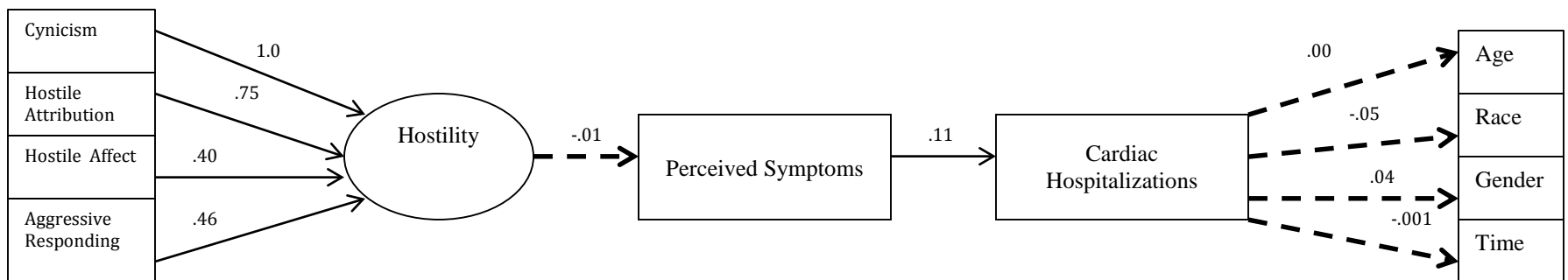
Figure 35. Structural Model: Hostility and Self-Care with Non-cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. Non-cardiac hospitalizations n=215 (data winsorized).

