Predictors of Health-related Quality of Life of Adults with Heart Failure

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Background: Heart failure patients experience low health-related quality of life and poor health outcomes.

Objective: The purpose of this study was to examine interrelationships among and predictors of health-related quality of life of adults with heart failure.

Methods: This cross-sectional secondary analysis of 161 older (*M*=56.09 years ± 11.74), white (93.2%), male (69.6%) heart failure patients was prescribed angiotensin converting enzyme inhibitors and used electronic Medication Event Monitoring System. Ejection fraction, comorbid conditions, vitality, age, gender, income, prescription insurance, social support (appraisal, belonging, self-esteem, and tangible support by Interpersonal Support Evaluation List), medication regimen (number of prescribed medications and times per day medication is prescribed), medication adherence (*days adherence* and *on-time adherence)*, general health perceptions, and health-related quality of life (Short Form-36 physical and mental component scores) were analyzed by simple and multiple linear regression.

Results: Vitality was positively associated with mental (*p*=<.001) and physical (*p*=<.001) component scores of health-related quality of life. Females (*p*=.033) and those with prescription insurance (*p*=.032) had decreased mental component scores, while *on-time adherence (p*=.043) was positively associated with mental component scores. Greater number of prescribed medications (*p*=.038) was associated with decreased physical component scores, while increased

general health perceptions (p<.001) were associated with increased physical component scores. More comorbid conditions (p=.024) and increased social support (appraisal, p=.016) were associated with decreased vitality, whereas increased social support (self-esteem, p=.035) was associated with increased vitality. Higher income (p=.023) was associated with increased *days adherence*. Greater number of times per day medication is prescribed (p=.002) was associated with decreased *on-time adherence,* and higher ejection fraction (p=.032) was associated with increased *on-time adherence*. Vitality (p<.001) was positively associated with general health perceptions.

Conclusions: Interventions that incorporate these variables may reduce negative impacts on health-related quality of life and improve health outcomes in heart failure patients.

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PREFACE

I would like to thank the following family, friends and colleagues who helped me on this journey. First, my sincere thanks to the members of my dissertation committee, Dr. Lora Burke, Dr. Linda Cadaret, Dr. Elizabeth Schlenk, and Dr. Susan Sereika for your dedicated support and years of investment in me. I want to send a special thanks to Dr. Patricia Bohachick for kindly sharing your data and consulting with me. I especially want to thank Dr. Elizabeth Schlenk for providing the best mentorship and guidance. You individualized this program for my success and I am very grateful for your dedication. Thank you Dr. Judith Erlen who was instrumental in my joining this program as well as always stayed updated on my progress. My family has been a constant solid support. My husband, Donald, has provided love and unending support to accomplish this goal. You have kept me focused and strong. My children, Rachel and James, have continually reminded me to enjoy life, laugh and have fun. My father, James Uselman, has provided me with positive encouragement and support. My mother, Loreen Uselman, has been a great role model, gave me the "can do" attitude, and always believed I could accomplish this. You continue to inspire me from Heaven. My mother-in-law, Norma Simms, has always been there and helped me to find the time to get things done. My brothers and their families, Dr. James Uselman, Ann, Emily and Sophia; Jeffrey Uselman, Debbie, Jeffrey Jr., Kelly and Danny, always listened and pushed me forward to complete this goal. Lastly, I want to recognize the many friends and colleagues that have helped me along the way. Thank you.

1.0 INTRODUCTION

Heart failure (HF), a chronic disease in which the heart cannot pump enough blood to meet the body's needs (Hall, Levant, & DeFrances, 2012), affects approximately 5.1 million adult Americans with 670,000 new cases per year (Lloyd-Jones et al., 2010). HF accounted for 1,106,000 hospitalizations in 2006 and resulted in approximately 281,437 deaths in 2008 (Lloyd-Jones et al., 2010; Roger et al., 2012). HF is the most common diagnosis of hospitalized patients over 65 years and men (Lloyd-Jones et al., 2010; Roger et al., 2004). HF accounts for an estimated 40% of preventable hospitalizations of adults over 65 years with a cost estimated at $32 billion for 2013 (Heidenreich et al., 2011).

HF management includes medication, diet, fluid management, daily weight monitoring, exercise, and rest (Hodges, 2009a). Medication adherence is imperative for successful management and prevention of exacerbations (Hodges, 2009a). Medication adherence and other self-care activities are essential to successful management of HF (Evangelista & Shinnick, 2008). However, medication nonadherence and other lifestyle recommendations are a major problem in patients with HF (Van der Wal, Jaarsma, & Van Veldhuisen, 2005). Several factors have been identified as having a relationship to medication adherence. Multiple co-morbidities have been linked to nonadherence (Soumerai et al., 2006). Medication nonadherence is a particular issue

with older adults (Schlenk, Bernardo, Organist, Klem, & Engberg, 2008) with cost of medications identified as a barrier to adherence (Wu, Moser, Chung, Lennie, Peden et al., 2008). Furthermore, HF patients often face complex schedules that pose a challenge.

Health-related quality of life (HRQOL) is low in hospitalized patients with HF (Chin & Goldman, 1998). Biological and physiological factors such as ejection fraction (EF) and comorbid conditions influence physical symptom status such as vitality, or energy level, which is a predictor of HRQOL (Heo, Doering, Widener, & Moser, 2008). Older age has been associated with increased risk of poorer HRQOL (Gallicchio, Hoffman, & Helzlsouer, 2007). HF results in substantial impairment of HRQOL for both men and women (Gallicchio et al., 2007; Heo, Lennie, Okoli, & Moser, 2009; Sayers, Riegel, Pawlowski, Coyne, & Samaha, 2008) with HRQOL more impaired in women than men (Gallicchio et al., 2007). Better income has been associated with higher HRQOL (Clark, Tu, Weiner, & Murray, 2003). Changes in social support have been shown to be associated with changes in HRQOL (Bennett, Perkins, Lane, Deer, Brater, & Murray, 2001). Poor adherence may contribute to poorer HRQOL (Hauptman, 2008). Medication regimen, particularly number of medications (Demir & Unsar, 2011) and frequency of dosing (Dunbar-Jacob, Bohachick, Mortimer, Sereika, & Foley, 2003) affects HRQOL. Poor adherence may contribute to poorer HRQOL (Hauptman, 2008). General health perceptions (GHP) have a direct effect on HRQOL in HF patients (Grady et al., 1995).

1.1 PROBLEM OF INTEREST

The impact of unmanaged HF is comprised of potential or actual disability, loss of independence, decreased socialization, financial burden for both the person and the health care system, and decreased HRQOL. HF contributed to 1,801,000 office visits in 2010, and 668,000 emergency department visits and 293,000 outpatient visits in 2009 (Go et al., 2013). HF was listed as the first diagnosis for hospital discharges in 1,094,000 cases (Roger et al., 2012). There is a need to study factors that influence HRQOL in the HF population. The knowledge gained would contribute to the development of interventions to improve HRQOL of persons with HF.

1.2 PURPOSE

The purpose of the proposed study is to examine interrelationships among and predictors of HRQOL of adults with HF utilizing the Wilson and Cleary (1995) model.

1.3 BROAD LONG-TERM OBJECTIVES

The long-term goal of this research is to provide health care workers with effective methods of identifying those factors influencing HRQOL. This information will contribute to the development of future intervention studies that can lead to improved HRQOL of people with HF. Any improvement in HRQOL may decrease HF exacerbations, admissions, and medical costs.

1.4 SPECIFIC AIMS

The specific aims of this study are to examine (1) EF, comorbid conditions, age, gender, income, prescription insurance, social support, and medication regimen as predictors of vitality of HF clinic patients; (2) EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, and medication regimen as predictors of adherence to angiotensin converting enzyme (ACE) inhibitor medication therapy; (3) EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, and medication adherence as predictors of GHP; and (4) EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, medication adherence, and GHP as predictors of HRQOL.

1.5 HYPOTHESES

The specific hypotheses are:

(1) Biological and physiological factors (EF and comorbid conditions), characteristics of the individual (age, gender, income, and prescription insurance) and characteristics of the environment (social support [4 variables] and medication regimen [number of prescribed medications and number of times per day medication is prescribed]) have a direct effect on symptom status (vitality).

(2) Biological and physiological factors (EF and comorbid conditions), symptom status (vitality), characteristics of the individual (age, gender, income, and prescription insurance) and characteristics of the environment (social support [4 variables] and medication regimen [number of prescribed medications and number of times per day medication is prescribed]) have a direct effect on medication adherence (3 variables);

(3) Biological and physiological factors (EF and comorbid conditions), symptom status (vitality), characteristics of the individual (age, gender, income, and prescription insurance), characteristics of the environment (social support [4 variables] and medication regimen [number of prescribed medications and number of times per day medication is prescribed]), and medication adherence (3 variables) have a direct effect on GHP.

(4) Biological and physiological factors (EF and comorbid conditions), symptom status (vitality), characteristics of the individual (age, gender, income, and prescription insurance), characteristics of the environment (social support [4 variables] and medication regimen [number of prescribed medications and number of times per day medication is prescribed]), medication adherence (3 variables), and GHP have a direct effect on HRQOL (2 variables).

1.6 BACKGROUND AND SIGNIFICANCE

1.6.1 Heart Failure

The hallmark Framingham Heart Study (FHS) enrolled 1,980 men and 2,421 women residing in Framingham, Massachusetts, between 1948 and 1951, in this first of its kind study to collect information from a community cohort (Mehta & Khan, 2002). Fifty years worth of data was collected and numerous papers were published from this study. This community cohort longitudinal study was the first major cardiovascular study and the first study that included women. This study provided the framework of determining HF risk factors and treatment.

In 1991, the Studies of Left Ventricular Dysfunction (SOLVD) investigators published results indicating the positive effects that ACE inhibitors have on HF (SOLVD Investigators, 1991). A total of 2,569 HF subjects were randomly assigned to placebo (n=1284) or enalapril (n=1285) groups for an average of over 40 months. The authors concluded that the addition of enalapril, an ACE inhibitor, with current HF treatment, significantly decreased mortality and hospitalizations for HF (SOLVD Investigators, 1991). The benefit of ACE inhibitors has been described as the most important advance in HF therapy in recent times (Baker, Konstam, Bottorff, & Pitt, 1994). ACE inhibitors are the gold standard treatment for reducing mortality and hospitalizations for HF. ACE inhibitors are the standard recommended medication for treatment of HF. Both groups were mostly male (placebo group = 79.8% and treatment group = 80.9%) (SOLVD Investigators, 1991).

Between 1979 and 2000, utilizing the Framingham Heart Study criteria, 4,537 patients residing in Olmsted County, Minnesota were recruited for this cohort study in which the Mayo Clinic and Olmsted Medical Center provided most of the care for this sample. The medical records, which were data based through the Rochester Epidemiology Project, linked through a central system maintained by the Mayo Clinic (Roger et al., 2004). Trends in HF and survival were monitored. Hospitalizations were noted to be common with 83% at least once and 43% at least four times among the 1,077 subjects with HF. Incidence of HF was higher among men than women. Although survival after onset of HF was improved overall, women and older adults had less improvement in survival after onset of HF than men and younger adults, respectively (Roger et al. 2004).

The Health, Aging, and Body Composition (Health ABC) study enrolled 2,934 community-dwelling persons without HF in the Pittsburgh, Pennsylvania and Memphis Tennessee areas via a random sample of Medicare beneficiaries. Baseline data were collected between April 1997 and June 1998. All subjects were to report any hospitalizations and every 6 months were asked questions regarding cardiovascular-related events. This study found that men were more likely to develop HF than women. No gender-based differences in risk factors were identified. The authors concluded that incident HF is common in older persons (Kalogeropoulos et al., 2009).

In 1998, hospitals and long-term care facilities were required to participate in the ORYX initiative, which was the precursor to core measures (Joint Commission, n.d.). ORYX is not an acronym, but is a fast moving "Gazelle like" animal with long horns. It represents picking away at problems and digging for new ways to improve outcomes, which is at the heart of this

initiative. In 1999, the Joint Commission began gathering information about potential core measures. In 2001, the Joint Commission and Centers for Medicare and Medicaid Services (CMS) identified the diagnosis of HF as one of the core measures to integrate performance measures with accreditation. In subsequent years, other initiatives emerged. Hospitals are charged with identifying and providing standard evaluation and interventions for a variety of targeted procedures and diagnoses, including HF. Performance measures of HF include discharge instructions, left ventricular function assessment, ACE inhibitor use for left ventricular systolic dysfunction, and adult smoking cessation advice/counseling. The overall goal is to ultimately decrease the number of preventable readmissions by effectively treating and educating HF patients while they are in the hospital. Despite this national initiative, there has been no significant decrease in HF incidence over the past 20 years (Roger et al., 2004).