Figure 36. Structural Model: Hostility and Self-Care with All-cause hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at p<.05 and the dashed lines represent all non-significant paths. All-cause hospitalizations *n*=448 (data winsorized).
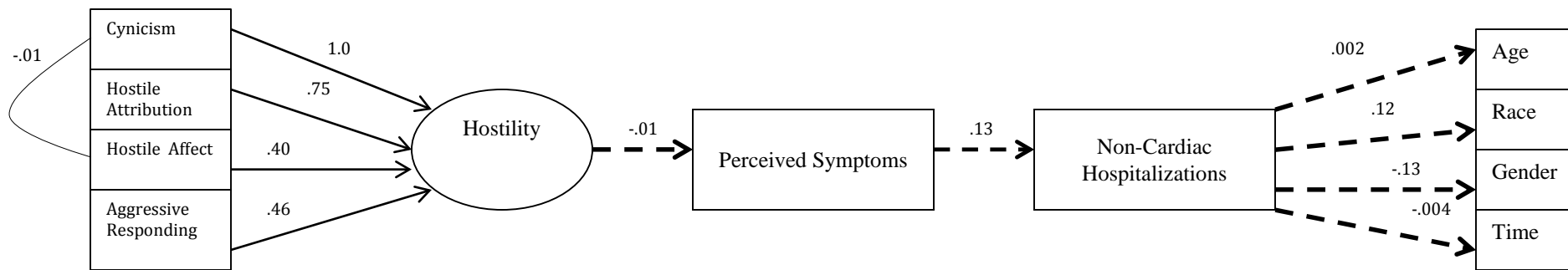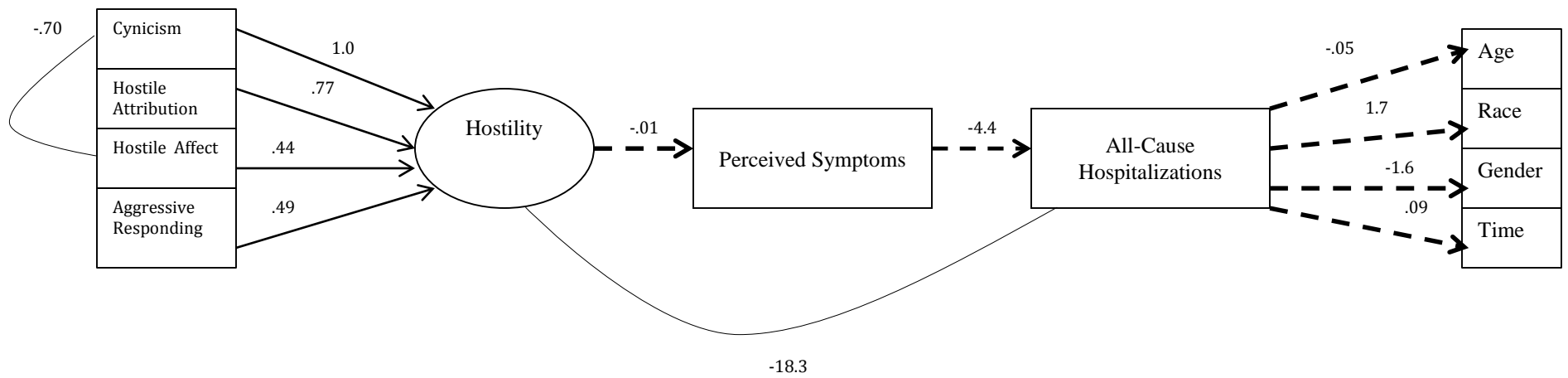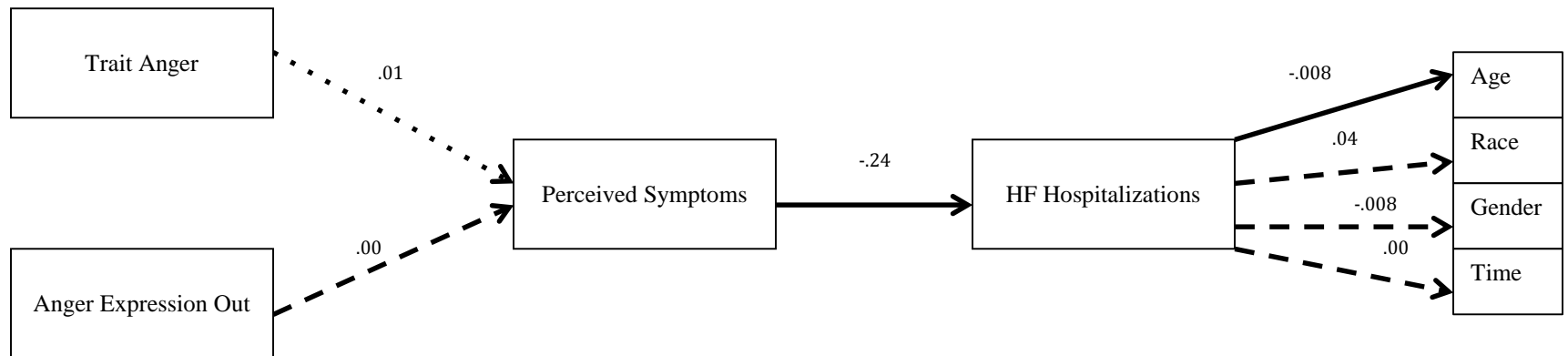
Figure 37. Path Model: Anger Expression Out and Trait Anger and Perceived Symptoms with HF hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at $p<.05$ and the dashed lines represent all non-significant paths. The smaller dashed lines represent a trending significance $p=.06$. HF hospitalizations $n=165$ (data winsorized).