Even with breakthroughs in treatment, HF remains a contributing factor in hospital admissions and mortality. Greater than three fourths of the United States population with HF are older than 65 years (Ammar et al., 2007) and represent greater than 80% of inpatients with HF (Kalogeropoules et al., 2009). In 2008, one out of every nine deaths has HF mentioned on the death certificate (Roger et al., 2012). Approximately 50% of people diagnosed with HF will be deceased within five years (Levy et al., 2002). The percentages of death rates after hospitalization for HF are concerning at 10.4% for 30 days, 20.0% at one year, and 42.3% at five years (Roger et al., 2012). By 2030, an estimated 9 million people will have HF (Heidenreich et al., 2011). The incidence of HF has not decreased, but survival after onset has increased overall (Roger et al., 2004). Older adults have a higher rate of occurrence for HF and, with the increase in the aging population, warrant particular attention for HF management.

Factors that influence HF outcomes and exacerbations are comorbid conditions (Naylor et al., 2004), age (Roger et al., 2004), economic status (Dunlay, Eveleth, Shah, McNallan, & Roger, 2011), social support (Luttik, Jaarsma, Moser, Sanderman, & Van Veldhuisen, 2005), medication regimen (Naylor et al., 2004), medication adherence (Hope, Wu, Tu, Young, & Murray, 2004; Wu, Moser, Chung, & Lennie, 2008), GHP (Morgan et al., 2006) and HRQOL (Chin & Goldman, 1998). Even with the advancements in management, HF numbers continue to rise with poor medication adherence in patients playing a major role (Wu, Moser, Chung, and Lennie, 2008).

1.6.2 Wilson and Cleary Model

The Wilson and Cleary model is the conceptual model that will be used in this study (Wilson & Cleary, 1995). The model is comprised of five components: biological/physical, symptom status, functional status, general health perceptions, and overall HRQOL with characteristics of the individual and characteristics of the environment as influencing factors on the model. Each of these five components is proposed to be on a continuum from biological measures to more complex and integrated measures, such as GHP. The model proposes causal relationships with HRQOL as the outcome (see Figure 1).

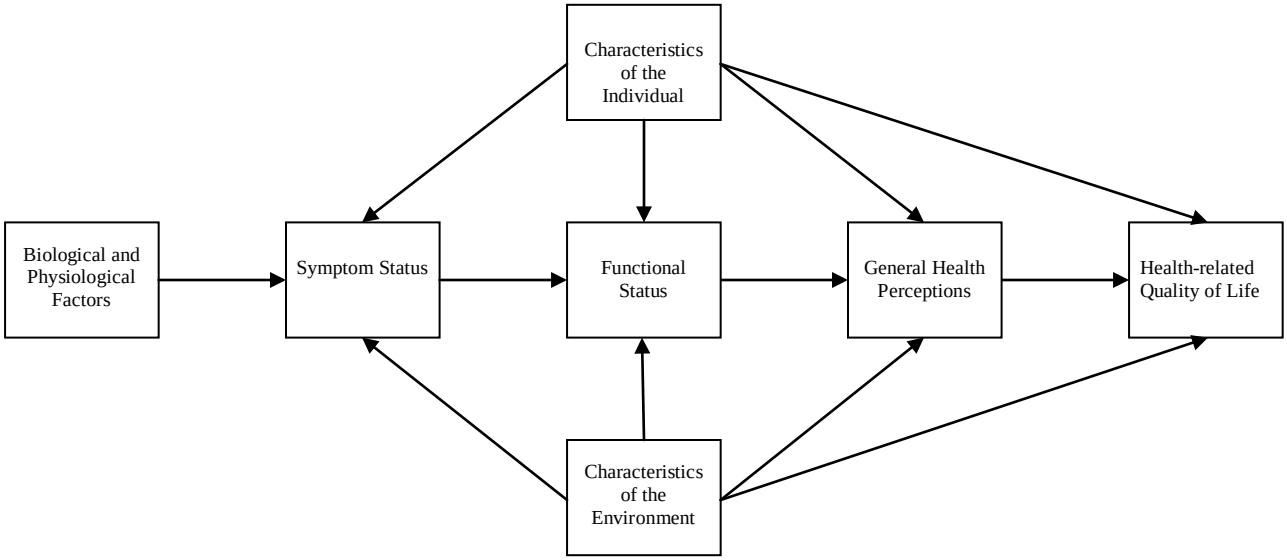

Figure 1. Wilson and Cleary Model of Health-related Quality of Life

For this study, the biological/physical component is operationalized as EF and comorbid conditions; symptom status is operationalized by a scale of vitality; characteristics of the individual include age, gender, income, and prescription insurance; and characteristics of the environment include social support and medication regimen. Functional status assesses the ability of the individual to perform particular task and will be operationalized as medication adherence. The general health perceptions component will be operationalized by a scale of GHP. HRQOL will be operationalized by scales of mental and physical health.

Using the Wilson and Cleary model of HRQOL (Wilson & Cleary, 1995), the four outcome variables of vitality, medication adherence, GHP and HRQOL will be examined in adults with HF. EF, comorbid conditions, age, gender, income, prescription insurance, social support, and medication regimen will be analyzed as predictors of vitality. EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, and medication regimen will be analyzed as predictors of medication adherence. EF, comorbid conditions,

vitality, age, gender, income, prescription insurance, social support, medication regimen, and medication adherence will be analyzed as predictors of GHP. Lastly, EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, medication adherence, and GHP will be analyzed as predictors of HRQOL (see Figure 2).

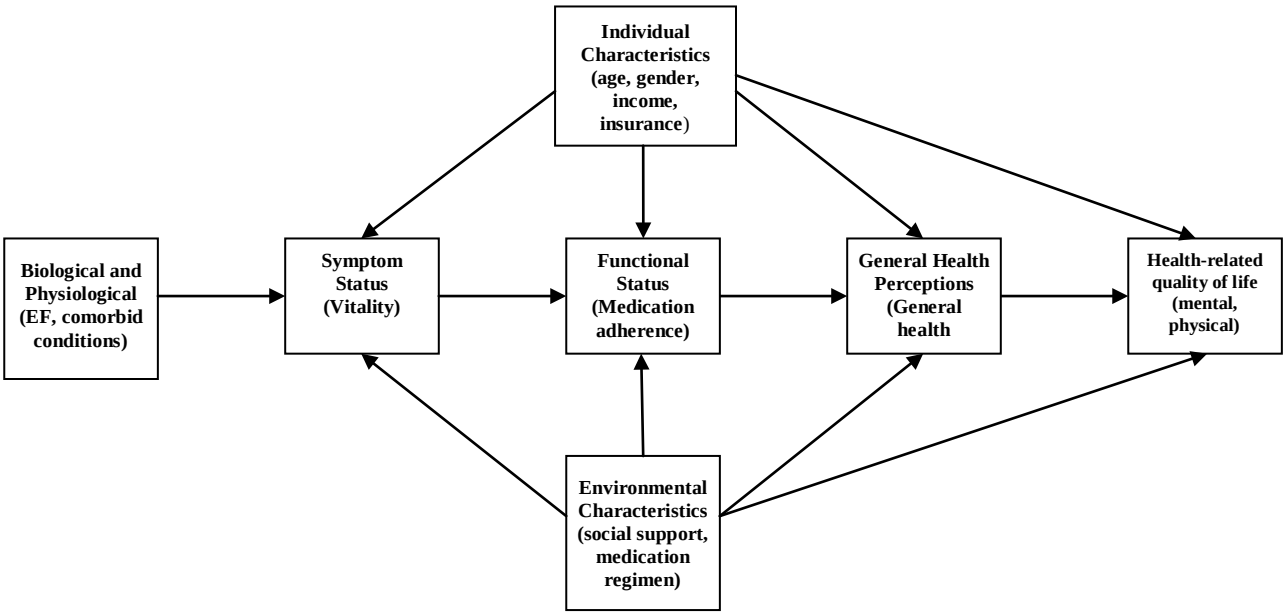

Figure 2. Study Model

1.6.3 Biological and Physiological: EF and Comorbid Conditions

EF is associated with HF. It is a measurement of how much blood the left ventricle pumps out with each contraction (Hall et al., 2012). A measurement under 40% may indicate heart failure (American Heart Association, 2012). Comorbid conditions contribute to poor outcomes in patients with HF (Naylor et al., 2004). Comorbidities are prevalent for many older adults with

HF and make care challenging because overall treatment includes both HF and the comorbidities (Lang & Mancini, 2007).

1.6.4 Symptom Status: Vitality

Vitality, often used interchangeably with vigor, is defined as a measurement of energy and the absence of fatigue, weakness, and exhaustion (Gump, 1997). It is common for people with HF to experience exercise intolerance and fatigue symptoms (Lewis et al., 2007). Vitality is viewed as a measure of symptom status in relation to the Wilson and Cleary model. In this model, symptom is defined as a patient's perception of an abnormal physical, emotional, or cognitive state (Wilson & Cleary, 1995). Vitality is measured most often with the Medical Outcomes Study Short Form-36 (MOS SF-36) vitality subscale (Gump, 1997).

1.6.5 Functional Status: Medication Adherence

Long-term medication adherence is commonly lacking for those with chronic diseases (Dunbar-Jacob et al., 2003). There is a major gap between medication that is effective and adherence to the prescribed regimen. Medication adherence is essential to the success of living with HF (Evangelista & Shinnick, 2008). Adherence is a prime factor in positive clinical outcomes in HF (Hodges, 2009a). Medication non-adherence is the primary reason of HF flares and hospital readmissions (Chin & Goldman, 1998; Hope et al., 2004). Poor adherence is also associated with increased mortality (Granger et al., 2009). In 2001, the American College of

Cardiology/American Heart Association established guidelines that all patients with HF should be treated with an ACE inhibitor, or angiotensin receptor blocker (ARB) as an alternative, and a beta blocker.

Even with the knowledge of effective treatment, medication adherence is still a challenge. Adherence to ACE inhibitor therapy of HF clinic patients who used an electronic event monitor for adherence measurement over three months has shown favorable rates in a descriptive observational study with mean dose adherence of 94.3% (*SD*=13.2), mean days adherence of 84.1% (*SD*=23.2), and mean on-time adherence of 74.1% (*SD*=28.6) (Bohachick, Burke, Sereika, Murali, & Dunbar-Jacob, 2002). However, the authors concluded that a large percentage of subjects demonstrated adherence problems, particularly with more frequent dosages. Lower adherence is associated with increased cardiovascular-related emergency room visits (Hope et al., 2004). Continued studies are warranted for factors associated with medication adherence.

1.6.6 General Health Perceptions: GHP

Health perceptions are low in older patients with HF compared to healthy older adults (Carlson, Pozehl, Hertzog, Zimmerman, & Riegel, 2013; Heo, Moser, Lennie, Zambroski, & Chung, 2007). Low health perceptions are linked to higher mortality in patients with HF. Johansson and colleagues (2008) studied 412 older HF outpatients with the purpose of evaluating a single question as an indicator of HRQOL. One question about global perceived health was the strongest predictor of HRQOL when compared to the different SF-36 domains (Johansson,

Brostrom, Dahlstrom, & Alehagen, 2008). The authors concluded that this item can predict HRQOL in older adults with HF.

1.6.7 Health-related Quality of Life: HRQOL

In general, patients with HF self-report a low to moderate overall HRQOL (Bennett et al., 2001). HRQOL is low in hospitalized patients with HF (Chin & Goldman, 1998). Numerous factors have been studied and identified as factors or potential factors contributing to HRQOL. The Wilson and Cleary model provides an ideal framework to examine factors predicting HRQOL.

1.6.8 Individual Characteristics: Age, Gender, Income, and Prescription Insurance

1.6.8.1 Age

Despite increased survival for all of those with HF, older adults with HF have less improvement in survival after onset of HF than younger adults (Roger et al., 2004). Sensory perception decreases as people age. This factor may play a part in the ability to fully hear and may possibly decrease understanding of signs, symptoms, and self-management. Poor vision may influence the ability to visualize the prescription labels, dosing schedules, or pill colors and shapes. The ability to read prescription labels has been related to fewer emergency room visits (Hope et al., 2004). Limited physical ability may increase difficulty with opening the pill bottles and handling the pills. HF patients need to know the dose, frequency, and the medication that is

prescribed. Additionally, HF patients should at least be able to read labels, open pill bottles, and know their pill colors and shapes (Hope et al., 2004).