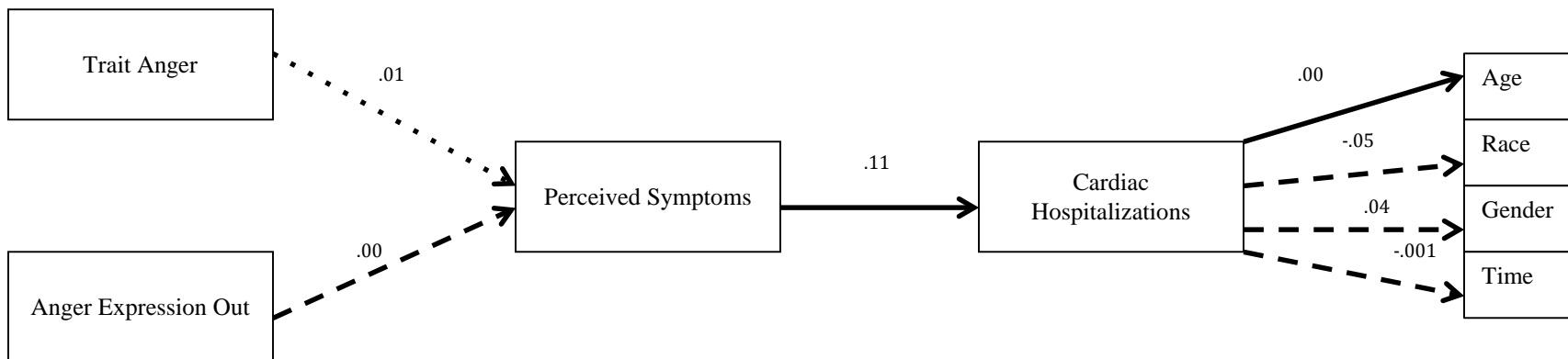
Figure 38. Path Model: Anger Expression Out and Trait Anger and Perceived Symptoms with Cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at $p<.05$ and the dashed lines represent all non-significant paths. The smaller dashed lines represent a trending significance $p=.06$. Cardiac hospitalizations $n=248$ (data winsorized).
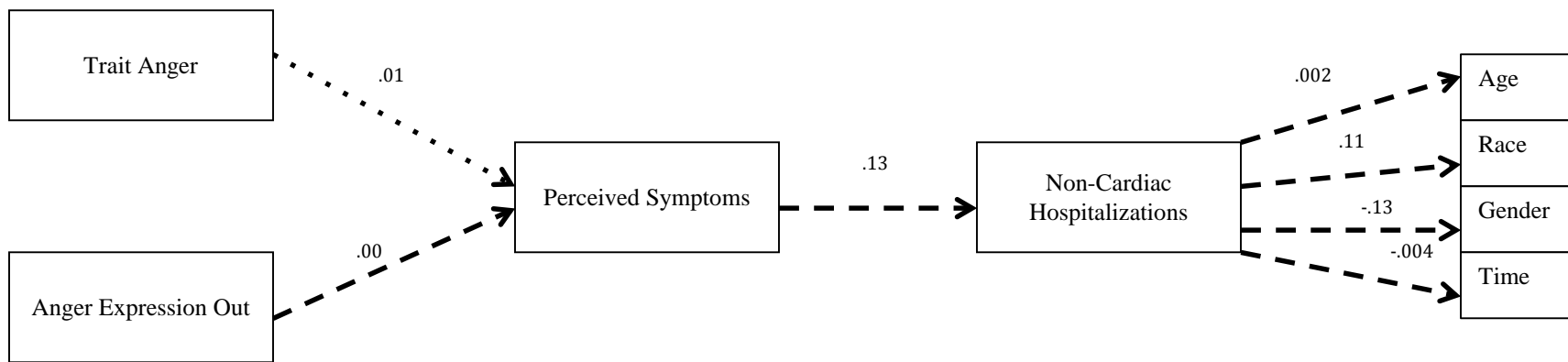
Figure 39. Path Model: Anger Expression Out and Trait Anger and Perceived Symptoms with Non-Cardiac hospitalizations