HF is the most common diagnosis of hospitalized patients over 65 years (Kalogeropoulos et al., 2009; Lloyd-Jones et al., 2010). However, there has been a shift in the composition of those hospitalized over age 65 years. Hospitalization rates of those aged 65-74 years and 75-84 years have decreased from 2000 to 2010, while rates of those 85 years and older have increased. Overall, the rate has decreased by 19% from 2000 to 2010 (Hall et al., 2012).

1.6.8.2 Gender

Almost half of the population diagnosed with HF are women (Lloyd-Jones et al., 2010), and hospitalizations for both males and females are virtually the same (Hall et al., 2012), yet few studies are reflective of the gender population mix. There are physiologic differences in the cardiovascular systems of men and women. Women have smaller hearts and coronary arteries. Men are more likely to develop HF even with no established gender risk factor differences (Kalogeropoulos et al., 2009). Survival after initial onset has increased for all of the HF population; however, women have less improvement in survival after onset of HF than men (Roger et al., 2004). From 2000 to 2010, the rate of hospitalization has decreased for women (Hall et al., 2012).

The Framingham Heart Study followed community subjects between 1948 and 1988 examining survival after onset of HF and concluded that there was a better prognosis for women despite being diagnosed at a later age than men (Ho, Anderson, Kannel, Grossman, & Levy, 1993). This finding was prior to ACE inhibitor utilization becoming part of the standard

treatment for HF. ACE inhibitor use has been shown to decrease mortality. This finding is in alignment with the authors' additional conclusion that advancements with HF treatment were not related to improvements in overall survival (Ho et.al., 1993). Women with HF tend to be older and have higher ejection fractions (Richardson, 2001). The Framingham Heart Study findings from information gathered from 1971 to 1996 concluded that the lifetime risk is 1 in 5 for both men and women for developing HF (Lloyd-Jones et al. 2002). According to the SOLVD registry, women have greater readmission rates than men, which is contradictory of other studies (SOLVD Investigators, 1991).

1.6.8.3 Income and prescription insurance

Older adults with low income are at higher risk for HF. Researchers completed 5,153 record reviews of seniors without HF in the 1990s, grouping them based on level of education and income. Those that lived on less and $25,000 per year were more likely to develop HF. Those with low income and low education were most at risk (American Heart Association, 2011). This situation was the case even if the subjects had Medicare coverage. The authors suggested that subjects with low incomes may not be able to afford the additional costs such as co-pays in conjunction with their Medicare coverage.

1.6.9 Environmental Characteristics: Social Support and Medication Regimen

1.6.9.1 Social support

Social support influences treatment adherence of people with chronic illness (Sayers et al., 2008). Due to the physical limitations associated with HF, attendance and participation in activities lessens. Social support is a strong predictor of hospital readmissions and mortality in HF patients; in particular, emotional support provided by partners or spouses plays an important role in these outcomes (Bean, Gibson, Flattery, Duncan, & Hess, 2009; Luttik et al., 2005). Bennett et al. (2001) examined 227 hospitalized patients with HF. They completed a social support survey and the chronic HF questionnaire at baseline and 12 months. The authors found that tangible support, defined as providing concrete aid and assistance (financial, transportation, housekeeping, etc.), and positive social interaction, defined as having persons with whom to share social activities, both predicted HF admissions. Social support has been conceptualized into subscales and researched. Tangible support or providing concrete materials for direct aid, such as driving to doctor's appointments, predicted heart failure-related admissions.

1.6.9.2 Medication regimen

Older adults with complex therapeutic regimens have been noted to have more difficulty with transition from hospital to home (Naylor et al., 2004). Wu and colleagues (2008) noted that in order to achieve better outcomes, medication adherence is extremely important (Wu, Moser, Chung, & Lennie, 2008). The clinician must explore the cause of therapy failures prior to increasing doses or changing prescribed medications (Wu, Moser, Lennie, Peden, Chen, & Heo,

2008). Some of these failures could be related to the medication regimen prescribed. More frequent doses have been linked to poorer adherence (Bohachick et al., 2002).

1.6.10 Biological and Physiological, Individual Characteristics, and Environmental Characteristics on Symptom Status

1.6.10.1 EF and comorbid conditions on vitality

The literature is limited on EF and comorbid conditions predicting vitality in patients with HF (Heo et al., 2008). However, Lerner and colleagues (1994) studied 1,319 working men and women who completed a modified Job Content Questionnaire, a health distress scale, and the MOS SF-36 Health Survey to assess job strain and HRQOL in adults (Lerner, Levine, Malspeis, & D'Agostino, 1994). In this study, two thirds of the subjects reported one or more chronic conditions. The higher the number of chronic conditions, the association with all nine of the MOS subscales decreased (vitality included). Heo and colleagues (2008) found that EF and comorbid conditions were not predictors of physical symptom status (Heo et al., 2008).

1.6.10.2 Age, gender, income, and prescription insurance on vitality

The literature is sparse on age, gender, income, and insurance predicting vitality in HF patients. Heo and colleagues (2008) found that age was an important predictor of physical symptom status. The older population has demonstrated more difficulty in detecting and interpreting shortness of breath than younger patients (Riegel et al., 2010). However, gender was not related to or predictive of physical symptoms status (Heo et al., 2008). Employment status has been

found to be an important predictor of physical symptom status for HF patients (Heo et al., 2008). There is evidence that having private health insurance and being female decreases hospital readmissions for HF (Betihavas et al., 2012). Employment status has been found to be an important predictor of physical symptom status for HF patients (Heo et al., 2008).

1.6.10.3 Social support and medication regimen on vitality

Cene and colleagues (2011) found that social isolation is an independent risk factor for HF and is strongly mediated by vital exhaustion (Cene et al., 2011). Nonadherence with the prescribed regimen can result in worsening symptoms (Van Der Wal et al., 2005). Older adults with HF who take fewer than six medications are more likely to recover from exhaustion (perception of inadequate energy) than those who take multiple medications (Whitson et al., 2011).

1.6.11 Biological and Physiological, Symptom Status, Individual Characteristics, and Environmental Characteristics on Functional Status

1.6.11.1 EF and comorbid conditions on medication adherence

Comorbid conditions have been linked to medication adherence. Soumerai and colleagues (2006) examined measures of skipping or reducing doses or not filling prescriptions from a national sample of 13,835 Medicare beneficiaries. The authors reported that all groups (nonelderly, elderly, and disabled) reported high rates of medication nonadherence due to cost. The authors concluded that cost-related medication nonadherence was further enhanced by poor

health, multiple comorbid conditions, and limited prescription drug coverage (Soumerai et al., 2006).

1.6.11.2 Vitality on medication adherence

Vitality has been linked to medication adherence in adults with HF. Riegel and colleagues (2012) followed 202 adults with HF for 6 months from the Northeastern United States. Nonadherence dimension indicators (socioeconomic, condition, therapy, patient, and healthcare system) identified from the World Health Organization were used to identify predictors of nonadherence. Those with excessive daytime sleepiness, a proxy for vitality, over time had less adherence (Riegel et al., 2012). Recognition of symptoms, particularly shortness of breath, has been shown to be more challenging in older adults, which leads to poor self-care management (Riegel et al., 2010).

1.6.11.3 Age, gender, income, and prescription insurance on medication adherence

There is no clear support of one single intervention to optimize medication adherence in older adults (Schlenk et al., 2008). There are potential influencing factors that may guide health care professionals to the appropriate interventions. Increased age has not been related to adherence, but women less than 75 years were found to be less adherent in the CHARM study (Granger et al., 2009). For HF patients, nonadherence rates are high among all ages, ethnic groups, and levels of socioeconomic status (Evangelista & Shinnick, 2008).

Findings are mixed for the relationship between gender and medication adherence. A study of 134 subjects with HF examining predictors of medication adherence utilizing the

Medication Event Monitoring System (MEMS), an electronic medication cap used to assess medication adherence, concluded that there were no differences in gender regarding medication adherence (Wu, Moser, Chung, and Lennie, 2008). Women generally live longer than men, which can lead to living alone. Women are likely to be socially isolated and have adherence problems with prescribed treatment regimens (Albert, 2005).

Cost of medication with challenges to make ends meet has been identified as a barrier to and predictor of medication adherence (Dunlay et al., 2011; Wu, Moser, Chung, & Lennie, 2008). Dunbar-Jacob and colleagues (2003) studied 169 older adults with cardiovascular comorbid conditions, including HF, and their medication adherence via the MEMS. In those patients with HF, income predicted lower medication adherence for both percentage of days with correct number of doses taken and percentage of expected doses within the correct timing interval (Dunbar-Jacob et al., 2003). Additionally, prescription insurance did not predict adherence (Dunbar-Jacob et al., 2003).

The more restrictive the prescription coverage plan is, the greater the risk of decreased medication adherence (Thanassoulis et al., 2009). Inadequate prescription coverage may be a factor in adherence problems for chronically ill adults (Hsu, 2006; Piette, Heisler, & Wagner, 2004; Soumarai et al., 2006).

1.6.11.4 Social support and medication regimen on medication adherence

Social support is one of the major predictors of adherence. HF patients who are depressed or lack social support have increased morbidity and hospital readmissions, are less adherent to their medical regimen, and have an overall increase in cost of care (Richardson, 2003). Patients who

perceived adequate social support from family members or others are more adherent (Sayers et al., 2008; Wu, Moser, Chung, and Lennie, 2008). Perceived social support has been moderately associated with better self-reported medication adherence, dietary adherence, and other self-care activities including daily weighing (Sayers et al., 2008); more specifically, emotional support has been related to medication adherence (Sayers et al., 2008).

Multiple and complex medications and schedules contribute to the difficulty with adherence in older adults with HF. Inconvenient scheduling, frequent dosing and number of medications are all identified as barriers to medication adherence (Bohachick et al., 2002; Wu, Moser, Lennie, Peden, Chen, and Heo, 2008). Both the number of medications and frequency of dosing affect medication adherence (Dunbar-Jacob et al., 2003). Riegel and colleagues (2012) studied predictors of adherence in HF patients. They found that patients who had greater than 2 medication dosings per day had less adherence (Riegel et al., 2012). Conversely, Wu, Moser, Chung, and Lennie (2008) found that number of pills taken per day and number of times per day medication is prescribed are not related to medication adherence.

1.6.12 Biological and Physiological, Symptom Status, Individual Characteristics, Environmental Characteristics, and Functional Status on GHP

1.6.12.1 EF and comorbid conditions on GHP

Consistent with other studies of EF on components of HRQOL, EF is not associated with any HRQOL subscale (Clark et al., 2003; Krethong, Jirapaet, Jitpanya, & Sloan, 2008), including

GHP. Comorbid conditions have been found to be associated with decreased GHP (Carlson et al., 2013; Suwanno, Petpichetchian, Riegel, & Issaramalai, 2009).

1.6.12.2 Vitality on GHP

Perceived health competence has been associated with symptoms of dyspnea and GHP in patients with HF (Arnold et al., 2005). Furthermore, a change in symptoms has been linked to decreased overall perceived health (Carlson et al., 2013). A causal study of Thai HF patients found that symptom status has a direct effect on GHP (Krethong et al., 2008).

1.6.12.3 Age, gender, income and prescription insurance on GHP

Increased age has had mixed results in the literature on GHP. In a study of perceived overall health, 212 older patients participated in a seven-month medication adherence study. The study concluded that increased age was related to an increase in GHP (Clark et al., 2003). However, Suwanno and colleagues (2009) concluded that increased age had a direct negative effect on health status (Suwanno et al., 2009). Women have a higher reported health perception than men (Evangelista et al., 2001). Additionally, being female is also identified with decreased hospitalizations (Betihavas et al., 2012). Low income, non-white, male patients with HF report a poor health perception (Macabasco-O'Connell, Crawford, Stotts, Stewart, & Froelicher, 2009). Further, perceived sufficiency of income has predicted overall perceived health (Carlson et al., 2013).