The path loadings presented above are estimates. The solid lines represent significant paths at *p*<.05 and the dashed lines represent all non-significant paths. The smaller dashed lines represent a trending significance *p*=.06. Non-cardiac hospitalizations *n*=215 (data winsorized).
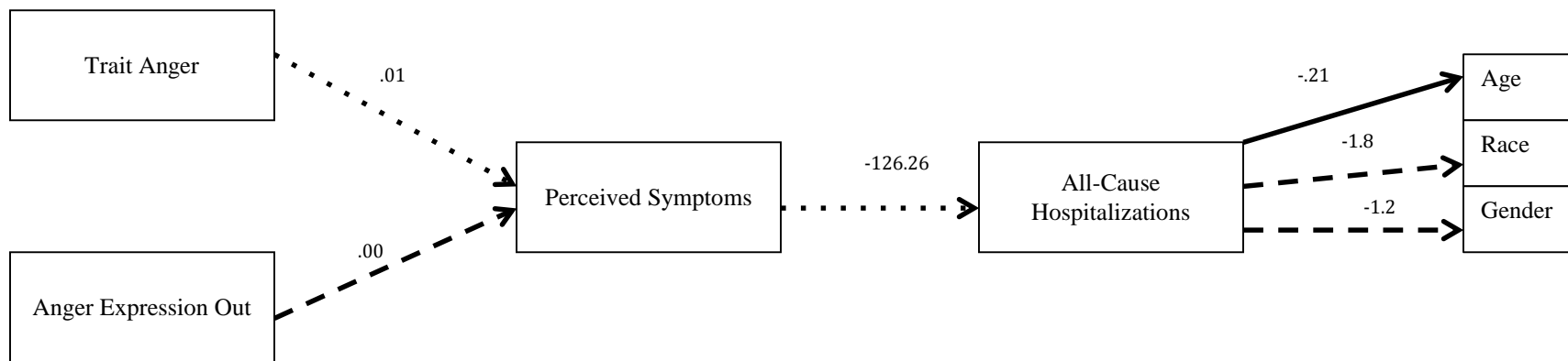
Figure 40. Path Model: Anger Expression Out and Trait Anger and Perceived Symptoms with All-Cause
hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at *p*<.05 and the dashed
lines represent all non-significant paths. The smaller dashed lines represent a trending significance *p*=.06. All-cause
hospitalizations *n*=448 (data winsorized).
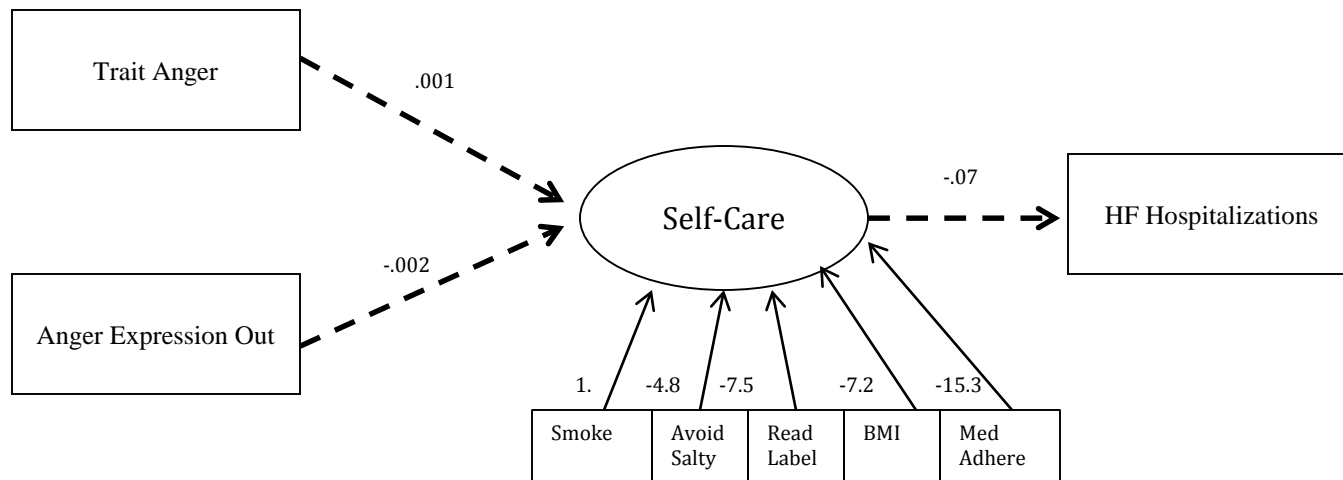