1.6.12.4 Social support and medication regimen on GHP

Psychosocial function and breathlessness/physical function directly affect global perceived health (Johansson et al., 2007). In Thai HF patients, social support had a significant positive direct effect on GHP (Krethong et al., 2008). The need to manage multiple medical prescriptive therapies is associated with decreased overall perception of health (Carlson et al., 2013).

1.6.12.5 Medication adherence on GHP

Krethong and colleagues (2008) studied 422 HF patients who visited clinics across Thailand. The researchers collected medical record data and administered questionnaires. Patients who rated their functional status as low in turn rated their GHP as low (Krethong et al., 2008).

1.6.13 Biological and Physiological, Symptom Status, Individual Characteristics, Environmental Characteristics, Functional Status, and GHP on HRQOL

1.6.13.1 EF and comorbid conditions on HRQOL

Juenger and colleagues (2002) studied HRQOL using the SF-36 in 205 German patients with HF and compared them with patients with other chronic diseases. The findings revealed that EF did not influence HRQOL. The study was limited by the small sample size and the sample was not representative of the HF population. The study concluded that other predictors of HRQOL should be explored and future studies with larger more representative samples are needed (Juenger et al., 2002). Heo and colleagues (2008) also found that EF was not predictive of HRQOL. They followed 84 patients with HF exacerbations after being discharged from four

hospitals in Columbus, Ohio and Lexington, Kentucky. The researchers administered the Minnesota Living with Heart Failure (MLHF) questionnaire and Dyspnea-Fatigue Index three months post-discharge to measure HRQOL and symptoms status, respectively (Heo et al., 2008). Clark and colleagues (2003) also concluded that both EF and comorbid conditions did not influence HRQOL in subjects with HF (Clark et al., 2003).

However, Lewis and colleagues (2007) studied HRQOL in 2,709 subjects from the CHARM program with both preserved and low EF. Subjects were enrolled from 243 sites in the United States and Canada. Both groups equally reported low HRQOL via the MLHF questionnaire. The authors concluded that further evaluation of factors affecting HRQOL is warranted (Lewis et al., 2007).

Fewer comorbidities have been associated with increased HRQOL. Seto and colleagues (2011) recruited 100 outpatients from the University Health Network Heart Function Clinic to complete the Self-care of HF Index (SCHFI) and the MLHF questionnaire to measure self-care behavior and HRQOL, respectively. The team found that fewer comorbidities were significantly related to better emotional quality of life (Seto et al., 2011). The study was limited by 37% of the participants having only been participating in the clinic for less than 6 months. One third of the subjects were called to remind them to complete and return the questionnaires, which may have introduced bias.

1.6.13.2 Vitality on HRQOL

Heo and colleagues (2008) followed 84 patients with HF exacerbations after being discharged from four hospitals in Columbus, Ohio and Lexington, Kentucky. The researchers administered

the MLHF questionnaire and Dyspnea-Fatigue Index three months post-discharge to measure HRQOL and symptoms status, respectively. The authors concluded that better physical symptom status was related to better HRQOL (Heo et al., 2008). The authors concluded that the study was limited by its small sample size and recommended futures studies with a larger sample size and including an additional variable of adherence to treatment regimen (Heo et al., 2008). Recurring symptoms have been linked to decreased HRQOL (Evangelista et al., 2001).

1.6.13.3 Age, gender, income, and prescription insurance on HRQOL

HRQOL is related to hospital readmissions in older patients with HF (Hodges, 2009a). HF potentially affects financial status secondary to job loss or increase in medical expenses. This financial burden is viewed negatively in respect to the HRQOL of older adults (Heo et al., 2009). Older age has been associated with higher risk for lower HRQOL (Gallicchio et al., 2007). Azevedo and colleagues (2008) studied 424 adults greater than 45 years with HF using the SF-36 and found that increased age was associated with decreased HRQOL, and increased socioeconomic status was related positively to HRQOL (Azevedo et al., 2008).

HF patients report substantial impairment of HRQOL for both men and women (Gallicchio et al., 2007; Heo et al., 2009; Sayers et al., 2008), but women to a greater extent (Bennett et al., 2001; Gallicchio et al., 2007). Using the MOS SF-36 as a measure of HRQOL, women have less improvement in the physical component score than men at one year (Chin & Goldman, 1998). In a large community-based cohort study in Washington County, Maryland known as CLUE-II, 4,498 men and 6,948 women were studied in order to identify factors associated with HRQOL. Investigators sent a follow-up questionnaire inquiring about social

support and HRQOL. The HRQOL question simply asked generally how the subject would rate his/her health. Similar to results by Chin and Goldman (1998), men reported a higher HRQOL than women (Gallicchio et al., 2007).

Income and HRQOL in the HF population has been linked. Clark and colleagues (2003) studied 212 older adults with HF utilizing baseline interview, medical records review, and questionnaires (Kansas City Cardiomyopathy, Chronic Heart Failure, and a single question of perceived overall health). Subjects with greater income had higher HRQOL scores (Clark et al., 2003). Azevedo and colleagues (2008) found that increased socioeconomic status was related positively to HRQOL (Azevedo et al., 2008). Although the literature is lacking with relationships of insurance to HRQOL, insurance is often coupled with income as ability to afford the prescribed regimen for optimum outcomes.

1.6.13.4 Social support and medication regimen on HRQOL

There is limited research on social support and its impact on outcomes in those persons with HF (Luttik et al., 2005). Physical impairment, polypharmacy, and decreased social support influence medication adherence and HRQOL in the older population (Evangelista & Shinnick, 2008; Gallicchio et al., 2007; Hope et al., 2004; Luttik et al., 2005; Schlenk et al., 2008). Social support has been positively correlated with HRQOL for both men and women (Gallicchio et al., 2007). Changes in social support have been linked to changes in HRQOL in one study. Bennett et al (2001) found that increased social support over a 12-month period predicted positive changes in HRQOL and decreased hospitalizations. Bennett et al. investigated 227 hospitalized men and women with HF who were categorized into under and over 65 years of age and

completed social support and HF surveys at baseline (n = 227) and 12 months (n = 147). Changes in social support were concluded to be predictors of changes in HRQOL. The authors suggested that interventions aimed at those with low social support may improve HRQOL.

Scant research has been done on the relationship between medication regimen and HRQOL. Number of medications prescribed is associated with HRQOL. As number of medications prescribed increases, HRQOL decreases (Demir & Unsar, 2011).

1.6.13.5 Medication adherence on HRQOL

Hospital readmissions for HF are commonly related to medical factors (hypertension), environmental factors (decreased social support), and behavioral factors, such as nonadherence with medications (Hodges, 2009b). Hodges studied 41 older adults with HF in San Antonio, Texas. This was a mixed methods study designed to examine individual perceptions in a HRQOL framework. The subjects participated in interviews and completed questionnaires. There was a positive relationship between HRQOL and readmissions (Hodges, 2009b), which may be partially attributable to medication nonadherence. Poor adherence may be a contributing factor to poorer HRQOL (Hauptman, 2008).

1.6.13.6 GHP on HRQOL

Health perceptions have a strong association with HRQOL. Heo and colleagues (2005) studied records from 293 HF patients who were given the MLHF questionnaire. Health perception and symptom status were determined to be most associated with HRQOL (Heo, Moser, Riegel, Hall, & Christman, 2005.

1.6.14 Gaps

HF remains an extreme burden on the population as a whole (Roger et al., 2004). Older adults lag behind in improvements in survival after the onset of HF compared to younger adults, which indicates that a better understanding is needed to develop effective interventions tailored to increasing those factors that have a positive impact on HRQOL of older adults. The biological and physiological factors, EF, and comorbid conditions warrant further study with definition of the number of comorbidities and high versus low EF. Evidence is limited on factors influencing vitality and is lacking regarding the effects of specific variables of income, insurance, social support, and medication regimen on vitality. Analysis of the gender differences in factors that affect HRQOL are lacking in the literature. Economic factors (income and insurance) need further analysis as predictors of HRQOL. Social support has had varying degrees of meaning in the literature, so there is a need to clearly define and study the relationship of social support measures with the outcome of HRQOL. Medication regimen needs to be further explored to determine threshold and directional relationships with HRQOL. Given the lack of medication adherence in a large portion of the HF population, there is continued need for research on ways to improve medication adherence, which in turn may affect HRQOL.

Research should utilize all of the components and influencing factors of the Wilson and Cleary model and incorporate all of the variables identified above to contribute to a more complete understanding of the complexities and factors contributing to HRQOL in HF patients. Efforts to improve HRQOL could decrease hospitalizations. Interventions with even a small

effect on hospital admissions could have a significant effect on the burden of cost on the treatment of HF (Lee, Chavez, Baker, & Luce, 2004).

1.6.15 Importance of Proposed Research

Part of the solution to this problem is already figured out. Proper self-care management and effective medications (primarily ACE inhibitors) significantly decrease mortality and hospital readmissions. Additionally, better HRQOL is associated with better health outcomes. However, the rest of the puzzle has not been successfully figured out. That is, how do health care professionals give HF patients the knowledge, tools, and confidence to follow the successfully discovered regimen to decrease exacerbations, thus lessening readmission and optimizing their HRQOL? With HRQOL primarily low in patient with HF, which is associated with poor health outcomes, research on the factors affecting HRQOL will guide clinicians about where to focus improvement interventions. Further insight into those factors that influence HRQOL will aid in the development of those interventions. In summary, it is important to examine the associations that EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, medication adherence, and GHP have on HRQOL to shed some light on development and testing of effective interventions to improve HRQOL.

1.7 RESEARCH DESIGN AND METHODS

The purpose of the proposed study is to examine interrelationships among and predictors of HRQOL of adults with HF utilizing the Wilson and Cleary model.

The specific aims of this study are to examine:

(1) EF, comorbid conditions, age, gender, income, prescription insurance, social support, and medication regimen as predictors of vitality of HF clinic patients;

(2) EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, and medication regimen as predictors of adherence to ACE inhibitor medication therapy;

(3) EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, and medication adherence as predictors of GHP; and

(4) EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, medication adherence, and GHP as predictors of HRQOL.

1.7.1 Hypotheses

1.7.1.1 Hypotheses for Aim 1

(H1.1) Biological and physiological factors (low EF and high comorbid conditions) have a direct association with decreased symptom status (vitality).

(H1.2) Characteristics of the individual (increased age, female, low income, and no prescription insurance) have a direct association with decreased symptom status (vitality).

(H1.3) Characteristics of the environment (increased social support [4 variables] and less complex medication regimen [2 variables]) have a direct association with increased symptom status (vitality).

1.7.1.2 Hypotheses for Aim 2

(H2.1) Biological and physiological factors (low EF and increased comorbid conditions) have a direct association with decreased medication adherence (3 variables).

(H2.2) Increased symptom status (vitality) has a direct association with increased medication adherence (3 variables).

(H2.3) Characteristics of the individual (increased age, female, low income, and no prescription insurance) have a direct association with decreased medication adherence (3 variables).

(H2.4) Characteristics of the environment (increased social support [4 variables] and less complex medication regimen [2 variables]) have a direct association with increased medication adherence (3 variables).

1.7.1.3 Hypotheses for Aim 3

(H3.1) Biological and physiological factors (low EF and increased comorbid conditions) have a direct association with decreased GHP.

(H3.2) Increased symptom status (vitality) has a direct association with increased GHP.

(H3.3) Characteristics of the individual (increased age, female, low income, and no prescription insurance) have a direct association with decreased GHP.

(H3.4) Functional status (increased medication adherence [3 variables]) has a direct association with increased GHP.

(H3.5) Characteristics of the environment (increased social support [4 variables] and less complex medication regimen [2 variables]) have a direct association with increased GHP.

1.7.1.4 Hypotheses for Aim 4

(H4.1) Biological and physiological factors (low EF and higher comorbid conditions) have a direct association with decreased HRQOL (2 variables).

(H4.2) Increased symptom status (vitality) has a direct association with increased HRQOL (2 variables).

(H4.3) Characteristics of the individual (increased age, female, low income, and no prescription insurance) have a direct association with decreased HRQOL (2 variables).

(H4.4) Functional status (increased medication adherence [3 variables]) has a direct association with increased HRQOL (2 variables).

(H4.5) Characteristics of the environment (increased social support [4 variables] and less complex medication regimen [2 variables]) have a direct association with increased HRQOL (2 variables).

(H4.6) Increased GHP has a direct association with increased HRQOL (2 variables).

1.7.2 Research Design

This proposed study is a secondary analysis of cross-sectional data from the parent study, "Medication Adherence and Quality of Life in Chronic Illness" (NIH, National Institute of Nursing Research Grant K01 NR00083, Principal Investigator: Patricia Bohachick). This study will use a descriptive correlational design to test the hypotheses. See Appendix A for a copy of the parent study consent document.

1.7.3 Setting

The setting in the parent study was a university-affiliated HF clinic. HF management cardiologists and advance practice nurses operate the HF clinic. Consistency of follow-up visits with the same cardiologist occurred. Frequency of the patient visits was patient condition specific. Outpatients spent approximately 30 minutes with the cardiologist and then additional time with the nurse or dietitian as needed for education and counseling. The clinic was associated with the University of Pittsburgh Medical Center in Pittsburgh, Pennsylvania, an internationally recognized academic medical center providing comprehensive medical care, education of health care professionals, and research.

1.7.4 Population

The population in the parent study consisted of patients who attended the University of Pittsburgh Medical Center Heart Failure clinic in Pittsburgh, Pennsylvania. This clinic sees thousands of persons diagnosed with HF each year supporting the tri-state area of Western Pennsylvania, Eastern Ohio, and the Northern Panhandle of West Virginia.

1.7.5 Sampling Procedures

The parent study sample was obtained through convenience sampling. The parent study sample was comprised of university-affiliated HF clinic patients who were prescribed ACE inhibitors and used electronic event medication monitoring by MEMS over three months to evaluate adherence to ACE inhibitor therapy (Bohachick et al., 2002). Participants had to be 21 years of age or older, prescribed ACE inhibitor therapy, and able to self-manage their medications. Subjects were excluded from the study if they had an unstable medical condition, exhibited signs of confusion, or were unable to read and write English.

1.7.6 Sample

The initial sample in the parent study consisted of 235 subjects. Sixty-four (27.2%) of those subjects used dose organizers where they removed multiple pills from the bottle with the MEMS cap and placed them into dose organizers from which to administer their medication. Since the

parent study depended on the valid assessment of medication adherence, these 64 subjects were excluded from the final sample in the parent study. Thus, the final parent study sample was comprised of the 171 subjects who took their medication directly from the bottle with the MEMS cap and completed the Interpersonal Support Evaluation List (ISEL), MOS SF-36, and a demographics questionnaire. Data on 10 of the subjects in the final parent study sample had missing values on variables examined in this study (one subject for number of times per day medication is prescribed, seven subjects for income, and two subjects for prescription insurance coverage). A missing values analysis demonstrated no variables with 5% or more missing values. Thus, the subjects with missing data were excluded from this study. The sample for this study will be comprised of 161 HF clinic patients with complete data on the proposed study variables.

1.7.7 Instruments

1.7.7.1 Demographics questionnaire

The Demographics questionnaire is a self-report questionnaire completed by subjects that provides socio-demographic data such as age, gender, marital status, race, education level, employment status, occupation, income, and questions about medication insurance coverage, cost, and regimen (See Appendix B). Data will be pulled from the Demographics questionnaire to describe the sample. Age, gender, income, and insurance data obtained from this questionnaire will be considered characteristics of the individual in the Wilson and Cleary model.

1.7.7.2 Medical Record Data (MRD)

Medical information was gathered from the subject's medical record and recorded onto the MRD (See Appendix B). EF and comorbid conditions from the MRD will be considered biological and physiological factors in the Wilson and Cleary model. Number of medications and number of times per day medication is prescribed from the MRD are elements of the medication regimen and will be considered environmental characteristics in the Wilson and Cleary model.

1.7.7.3 Interpersonal Support Evaluation List (ISEL)

The ISEL, a 40-item self-report measure, will be used to measure social support (See Appendix B). The ISEL is based on the premise that social resources potentially aide with coping in stressful situations. The ISEL, used to measure the perceived availability of potential social support resources, contains four subscales: appraisal support, sense of belonging support, self-esteem support, and tangible support. Appraisal support is one's perceived availability to talk about one's problems. Belonging support is the perceived availability of someone with whom one can do things. Self-esteem support is the perceived availability of a positive comparison of one's self with others. Tangible support is perceived availability of material aid (Cohen, Mermelstrin, Kamarck, & Hoberman, 1985). The scores from the ISEL are highly ordinal and approximate interval scaled variables. Half (20 items) of the items are constructed positively and half (20 items) negatively. Items are rated on a 4-point scale with response to statement choices of definitely false, probably false, probably true, or definitely true. Each statement has a scoring range of 0 - 3 with a potential range of 0 - 120 for the total score. The higher the score, the greater the perceived social support is viewed. The subscale scores are obtained similarly with a

range from 0 - 30 with higher scores meaning greater perceived social support (Cohen et al., 1985).

The ISEL is a widely used, valid and reliable instrument. The general population scale correlated at 0.30 with the established Moos Family Environment Scale and 0.31 with the Partner Adjustment Scale (Cohen et al., 1985). Cohen et al. (1985) reported that internal consistency reliability in the general population was favorable with alpha coefficient ranges for the total ISEL from 0.88 to 0.90. Reports of the subscales were 0.70 to 0.82 for appraisal support, 0.73 to 0.78 for belonging support, 0.62 to 0.73 for self-esteem support, and 0.73 to 0.81 for tangible support.

Test-retest reliability was reported for two days, six weeks, and six months in the general population from data obtained from five studies. Reliability estimates ranged from 0.70 to 0.87 for the total ISEL, 0.60 to 0.84 for appraisal support, 0.65 to 0.68 for belonging support, 0.54 to 0.74 for self-esteem support, and 0.49 to 0.78 for tangible support (Cohen et al., 1985).

The general population ISEL was administered three times in the Oregon Smoking Study (community sample) at baseline, six weeks, and six months. Mean scores ranged from 32.9 to 34.4. Standard deviations ranged from 4.96 to 5.98. In this analysis, social support will be viewed as a characteristic of the environment in the Wilson and Cleary model.

1.7.7.4 Medication Event Monitoring System (MEMS)

Medication adherence was measured by electronic event monitoring using MEMS. This method provides an alternate more objective method than the self-report method of medication

adherence. Data are electronically gathered and stored in the cap of the pill bottle that can later be downloaded for analysis of medication taking practices.

The MEMS recorded the date and time the bottle was opened. From these serially collected data, summary indices were derived that provided global measures of medication adherence that are continuous, ratio scaled variables. The three measures of medication adherence are: percentage of prescribed administrations taken (dose adherence), percentage of days with the prescribed number of administrations (days adherence), and percentage of days with the prescribed number of administrations and optimal inter-dose intervals (on-time adherence). Optimal inter-dose intervals were computed as the time interval between bottle openings and were within 25% of the optimal dosing interval. For example, for once daily dosing, 24 ± 6 hours of the previous bottle opening is optimum; for twice daily dosing, 12 ± 3 hours of the previous bottle opening is optimum; and for three times per day dosing, 8 ± 2 hours of the previous bottle opening is optimum.

Obtaining adherence data electronically, such as through the MEMS, reveals adherence information that may not otherwise be obtained through alternate means such as via diary submission. MEMS provides an objective accuracy that is lacking with the self-report methods. The AARDEX Group (n.d.) that manufactures the MEMS product used in this study reports a failure rate below 0.5% and informs published successful use in greater than 518 peer review papers (www.aardexgroup.com). In this study, medication adherence will be viewed as a measure of functional status in the Wilson and Cleary model.

1.7.7.5 Medical Outcomes Study Short Form-36 (MOS SF-36)

For this study, HRQOL will be measured by the physical component score (PCS) and mental component score (MCS) from the MOS SF-36 (See Appendix B). This well-known and widely used instrument has established reliability and validity in various age groups and diseases. It has a fair test-retest reliability with median r = 0.64 and good internal consistency with median alpha = 0.80 (McHorney, Ware, Lu, & Sherbourne, 1994; McHorney, Ware, & Raczek, 1993; McHorney, Ware, Rogers, Raczek, & Lu, 1992).

The MOS SF-36 contains eight scales that measure health status. They are physical functioning, role functioning-physical, role functioning-emotional, social functioning, bodily pain, mental health, vitality, and GHP. The Vitality and GHP subscales were used as measures of symptom status and general health perceptions in the model, respectively. The Mental HRQOL and Physical HRQOL are summary scales with possible scores range from 0 to 100, where 0 is the worst health status and 100 is the best health status (Ware, Kosinski, & Keller, 1994). The mental HRQOL is made up of all eight scores mostly derived from the mental health, role functioning-emotional, and social functioning scores. The physical HRQOL is also made up of all eight scores primarily derived from the physical functioning, role functioning-physical, and bodily pain scores. The mental HRQOL and physical HRQOL component scores from the MOS SF-36 are highly ordinally scaled and approximate interval scaled variables. Mental HRQOL and physical HRQOL were considered measures of HRQOL in the model.

1.7.8 Procedures for Data Collection

In the parent study, physicians in the clinic reviewed the study with their patients and asked permission for the clinic clinicians to meet with them. If the potential subject agreed, the clinician presented the study and obtained permission to share their contact information with the principal investigator and project nurse. If potential subjects agreed, the project nurse reviewed the medical record to evaluate eligibility and met with the potential subjects during a schedule clinic appointment.

Those who agreed to participate provided written informed consent that covered the study description, purpose of the study, potential risks and benefits of participation, and subject rights (confidentiality, right to withdraw without risk or disruption of care). At this time, those consenting were informed/encouraged to ask questions and given the PI's contact information for future questions.

Consenting subjects signed and dated three copies of the consent document, one for the research record, one for the medical record and one for the subject. The principal investigator or project nurse witnessed the subject signing the consent document and signed and dated the consent document as well. A log was maintained of potentially eligible subjects with the reasons for exclusion from the study.

Subjects received the MEMS cap along with instructions on its use. Subjects were directed to place the MEMS cap on the vial containing their ACE inhibitor medication. They were informed to open the MEMS cap only to take the prescribed medication and to record on a medication diary the date, time, and reason for any other extra openings or missed doses over a

span of three months. Those that used dose organizers were directed to place the MEMS fitted bottle next to their dose organizers and to open the cap on the bottle each time they removed the ACE inhibitor from their dose organizer.

Subjects received a packet of baseline self-report questionnaires to complete and return within 2-3 days. Time to complete the questionnaires was estimated at sixty minutes. Subjects were given a pre-addressed stamped envelope to use for returning the completed questionnaires. The project nurse contacted subjects within three days after the clinic visit to follow-up on any additional questions and/or concerns related to the study. MEMS data were collected over a three-month period. At the end of three months, subjects returned the MEMS cap either at a follow-up clinic appointment or through the mail in a pre-addressed stamped envelope that the project nurse gave the subjects during the clinic visit and initial enrollment. Final questionnaires were completed at the three-month follow-up clinic visits. Medical records were reviewed to collect sociodemographic and medical data.

After the three-month study, MEMS caps were received and data were uploaded onto a project computer. Event files were adjusted based on diary entries. If the subject missed doses for hospitalization, the days of observation/monitoring were adjusted to reflect only those days not hospitalized. If subjects opened the cap for reasons other than for taking medications, the event was deleted.

1.7.9 Procedures for Data Analysis

1.7.9.1 Preliminary analysis

Data screening and analysis to test the hypotheses will be performed using SPSS v 20.0 for Windows. Frequency reports for all variables will be produced to determine if there are any inaccurate data or values that do not fall within the range expected. The data will be summarized using frequencies, percentages, medians, means, ranges, and standard deviations as appropriate given the variable's level of measurement and observed data distribution. Measures of central tendency and dispersion of the variables will be explored. Descriptive statistics will be used to examine demographic characteristics of the sample.

Univariate and multivariate outliers

Univariate and multivariate outliers will be assessed using frequencies, histograms, and scatter plots. Z-scores will be computed to screen for univariate outliers. Mahalanobis distance measures will be computed to screen for multivariate outliers.

Normality

Univariate normality will be assessed using frequencies, measures of skewness and kurtosis, histograms, and scatterplots. Further normality will be assessed after fitting the model mainly by looking at residuals. Data transformations will be considered including making the term quadratic, centering, and using a base 10 logarithm and analyses with comparison of both the transformed and nontransformed versions.

Linearity

All terms will be evaluated for linearity using scatter plots and partial plots of residuals. If variables appear nonlinear, exploration of those variables with creation of variables to adjust for this (e.g., quadratic terms and centering) will occur to reduce the nonessential multicollinearity. Multicollinearity screening will consist of examining conditioning indices and their corresponding variance decomposition proportions, tolerance, and variance inflation factors. Homoscedasticity will be evaluated using bivariate scatter plots, partial plots, and residuals. There are no missing data from the proposed study variables.