Figure 41. Structural Model: Anger Expression Out and Trait Anger and Self-Care with HF hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at $p<.05$ and the dashed lines represent all non-significant paths. HF hospitalizations $n=165$ (data winsorized).
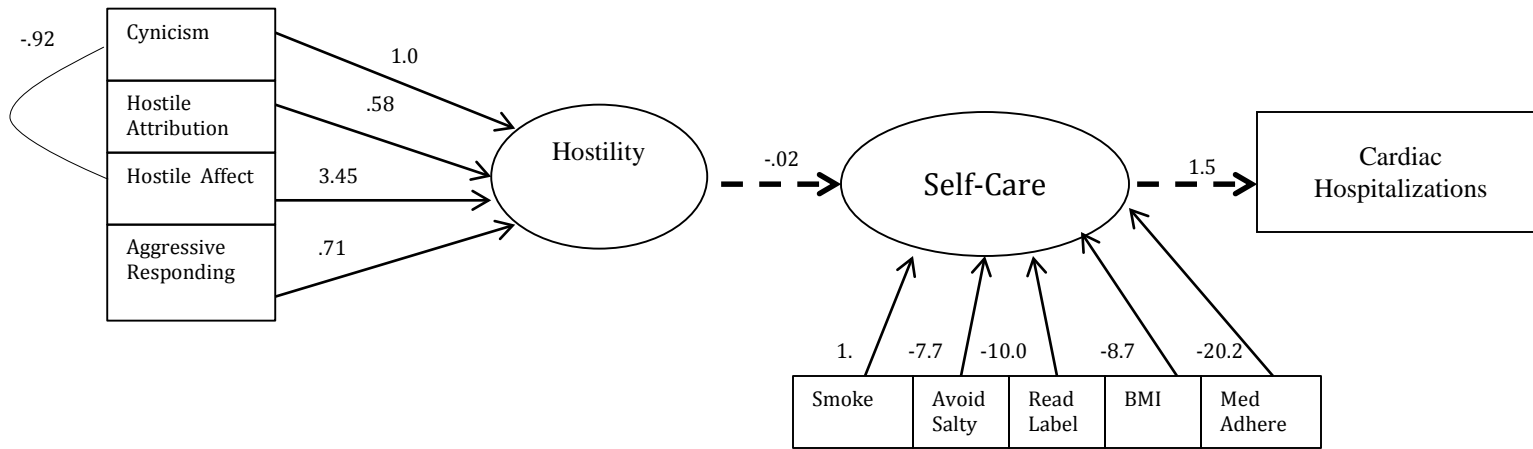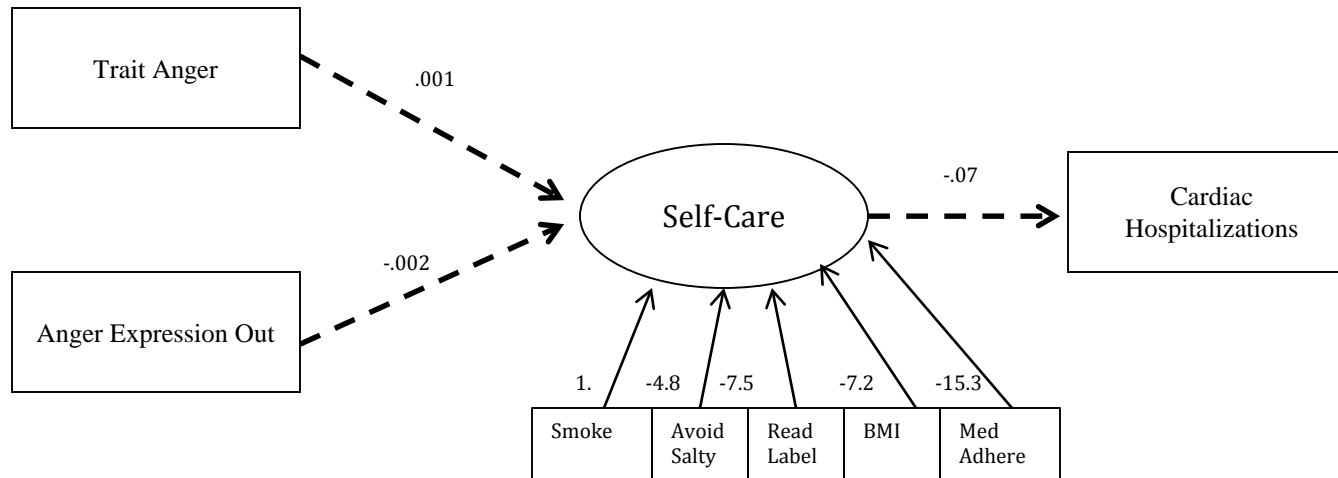
Figure 42. Structural Model: Anger Expression Out and Trait Anger and Self-Care with Cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at $p<.05$ and the dashed lines represent all non-significant paths. Cardiac hospitalizations $n=248$ (data winsorized).
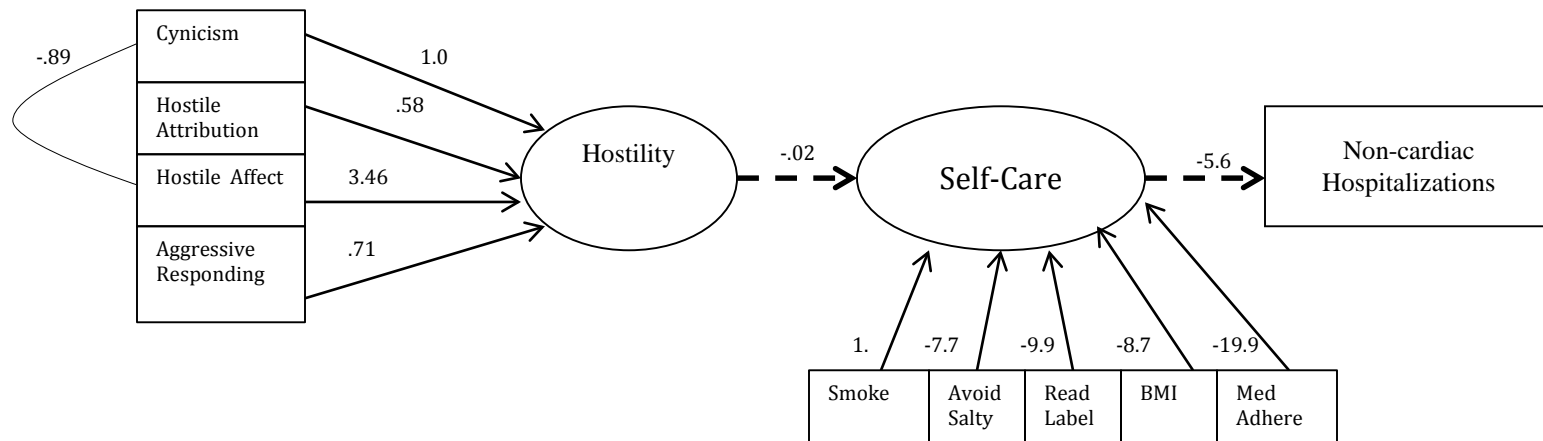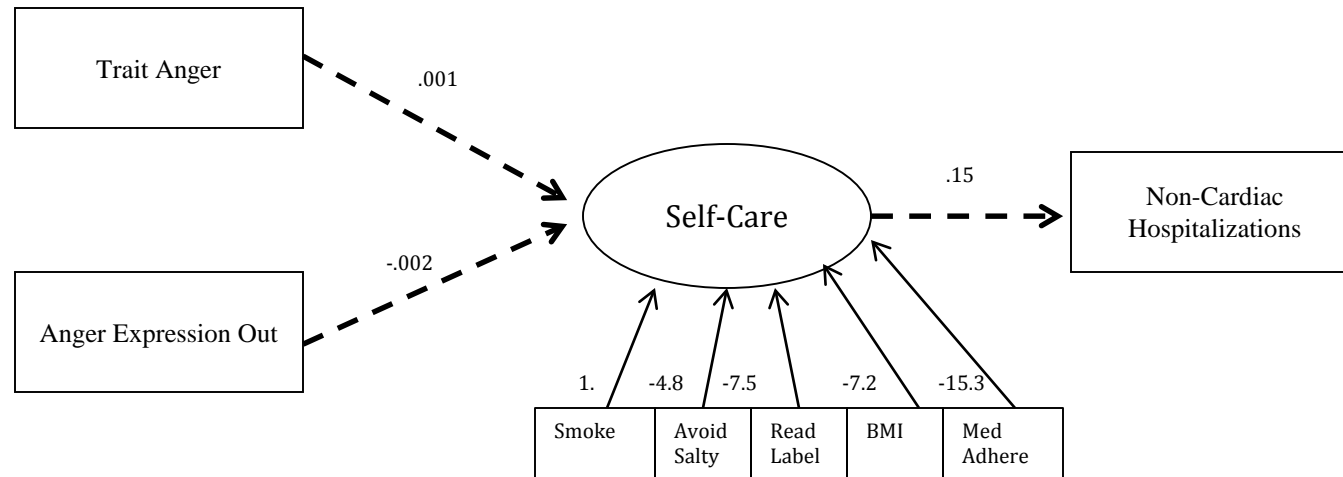