1.7.9.2 Primary analysis for aim 1

To test the first hypothesis that biological and physiological factors (EF and comorbid conditions), characteristics of the individual (age, gender, income, and prescription insurance), and characteristics of the environment (social support [4 variables] and medication regimen [2 variables]) have a direct effect on symptom status (vitality), simple linear regression analysis will be conducted considering each predictor one at a time. A standard multiple linear regression will be used for the analysis of the set of predictors of EF, comorbid conditions, age, gender, income, prescription insurance, social support, and medication regimen on vitality.

1.7.9.3 Primary analysis for aim 2

To test the second hypothesis that biological and physiological factors (EF and comorbid conditions), symptom status (vitality), characteristics of the individual (age, gender, income, and prescription insurance), characteristics of the environment (social support [4 variables] and

medication regimen [2 variables]) have a direct effect on medication adherence (3 variables), simple linear regression analysis will be conducted considering each predictor one at a time. A standard multiple linear regression will be used for the analysis of the set of predictors of EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, and medication regimen on medication adherence.

1.7.9.4 Primary analysis for aim 3

Simple linear regression taking each predictor one at a time will be utilized to analyze the third hypothesis that biological and physiological factors (EF and comorbid conditions), symptom status (vitality) characteristics of the individual (age, gender, income, and prescription insurance), characteristics of the environment (social support [4 variables] and medication regimen [2 variables]), and medication adherence (3 variables) have a direct effect on GHP. Multiple linear regression analysis will be used to examine joint associations between EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, and medication adherence on GHP.

1.7.9.5 Primary analysis for aim 4

Simple linear regression taking each predictor one at a time will be utilized to analyze the fourth hypothesis that biological and physiological factors (EF and comorbid conditions), symptom status (vitality) characteristics of the individual (age, gender, income, and prescription insurance), characteristics of the environment (social support [4 variables] and medication regimen [2 variables]), medication adherence (3 variables), and GHP have a direct effect on

HRQOL (2 variables). Multiple linear regression analysis will be used to examine joint associations between EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, medication adherence, and GHP on HRQOL.

1.7.9.6 Data interpretation

Standard linear regression will be performed with forced variable entry, with point (regression coefficients) and interval estimates (95% confidence intervals) being obtained for each predictor variable. Significance testing with the t-test at a significance level of .05 will be conducted to see if regression coefficients are different from zero. For each model fitted, model summary statistics (adjusted R-square values and standard error of estimate) will be computed and a residual analysis using graphical and inferential methods will be conducted to assess for violations in the assumptions regarding the distribution of residuals (i.e., independence, linearity, homoscedasticity, and normality). Data transformations will be considered if the distribution of residuals appears to be significantly skewed. Scatterplots of each independent variable with the dependent variable will be viewed to verify that there is a linear relationship. Residuals displayed in partial plots will also be visualized to view the direction and strength of the relationship and to check for outliers. Transformations will be considered for outliers. Multicollinearity will be assessed by looking at the tolerance statistics, variance inflation factors, condition indices and variance decomposition proportions. Screening for influential cases will also be accomplished. Studentized deleted residuals and leverage statistics will be examined initially to identify potentially influential observations. Change statistics (R-squared and F-test) will be examined in the regression analyses.

1.7.10 Study Limitations

This proposed study is a secondary analysis of data, which is a limitation because the analyses are restricted to the data available in the parent study. There will not be an opportunity to clarify or obtain additional data. Data were not collected in the parent study with this research proposal as the focus, which may limit the appropriate information sought. However, evaluation of the measures used in the parent study support their use to test the research hypotheses in this proposed study. Errors in the original data collection will not be visible in this secondary analysis. The descriptive correlational design of this study limits the ability to make causal inferences about the associations of the predictors on HRQOL.

1.7.11 Potential Problems with Proposed Procedures

The existing data were collected in 1998 and are dated. However, HF continues to be a significant chronic disease and has not changed even in the past decade. The rate of overall hospitalizations has not changed significantly from 2000 to 2010 and increases with age (Hall et al., 2012). Therefore, the dataset is still relevant and appropriate for this secondary analysis of existing data. This study is also limited as described in the parent study. The parent study found that the rate of adherence was higher than the usual reports. The authors surmised that higher adherence may be due to the study consisting of well-educated, married persons whose self-reported household income was adequate for their needs (Bohachick et al. 2002).

1.7.12 Alternative Approaches to Achieve Specific Aims

Alternative statistical software packages such as SAS could be used to evaluate the specific aims. The principal investigator will consult with the statistician member of the dissertation committee for evaluation of the appropriateness of the chosen methods of analysis utilizing the statistical software package of SPSS. Input will be sought to determine if alternative approaches are warranted. Should a change in approach be suggested, further consultation with the dissertation chair will occur. Once all questions are answered and clarification sought, a collaborative decision will be made on whether or not to continue with the original research methods. If an alternate approach is considered to be superior, efficient, and available, a new research plan will be drafted to guide this alternative approach.

1.7.13 Plans for Further Testing

Future research directions include examining mediation proposed in the Wilson and Cleary model. This mediational analysis will likely include structural equation modeling, which is appropriate to examine mediation. Through path analysis, the predictive and mediational roles of the variables described in the Wilson and Cleary model can be tested.

1.8 RESEARCH PARTICIPANT RISK AND PROTECTION

A protocol application was submitted to the University of Pittsburgh Institutional Review Board (IRB) under exempt status (PRO10100156). IRB approval for this secondary analysis of data was received on 02/07/2012. See Appendix C for a copy of the IRB approval letter. The principal investigator has obtained certificates of research training as required by the University of Pittsburgh (see Appendix D).

1.8.1 Involvement of Human Participants

This secondary analysis will consist of 161 subjects with age ranging from 21-82 years who were diagnosed with HF and prescribed ACE inhibitor therapy. Subjects were also able to self-manage their medications. Subjects were excluded from the study if they had an unstable medical condition, exhibited signs of confusion, or were unable to read and write English. There was not any involvement of vulnerable participants such as fetuses, pregnant women, children, or institutionalized individuals in this study.

1.8.2 Sources of Data

Patricia Bohachick, PhD, RN, principal investigator of the parent study, granted permission for Susan E. Simms, MSN, RN, CRRN, and PhD student at the University of Pittsburgh School of

Nursing to have access to the dataset to conduct the proposed secondary analysis of data. The data are de-identified.

1.8.3 Recruitment and Retention

The study proposed is a secondary analysis of de-identified existing data. No screening, recruitment, or follow-up will occur in the proposed research study. The parent dataset reflects the gender and minority composition of the Pittsburgh area in which the HF clinic is located.

1.8.4 Potential Risks

There is minimal risk to the participants. The data are already de-identified. The likelihood of occurrence and seriousness of risk is null.

1.8.5 Procedures to Minimize Potential Risks

No protected health information will be accessed for this research or placed into the medical record. No medical record data will be obtained. No strategies to prevent breach of confidentiality are needed.

1.8.6 Cost-to-Benefit

There will not be any compensation to subjects for participation in this research study. Subjects will not receive a direct benefit from this research. The knowledge gained may help to identify those factors contributing to the HF outcome of HRQOL, which in term may help the principal investigator to design interventions to improve HRQOL in this population.

2.0 MANUSCRIPT 1: PREDICTORS OF HEALTH-RELATED QUALITY OF LIFE OF ADULTS WITH HEART FAILURE

2.1 ABSTRACT

Background: Heart failure patients experience low health-related quality of life and poor health outcomes.

Objective: The purpose of this study was to examine interrelationships among and predictors of health-related quality of life of adults with heart failure.

Methods: This cross-sectional secondary analysis of 161 older (M=56.09 years ± 11.74), white (93.2%), male (69.6%) heart failure patients was prescribed angiotensin converting enzyme inhibitors and used electronic Medication Event Monitoring System. Ejection fraction, comorbid conditions, vitality, age, gender, income, prescription insurance, social support (appraisal, belonging, self-esteem, and tangible support by Interpersonal Support Evaluation List), medication regimen (number of prescribed medications and times per day medication is prescribed), medication adherence (days adherence and on-time adherence), general health perceptions, and health-related quality of life (Short Form-36 physical and mental component scores) were analyzed by simple and multiple linear regression.

Results: Vitality was positively associated with mental (p=<.001) and physical (p=<.001) component scores of health-related quality of life. Females (p=.033) and those with prescription insurance (p=.032) had decreased mental component scores, while on-time adherence (p=.043) was positively associated with mental component scores. Greater number of prescribed medications (p=.038) was associated with decreased physical component scores, while increased general health perceptions (p<.001) were associated with increased physical component scores. More comorbid conditions (p=.024) and increased social support (appraisal, p=.016) were associated with decreased vitality, whereas increased social support (self-esteem, p=.035) was associated with increased vitality. Higher income (p=.023) was associated with increased days adherence. Greater number of times per day medication is prescribed (p=.002) was associated with decreased on-time adherence, and higher ejection fraction (p=.032) was associated with increased on-time adherence. Vitality (p<.001) was positively associated with general health perceptions.

Conclusions: Interventions that incorporate these variables may reduce negative impacts on health-related quality of life and improve health outcomes in heart failure patients.

2.2 INTRODUCTION

Heart failure (HF), a chronic disease in which the heart cannot pump enough blood to meet the body's needs (Hall, Levant, & DeFrances, 2012), affects approximately 5.1 million adult Americans with 670,000 new cases per year (Lloyd-Jones et al., 2010). Even with breakthroughs in treatment, HF remains a common diagnosis in hospital admissions and mortality. HF accounted for 1,106,000 hospitalizations in 2006 and resulted in approximately 281,437 deaths in 2008 (Lloyd-Jones et al., 2010; Roger et al., 2012). Approximately 50% of people diagnosed with HF will be deceased within five years (Levy et al., 2002). HF is the most common diagnosis of hospitalized patients over 65 years and men (Lloyd-Jones et al., 2010; Roger et al., 2004). HF accounts for an estimated 40% of preventable hospitalizations of adults over 65 years with a cost estimated at $32 billion for 2013 (Heidenreich et al., 2011).

Health-related quality of life (HRQOL) is greatly decreased in patients with HF (Juenger et al., 2002). Further, HRQOL is low in hospitalized patients with HF (Chin & Goldman, 1998). Numerous factors have been identified in various studies as contributing to HRQOL, such as symptom status (Heo, Moser, Riegel, Hall, & Christman, 2005; Kethrong, Jirapaet, Jitpanya, & Sloan, 2008), functional status (Hauptman, 2008), and general health perceptions (GHP) (Heo et al., 2005; Kethrong et al., 2008). In addition, variables potentially influencing these predictors of HRQOL consist of biological and physiological features (ejection fraction (EF) and comorbid conditions), individual characteristics (age, gender, income, and prescription insurance coverage), and environmental characteristics (social support and medication regimen (number of

prescribed medications and number of times per day medication is prescribed). However, no single study to date has examined all of these identified factors in a model for HF patients.

HF management is complex with no single intervention or self-care modality to optimize outcomes. Therefore, identification and examination of factors influencing HRQOL and their associated factors will provide keys to target interventions to improve HF outcomes. The Wilson and Cleary (1995) model of HRQOL is an ideal model to test these factors in patients with HF. The knowledge gained would contribute to the development of multifaceted interventions to improve the main influences on HRQOL of persons with HF.

2.3 BACKGROUND

Since the hallmark Framingham Heart Study (FHS), which set the framework of determining HF risk factors and treatment, researchers have been studying relationships and interventions to improve HF outcomes (Mehta & Khan, 2002). The Olmsted County study, utilizing the FHS criteria, identified HF trends and survival (Roger et al., 2004). In 1991, Studies of Left Ventricular Dysfunction (SOLVD) investigators determined the addition of enalapril, an angiotensin converting enzyme (ACE) inhibitor, with current HF treatment, significantly decreased mortality and hospitalizations for HF (SOLVD Investigators, 1991). The benefit of ACE inhibitors, described as the most important advance in HF therapy in recent times (Baker, Konstam, Bottorff, & Pitt, 1994), has become the standard recommended medication treatment for reducing HF mortality and hospitalizations. Medication adherence is essential to the success

of living with HF (Evangelista & Shinnick, 2008). Long-term medication adherence is commonly lacking for those with chronic diseases (Dunbar-Jacob, Bohachick, Mortimer, Sereika, & Foley, 2003), and medication non-adherence is the primary reason of HF flares and hospital readmissions (Chin & Goldman, 1998; Hope, Wu, Young, & Murray, 2004), which may be a contributing factor to poorer HRQOL (Hauptman, 2008).