Figure 43. Structural Model: Anger Expression Out and Trait Anger and Self-Care with Non-cardiac hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at $p<.05$ and the dashed lines represent all non-significant paths. Non-cardiac hospitalizations $n=215$ (data winsorized).
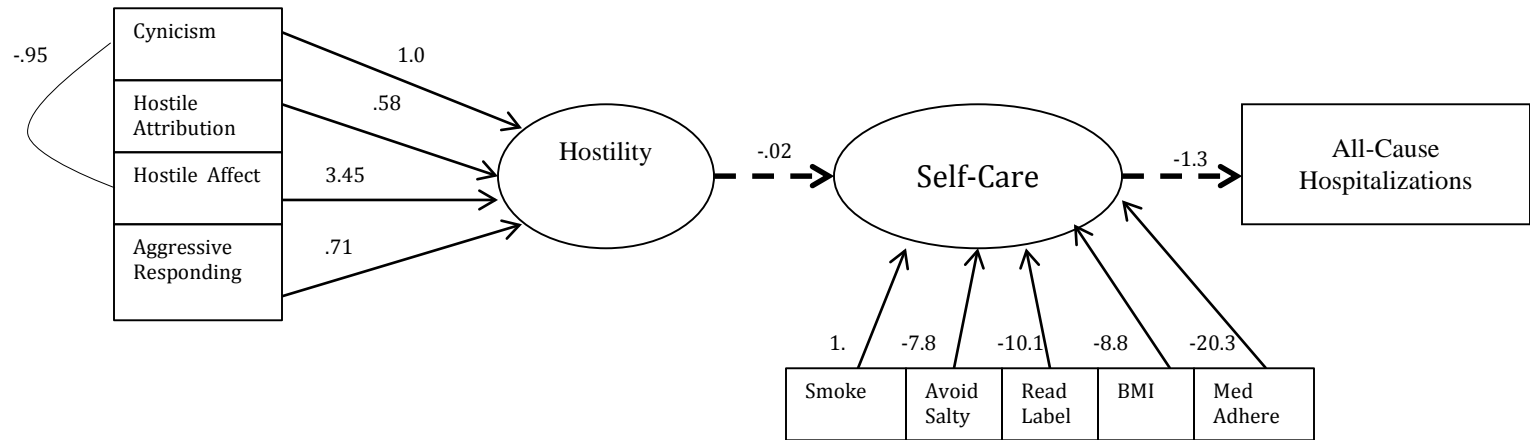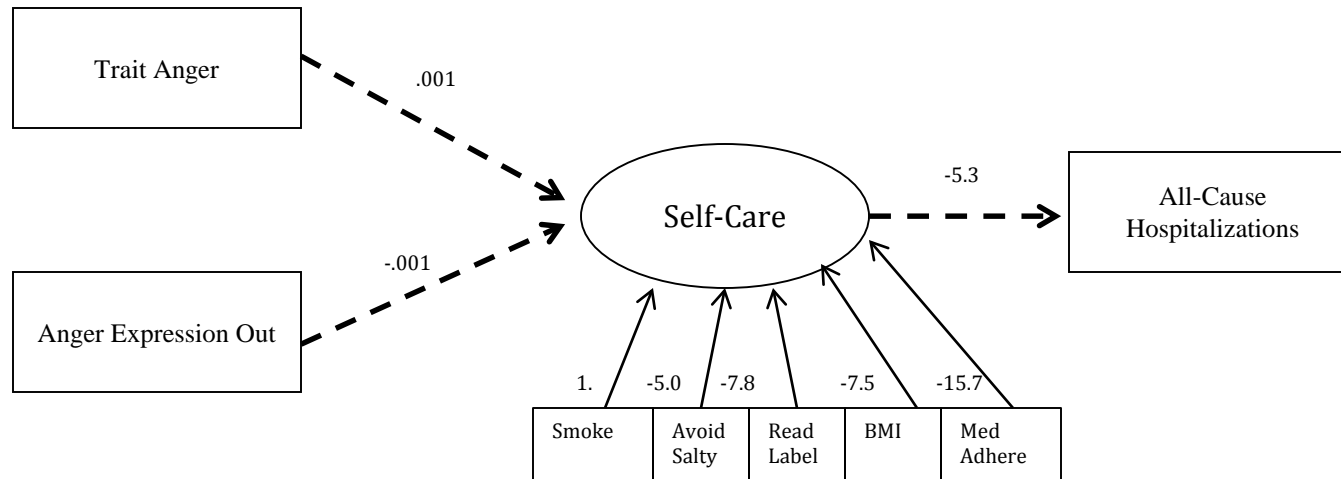
Figure 44. Structural Model: Anger Expression Out and Trait Anger and Self-Care with All-cause
        hospitalizations
The path loadings presented above are estimates. The solid lines represent significant paths at *p*<.05
and the dashed lines represent all non-significant paths. All-cause hospitalizations *n*=448 (data
winsorized.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria

Left ventricular ejection fraction ≤ 40%
Age of ≥ 18
Symptomatic HF (New York Heart Association level of II-IV)
<3 months

Exclusion Criteria

Myocarditis in last 6 months
Significant mitral valve disease
Thyroid dysfunction as HF etiology
Alcohol abuse current or last 6 months
Presence of Left ventricular assist device
Prior heart transplant
Active cancer treatment
Nursing home residence
Severe cognitive impairment

Table 2. Latent Construct Composition, Observed Variables, and Dependent Variables

Latent Construct Composition – IVs	Measures
Negative Affect	
Depression	Beck Depression Inventory-II (BDI-II)
Anxiety	State-Trait Anxiety Inventory (STAI)
Anger	State-Trait Anger Expression Inventory (STAXI-II)
Hostility	Cook-Medley Hostility Scale
Stress	Perceived Stress Scale (PSS)
Attitudes	
Optimism	Life Orientation Test (LOT)
Self-efficacy	Self-Efficacy Subscale of KCCQ
Social Support	
Interpersonal	Interpersonal Support Evaluation List (ISEL)
Social Network	Social Network Index (SNI)
Self-Care	
Diet	Have you avoided salty foods? (ect.)
Exercise	Have you exercised within the past 24 hours?
Medication Adherence	Brief Medication Questionnaire/Morisky Adherence Scale
Observed Variables	
Perceived Symptoms	Kansas City Cardiomyopathy Questionnaire (KCCQ)
DVs	
	Cardiac Hospitalizations Non-cardiac Hospitalizations All-cause Hospitalizations

Table 3. Observed Variables Used

Latent Construct	Observed Variables
Negative Affect	Beck Depression Total Score Trait Anger Hostility Total Score Stress Total Score Trait Anxiety
Positive Attitudes	Optimism Total Score Self-efficacy Total Score
Social Support	Number of people in social network Number of high contact social supports Interpersonal Support Total Score
Self Care	Do you avoid salty food? BMQ/Morisky Total Score Do you exercise?
Perceived Symptoms	KCCQ Total Symptom Score

Table 4.
Sample Characteristics

	Full Sample N=150	
Gender	Male	113 (75.3%)
Age (years)	56.82 $\pm$11.43 (SD)	
Race		
	African American	103 (70.5%)
	Caucasian	42 (28.8%)
	Other	(.7%)
Household Income		
	<$15,000	51 (35.2%)
	$15-30,000	39 (26.9%)
	$30-70,000	43 (29.7%)
	>$70,000	12 (8.3%)
History of Hypertension	116 (77%)	
Creatinine (mg/dl)	1.38 $\pm$ .71 (SD)	
Ejection fraction (%)	23.14 $\pm$ 7.48 (SD)	
Mean time in the Study (months)	24.76 $\pm$ 13.40 (SD)	
Body Mass Index (BMI)	31.65$\pm$7.92(SD)	
BUN	23.72$\pm$17.98	
Presence of Defibrillator	n=74 (49%)	
Beta-blocker	n=138 (92%)	
Ace Inhibitor	n=113 (75%)	
Angiotensin Blocker	n=22 (15%)	
Diuretic	n= 124 (83%)	

Table 5.
Hospitalizations

Type of admitting diagnosis	n
Cardiac	
Heart Failure	183
Angina	35
ICD related	32
Hypo/hypertension	9
Myocardial Infarction	7
Shortness of breath	6
Stroke	5
Other (e.g., renal related, ischemia, revascularization, cardiomyopathy)	14
Total:	**291**
Non-cardiac	
Non-cardiac chest pain	58
Psychiatric/Psychology	10
Injury (e.g., broken arm)	14
Acute Illness (e.g., pneumonia, bronchitis)	56
Chronic Illness (e.g., cancer, COPD)	54
Surgery (e.g., back surgery, knee replacement)	13
Undifferentiated Symptoms	40
Other (e.g., supratherapeutic INR, sleep study)	39
Total:	**284**
All-Cause	
Total:	**575**
Number of Participants with 0 All-Cause Hospitalizations	**56**
Number of Participants with 1 All-Cause Hospitalization	**23**
Number of Participants with 2 All-Cause Hospitalizations	**18**
Number of Participants with 3 All-Cause Hospitalizations	**9**
Number of Participants with 4 All-Cause Hospitalizations	**5**
Number of Participants with 5 or more All-Cause Hospitalizations	**39**

*hospitalizations are not corrected for skew

Table 6.