In 2001, the Joint Commission and Centers for Medicare and Medicaid Services (CMS) identified HF diagnosis as one of the core measures to integrate performance measures with accreditation. Hospitals are charged with identifying and providing standard evaluation and interventions for a variety of targeted procedures and diagnoses, including HF. Performance measures of HF include discharge instructions, left ventricular function assessment, ACE inhibitor use for left ventricular systolic dysfunction, and adult smoking cessation advice/counseling. The goal is to decrease the number of preventable readmissions by effectively treating and educating HF patients while they are in the hospital. This initiative indicates that multiple factors influencing HF readmissions must be addressed. Although there has been significant improvement in the successful management of HF with national initiatives, including decreasing mortality rates, there is no significant decrease in HF incidence (Roger et al., 2004).

It is common for people with HF to experience exercise intolerance and fatigue symptoms (Lewis et al., 2007). Better physical symptom status has been related to increased HRQOL and is a predictor of HRQOL (Heo et al., 2005; Kethrong et al., 2008). Yet, there are limited studies in the literature on symptom status and HRQOL in persons with HF. Symptom status, such as vitality (VT), in persons with HF is in need of further study.

Health perceptions are low in older patients with HF compared to healthy older adults (Carlson, Pozehl, Hertzog, Zimmerman, & Riegel, 2013; Heo, Moser, Lennie, Zambroski, & Chung, 2007). Low health perceptions are linked to higher mortality in patients with HF. Health perceptions have been identified as predictors of HRQOL in older adults with HF (Johansson, Brostrom, Dahlstrom, & Alehagen, 2007).

There have been inconsistent findings in studies of biological and physiological factors on HRQOL in patients with HF. EF has been identified as a predictor of HRQOL in one study (Lewis et al., 2007), but not in other studies (Clark, Tu, Weiner, & Murray, 2003; Heo, Doering, Widener, & Moser, 2008; Juenger et al., 2002; Kethrong et al., 2008). Fewer comorbidities have been associated with increased HRQOL (Seto et al., 2011) while other studies have not found comorbidities to be influential (Clark et al., 2003; Heo et al., 2008). These results warrant further evaluation of the effect of biological and physiological variables on HRQOL.

Individual factors, such as age, gender, income, and prescription insurance coverage, have been associated with HRQOL. Older age has been associated with lower HRQOL (Gallicchio, Hoffman, & Helzlsouer, 2007). Low HRQOL has been reported by both men and women with HF (Gallicchio et al., 2007; Sayers, Riegel, Pawlowski, Coyne, & Samaha, 2008), but women to a greater extent (Bennett et al., 2001; Chin & Goldman, 1998; Gallicchio et al., 2007). Income and HRQOL have been linked in HF patients (Azevedo et al., 2008; Clark et al., 2003). The literature is lacking on relationships of prescription insurance with HRQOL, but insurance is often coupled with income in affording prescribed regimens for optimum outcomes.

Environmental factors including social support and medication regimen have been related to HRQOL. Positive social support has been identified as impacting HRQOL (Clark et al.,

2003), while another study reported a negative direct effect (Kethrong et al., 2008). Yet, another study found no impact at all (Heo et al., 2005). Scant research is available on relationships between medication regimen and HRQOL. Increased number of medications prescribed is associated with decreased HRQOL (Demir & Unsar, 2011).

HF remains an extreme burden on the population as a whole (Roger et al., 2004). Older adults lag behind in improvements in survival after the onset of HF compared to younger adults, which indicates that effective interventions tailored to increasing those factors that have a positive impact on HF management of older adults are needed. Analysis of the gender differences in factors that affect HRQOL are lacking in the literature. Social support has had varying degrees of meaning in the literature, so there is a need to clearly define and study the relationship of social support with HRQOL. Income and prescription insurance coverage need further analysis as predictors of HRQOL. Medication regimen needs further exploration to determine threshold and directional relationships with medication adherence and HRQOL. Given the lack of medication adherence in a large portion of the HF population, there is continued need for research on ways to improve medication adherence and HRQOL. Research utilizing the components and influencing factors of the Wilson and Cleary (1995) model will contribute to a more complete understanding of the complexities and factors contributing to HRQOL in HF patients. Efforts to improve HRQOL in HF patients could potentially decrease hospitalizations. Interventions with even a small effect on hospital admissions could have a significant effect on the burden of cost of treatment of HF (Lee, Chavez, Baker, & Luce, 2004).

Previous studies used the Wilson and Cleary (1995) model in HF patients (Arnold, Ranchor, Koeter, de Jongste, & Sanderman, 2005; Carlson et al., 2013); however, few studies

tested all of the domains and influencing factors of the Wilson and Cleary model (Heo et al., 2005; Kethrong et al., 2008). Krethong et al. (2008) tested the Wilson and Cleary model in 422 HF clinic patients in Thailand. Researchers collected medical record data and administered questionnaires. They concluded each variable affected HRQOL with symptom status as most influential on HRQOL. Patients who rated their functional status low also rated their GHP as low. Heo et al. (2005) fully tested the Wilson and Cleary model including mediation by studying medical records of 293 HF patients who resided in the United States and were given the Minnesota Living with HF questionnaire. Health perception and symptom status were determined to be most associated with HRQOL. Future studies were recommended to fully validate the relationships among the variables in the Wilson and Cleary model. Carlson et al. (2013) partially tested the Wilson and Cleary model focusing on overall perceived health as the outcome; environmental characteristics as predictors and HRQOL were not examined in this study. This study was a secondary analysis of 265 subjects recruited for a study on the influence of excessive daytime sleepiness on self-care, HRQOL, and unplanned hospitalization. Significant findings were categorized into unmodifiable (black race, income, and comorbidity) and modifiable factors (symptom stability and social functioning in men only) as predictors of overall perceived health (Carlson et al., 2013). Arnold et al. (2005) partially tested the Wilson and Cleary model comparing 95 chronic obstructive pulmonary disease (COPD) subjects with 90 HF subjects. The study investigated relationships between objective health parameters and general health perceptions mediated by symptoms of dyspnea and physical functioning. Individual and environmental characteristics and HRQOL were not studied. Both COPD and HF patients perceived health competence was related to symptoms of dyspnea and GHP.

Additionally, symptoms of dyspnea were associated with self-reported physical functioning, which was related to GHP (Arnold et al., 2005).

The Wilson and Cleary (1995) conceptual model being used in this study is comprised of five components: biological/physiological, symptom status, functional status, GHP, and overall quality of life with characteristics of the individual and the environment as influencing factors on the model. Each of these components is proposed to be on a continuum from biological measures to more complex and integrated measures such as GHP and HRQOL. The model proposes causal relationships with HRQOL as the final outcome.

This study tested all of the components and influencing factors of the Wilson and Cleary (1995) model. The biological/physiological component was operationalized as EF and comorbid conditions; symptom status was operationalized by a vitality scale; characteristics of the individual included age, gender, income, and prescription insurance; and characteristics of the environment included social support and medication regimen. Functional status assesses the ability of the individual to perform a particular task and was operationalized as medication adherence. The general health perceptions component was operationalized by a GHP scale. HRQOL was operationalized by scales of mental and physical health.

2.3.1 Objective

The purpose of the proposed study was to examine interrelationships among and predictors of HRQOL of adults with HF utilizing the Wilson and Cleary (1995) model (see Figure 3). The specific aims were to examine (1) EF, comorbid conditions, age, gender, income, prescription

insurance, social support, and medication regimen as predictors of vitality; (2) EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, and medication regimen as predictors of adherence to ACE inhibitor medication therapy; (3) EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, and medication adherence as predictors of GHP; and (4) EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, medication adherence, and GHP as predictors of HRQOL.

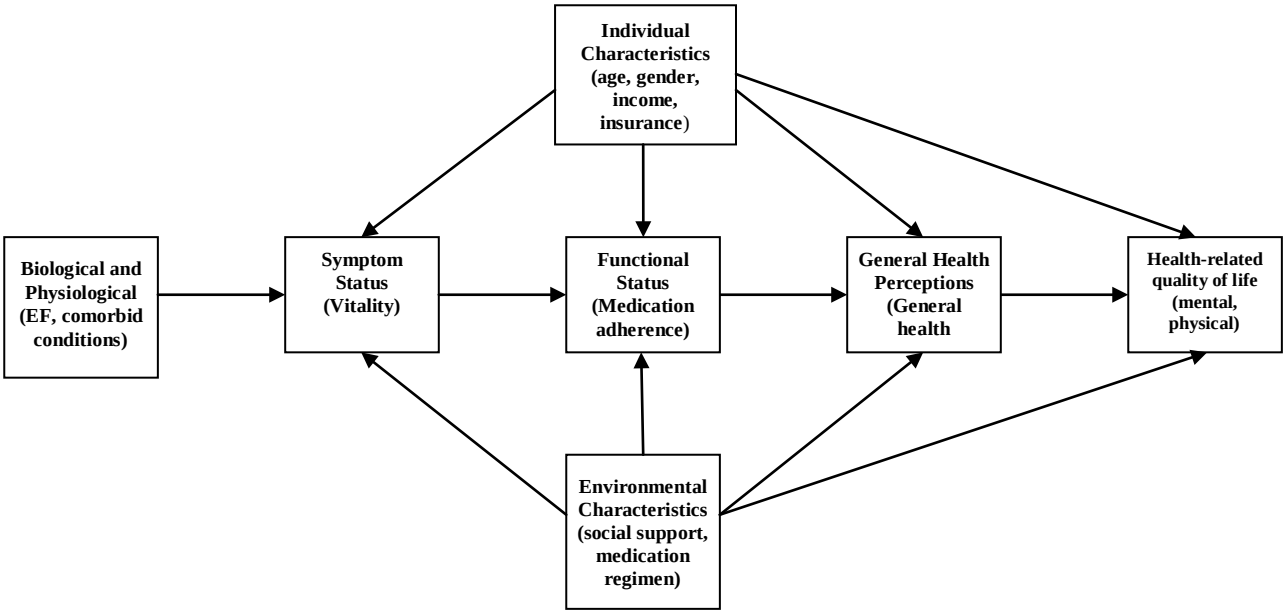

Figure 3. Study Model Based on Wilson and Cleary Model of Health-related Quality of Life

2.4 METHODS

2.4.1 Design and Sample

This study was a secondary analysis of cross-sectional data from the parent study, "Medication Adherence and Quality of Life in Chronic Illness" (National Institutes of Health, National Institute of Nursing Research, K01 NR00083, Principal Investigator: Patricia Bohachick). This study used a descriptive correlational design to address the specific aims.

The parent study convenience sample was comprised of HF clinic patients who attended the University of Pittsburgh Medical Center Heart Failure clinic in Pittsburgh, Pennsylvania. Participants had to be 21 years of age or older, prescribed ACE inhibitor therapy, and able to self-manage their medications. Subjects were excluded from the study if they had an unstable medical condition, exhibited signs of confusion, or were unable to read and write English. The subjects used electronic event medication monitoring by Medication Event Monitoring System (MEMS) over three months to evaluate adherence to ACE inhibitor therapy (Bohachick, Burke, Sereika, Murali, & Dunbar-Jacob, 2002).

The initial sample in the parent study consisted of 235 subjects. Sixty-four (27.2%) of those subjects used dose organizers where they removed multiple pills from the bottle with the MEMS cap and placed them into dose organizers from which to administer their medication. Since the parent study depended on the valid assessment of medication adherence, these 64 subjects were excluded from the final sample in the parent study. Thus, the final parent study sample was comprised of the 171 subjects who took their medication directly from the bottle

with the MEMS cap and completed the Interpersonal Support Evaluation List (ISEL), MOS SF-36, and a demographics questionnaire.