Mean, Standard Deviations, and Range of Observed Negative Affect Variables

	Mean	SD	Range
Hostility	19.81	7.72	0-36
State Anxiety	30.29	10.26	19-65
Trait Anxiety	35.95	11.88	20-70
Stress	13.23	8.32	0-32
Depression	12.47	10.05	0-47
State Anger	16.78	5.39	15-57
Trait Anger	16.35	6.15	10-37

Table 7.
Zero-order correlations between Observed Variables in Negative Affect

	Hostility	State Anxiety	Trait Anxiety	Stress	Depression	State Anger	Trait Anger
Hostility	1.00	.30***	.43***	.40***	.49***	.27**	.34***
State Anxiety	--	1.00	.66***	.54***	.56***	.48***	.26**
Trait Anxiety	--	--	1.00	.79***	.80***	.35***	.54***
Stress	--	--	--	1.00	.72***	.33***	.51***
Depression	--	--	--	--	1.00	.38***	.53***
State Anger	--	--	--	--	--	1.00	.47***
Trait Anger	--	--	--	--	--	--	1.00

$* p \leq .05, ** p \leq .01, *** p \leq .001$

Table 8
Mean, Standard Deviation and Range of Observed Attitude Variables

	Mean	SD	Range
LOT Optimism	11.81	3.19	2-16
LOT Pessimism	6.04	3.77	0-16
KCCQ Self-efficacy	91.77	14.24	50-100
Ad hoc Self-efficacy	53.19	10.71	0-70

Table 9.

Zero-order Correlations between Observed Variables in Attitudes

	KCCQ Self-efficacy	Ad-hoc Self-efficacy	LOT Optimism	LOT Pessimism
KCCQ Self-efficacy	1.00	.25**	-.04	.07
Ad-hoc Self-efficacy	--	1.00	.55***	-.19*
LOT Optimism	--	--	1.00	-.34***
LOT Pessimism	--	--	--	1.00

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Table 10.

Means, Standard Deviation, and Range of Observed Social Support Variables

	Mean	Standard Deviation	Range
People in Social Network	16.56	9.79	1-48
High Contact Roles	5.24	1.88	1-11
Embedded Networks	2.13	1.43	0-6
ISEL Total	38.08	6.76	15-48

Table 11.
Zero-order Correlations between Observed Variables in Social Support

	People in Social Network	High Contact Roles	Embedded Networks	ISEL Total
People in Social Network	1.00	.76***	.93***	.35***
High Contact Roles	--	1.00	.70***	.35***
Embedded Networks	--	--	1.00	.31***
ISEL Total	--	--	--	1.00

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Table 12.

Mean, Standard Deviation, and Range of Observed Variables in Self-Care

	Mean	Standard Deviation	Range
BMI	31.65	7.92	17-53
Avoid Salty Foods	2.13	1.18	1-5
Read Labels	2.69	1.70	1-5
Morisky Adherence Scale	1.08	1.64	0-8
Diabetes I/II/IDDM		n=67 (44%)	
Physically active within last 30 days (Yes/No)		n=93 (62% said yes)	
Smoking		n=104 (70% said yes)	

Table 13.
Zero-order Correlations between Observed Variables in Self-Care

	Smoking	BMI	Avoid Salty Foods	Read Food Labels	Morisky Adherence Scale	Diabetes II/IDDM[1]	Diabetes 1/IDDM[1]	Diabetes II/NIDDM[1]
Smoking	1.00	-.24**	-.09	.05	-.18*	.15	-.07	.08
BMI	--	1.00	.04	-.09	.11	-.08	-.04	-.01
Avoid Salty Foods	--	--	1.00	.48***	.09	-.07	.15	.14
Read Food Labels	--	--	--	1.00	.14	.01	.08	.10
Morisky Adherence Scale	--	--	--	--	1.00	-.19*	-.03	-.30***
Diabetes II/IDDM[1]	--	--	--	--	--	1.00	-.19*	.24**
Diabetes 1/IDDM[1]	--	--	--	--	--	--	1.00	.03
Diabetes II/NIDDM[1]	--	--	--	--	--	--	--	1.00

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

[1] indicates diabetes (which was added as an exploratory analysis) was not included in the overall model of Self-Care due to lack of correlation with most other Self-Care variables

Table 14. Estimates and Standard Errors of Paths between Latent Psychosocial Variables and Perceived Symptoms when Predicting All-Cause Hospitalizations

	Estimates	S.E.
Negative Affect	1.50	.13
Social Support	-.66	-.60
Attitudes	10.0	.38

Table 15. Estimates and Standard Errors of Paths between Latent Psychosocial Variables and All-Cause Hospitalizations

	Estimates	S.E.
Negative Affect	-.25	.38
Social Support	.05	.27
Attitudes	-.59	.29

Table 16. Estimates and Standard Errors of Paths between Latent Psychosocial Variables and Self-Care when Predicting Death

	Estimates	S.E.
Negative Affect	.01	.22
Social Support	-.35	-1.18
Attitudes	-.06	-.49

Table 17. Estimates and Standard Errors of Paths between Latent Psychosocial Variables and Death

	Estimates	S.E.
	.02	1.05
Social Support	-.004	-.94
Attitudes	.01	.32

Table 18.

Zero-order correlations Among Subscales of the Latent Construct of Hostility

	Cynicism	Hostile Attribution	Hostile Affect	Agg Responding
Cynicism	--	.61***	.45***	.50***
Hostile Attribution	--	--	.48***	.42***
Hostile Affect	--	--	--	.49***
Agg Responding	--	--	--	--

* denotes $p \leq .05$, ** denotes $p \leq .01$, *** denotes $p \leq .001$

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