Data on 10 of the subjects in the final parent study sample had missing values on the predictors and outcomes examined in this study (one subject for number of times per day a medication is prescribed, seven subjects for income, and two subjects for prescription insurance coverage). A missing values analysis demonstrated no variables with 5% or more missing values. Chi Square analysis comparing the subjects in this study with no missing data (N=161) with those in the parent study (N=171) revealed no significant differences on gender, race, marital status, education level, income, insurance covering the cost of medication, EF, comorbid conditions, and medication regimen. The t-test ($t(169) = -2.669$, $p = .008$) showed that there was a significant difference in mean age between the 161 subjects in this study with no missing data ($M = 56.09$, $SD = 11.74$ years) and the 10 subjects who had missing data ($M = 45.90$, $SD = 11.22$ years). The 161 subjects in this study were significantly older. Given that the two samples were generally comparable, only differing on age, the 10 subjects with missing data were excluded from this study. Thus, the sample for this study was comprised of 161 HF clinic patients with complete data on the study variables. The current study was reviewed and approved by the University of Pittsburgh Institutional Review Board.

2.4.2 Measures

2.4.2.1 Demographics questionnaire

An investigator-developed demographics questionnaire was completed by subjects that provided data such as age, gender, marital status, race, education level, employment status, occupation, income, and questions about prescription insurance coverage and cost of medications. Data from the demographics questionnaire were used to describe the sample. Additionally, age, gender (male = 0, female = 1), income (less than $30,000 annually = 0, $30,000 and greater annually = 1), and insurance data (no prescription insurance = 0, prescription insurance = 1) obtained from this form were utilized as characteristics of the individual in the model.

2.4.2.2 Medical record data (MRD)

Medical information was gathered from the subject's medical record. EF and comorbid conditions (less than 3 conditions = 0, 3 or more conditions = 1) were collected using MRD and were considered biological and physiological factors in the model. Number of medications (less than 7 medications = 0, 7 or more medications = 1) and number of times per day medication is prescribed (less than 3 times = 0, 3 - 4 times = 1), both elements of the medication regimen and considered environmental characteristics in the model, were gathered using MRD.

2.4.2.3 Interpersonal Support Evaluation List (ISEL)

The ISEL, a 40-item self-report measure, was used to measure social support. The ISEL is based on the premise that social resources potentially aid with coping in stressful situations. The ISEL,

used to measure the perceived availability of potential social support resources, contains four subscales: appraisal support, sense of belonging support, self-esteem support, and tangible support. Appraisal support is one's perceived availability to talk about one's problems. Belonging support is the perceived availability of someone with whom one can do things. Self-esteem support is the perceived availability of a positive comparison of one's self with others. Tangible support is perceived availability of material aid (Cohen, Mermelstein, Kamarck, & Hoberman, 1985). The scores from the ISEL are highly ordinal and approximate interval scaled variables. Half (20 items) of the items are constructed positively and half (20 items) negatively. Items are rated on a 4-point scale with response to statement choices of definitely false, probably false, probably true, or definitely true. Each statement has a scoring range of 0 - 3 with a potential range of 0 - 120 for the total score. The higher the score, the greater the perceived social support is viewed. The subscale scores are obtained similarly with a range from 0 - 30 with higher scores meaning greater perceived support (Cohen et al., 1985).

The ISEL is a widely used valid and reliable instrument. The general population scale correlated at 0.30 with the established Moos Family Environment Scale and 0.31 with the Partner Adjustment Scale (Cohen et al., 1985). Cohen et al. (1985) reported that internal consistency reliability in the general population was favorable with alpha coefficient ranges for the total ISEL from 0.88 to 0.90. Reports of the subscales were 0.70 to 0.82 for appraisal support, 0.73 to 0.78 for belonging support, 0.62 to 0.73 for self-esteem support, and 0.73 to 0.81 for tangible support. For this study, the total ISEL had an excellent alpha coefficient of .931. For the subscales, there was good internal consistency reliability for appraisal (α = .883) and belonging

(α =.836) support, while self-esteem (α =.783) and tangible (α =.705) support demonstrated fair internal consistency reliability.

Test-retest reliability was reported for two days, six weeks, and six months in the general population from data obtained from five studies. Reliability estimates ranged from 0.70 to 0.87 for the total score, 0.60 to 0.84 for appraisal support, 0.65 to 0.68 for belonging support, 0.54 to 0.74 for self-esteem support, and 0.49 to 0.78 for tangible support (Cohen et al., 1985).

The general population ISEL was administered three times in the Oregon Smoking Study (community sample) at baseline, six weeks, and six months. Mean scores ranged from 32.9 to 34.4. Standard deviations ranged from 4.96 to 5.98. In this analysis, social support was viewed as a characteristic of the environment in the model.

2.4.2.4 Medication Event Monitoring System (MEMS)

Medication adherence was measured by electronic event monitoring using MEMS. This method provides a more objective method than the self-report method of medication adherence. Data are stored electronically in the cap of the pill bottle that can later be downloaded for analysis of medication-taking practices.

The MEMS recorded the date and time the bottle was opened. From these serially collected data, summary indices were derived that provided global measures of medication adherence for the 3 months of monitoring that are continuous ratio scaled variables. The three measures of medication adherence are: percentage of prescribed administrations taken (dose adherence), percentage of days with the prescribed number of administrations (days adherence), and percentage of days with the prescribed number of administrations and optimal inter-dose

intervals (on-time adherence). The medication adherence variable, percentage of prescribed administrations taken, was removed from the analysis due to lack of variability. Optimal inter-dose intervals were computed as the time interval between bottle openings and were within 25% of the optimal dosing interval. For example, for once daily dosing, 24 ± 6 hours of the previous bottle opening is optimum; for twice daily dosing, 12 ± 3 hours of the previous bottle opening is optimum; and for three times per day dosing, 8 ± 2 hours of the previous bottle opening is optimum.

Obtaining adherence data electronically, such as through the MEMS, reveals adherence information that may not otherwise be obtained through alternate means such as via diary submission. MEMS provides a consistent accuracy that varies with the self-report methods. The AARDEX Group (n.d.) that manufactures the MEMS product used in this study reports a failure rate below 0.5% and informs published successful use in greater than 518 peer review papers (www.aardexgroup.com). In this study, medication adherence was viewed as a measure of functional status in the model.

2.4.2.5 Medical Outcomes Study (MOS) Short Form-36 (SF-36)

HRQOL was measured by the mental component score (mental HRQOL) and physical component score (physical HRQOL) from the MOS SF-36. This well-known and widely used instrument has established reliability and validity in various age groups and diseases. It has fair test-retest reliability with median r = 0.64 and good internal consistency with median alpha = 0.80 (McHorney, Ware, Lu, & Sherbourne, 1994; McHorney, Ware, & Raczek, 1993; McHorney, Ware, Rogers, Raczek, & Lu, 1992).

The MOS SF-36 contains eight scales that measure health status. They are physical functioning, role functioning-physical, role functioning-emotional, social functioning, bodily pain, mental health, vitality, and GHP. Vitality and GHP subscales were used as measures of symptom status and general health perceptions in the model, respectively. The Mental HRQOL and Physical HRQOL are summary scales. The mental HRQOL is made up of all eight scores mostly derived from the mental health, role functioning-emotional, and social functioning scores. The scores range from a possible 0 to 100, where 0 is the worst health status and 100 is the best health status (Ware, Kosinski, & Keller, 1994). The physical HRQOL is also made up of all eight scores primarily derived from the physical functioning, role functioning-physical, and bodily pain scores. The mental HRQOL and physical HRQOL component scores from the MOS SF-36 are highly ordinally scaled and approximate interval scaled variables. Mental HRQOL and physical HRQOL were considered measures of HRQOL in the model.

2.4.3 Procedures

In the parent study, physicians in the clinic reviewed the parent study with their patients and asked permission for the clinic clinicians to meet with them. If the potential subjects agreed, the clinician presented the study and obtained permission to share their contact information with the principal investigator and project nurse. If potential subjects agreed, the project nurse reviewed their medical record to evaluate eligibility and met with the potential subjects during a schedule clinic appointment. Those who agreed to participate provided written informed consent.

Subjects received the MEMS cap along with use instructions. Subjects were directed to place the MEMS cap on the vial containing their ACE inhibitor. They were informed to open the MEMS cap only to take the medication and to record on a medication diary the date, time, and reason for any other extra openings or missed doses over three months. Those who used dose organizers were directed to place the MEMS fitted bottle next to their dose organizers and to open the cap on the bottle each time they removed the ACE inhibitor from their dose organizer.

Subjects received a packet of baseline questionnaires to complete and return within 2 - 3 days, estimated at 60 minutes to complete. Subjects were given a pre-addressed stamped envelope to use for returning the completed questionnaires. The project nurse contacted subjects within three days after the clinic visit to follow-up on any additional questions and/or concerns related to the study. Final questionnaires were completed at three-month follow-up clinic visits. Medical records were reviewed to collect sociodemographic and medical data.

MEMS data were collected over a three-month period, after which subjects returned the MEMS cap at a follow-up appointment or through the mail in a pre-addressed stamped envelope that the nurse gave the subjects during the initial enrollment. MEMS data were then uploaded from the cap into a database on a project computer for processing. Event files were adjusted based on diary entries (e.g., a bottle opened for refill was excluded). If the subject missed doses for hospitalization, the days were refined to reflect only those days not hospitalized. If subjects opened the cap for reasons other than for taking medications, the event was deleted.

2.4.4 Data Analysis

Data screening and analysis to address the research aims were performed using SPSS v20.0 for Windows. Frequency reports for all variables were produced to determine if there were any inaccurate data or values that did not fall within the range expected. Univariate and multivariate outliers were assessed using frequencies, histograms, and scatter plots. Normality was assessed using frequencies, measures of skewness and kurtosis, histograms, scatterplots, and residuals. The medication adherence variables were reflected then transformed using a base 10 logarithm and analyses were run comparing both the transformed and nontransformed versions. Where the transformed versions were used, this affected the interpretation of results into a reflected form. All variables were evaluated for linearity. If variables appeared nonlinear, exploration of those terms with creation of proper terms (e.g., quadratic terms and centering) occurred to reduce the nonessential multicollinearity. The significance level was set at $p < 0.05$ for all analyses.

EF was dichotomized into two categories with a cut point of 35% (EF less than 35% = 0, 35% and greater = 1). It has been found that patients with EF greater than 35% have a lower mortality rate and experience more adverse events (Quinones et al., 2000). Results were generally similar between EF dichotomized using the cut point of 35% and EF reported as a percentage, with the exception that percentage of EF predicted days adherence in simple linear regression ($\beta = -.194$, $p = .014$) and multiple linear regression ($\beta = -.321$, $p = .032$). Therefore, we reported the dichotomized version in the results.

2.4.4.1 Primary analysis for aim 1

To test the first aim that biological and physiological factors (EF and comorbid conditions), characteristics of the individual (age, gender, income, and prescription insurance), and characteristics of the environment (social support [4 variables] and medication regimen [2 variables]) have a direct effect on symptom status (vitality), simple linear regression analysis was conducted considering each predictor one at a time. A standard multiple linear regression was used for the analysis of the set of predictors of EF, comorbid conditions, age, gender, income, prescription insurance, social support, and medication regimen on vitality.

2.4.4.2 Primary analysis for aim 2

The second aim tested if biological and physiological factors (EF and comorbid conditions), symptom status (vitality), characteristics of the individual (age, gender, income, and prescription insurance), characteristics of the environment (social support [4 variables] and medication regimen [2 variables]) have a direct effect on medication adherence (2 variables). Days adherence had non-normality properties (skewness and kurtosis) so it was reflected and transformed using log10 to improve the residuals. On-time adherence was also reflected and transformed to improve the residuals for linear regression. The residuals improved with the transformed data. Linear regression was performed on both the transformed and non-transformed days adherence and on-time adherence dependent variable with each proposed predictor. Simple linear regression analysis was conducted considering each predictor one at a time. A standard multiple linear regression was used for the analysis of the set of predictors of

EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, and medication regimen on medication adherence.

2.4.4.3 Primary analysis for aim 3

Simple linear regression taking each predictor one at a time was utilized to analyze the third aim that biological and physiological factors (EF and comorbid conditions), symptom status (vitality) characteristics of the individual (age, gender, income, and prescription insurance), characteristics of the environment (social support [4 variables] and medication regimen [2 variables]), and medication adherence (2 variables) have a direct effect on GHP. Multiple linear regression analysis was used to examine joint associations between EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, and medication adherence on GHP.

2.4.4.4 Primary analysis for aim 4

Simple linear regression taking each predictor one at a time will be utilized to analyze the fourth aim that biological and physiological factors (EF and comorbid conditions), symptom status (vitality) characteristics of the individual (age, gender, income, and prescription insurance), characteristics of the environment (social support [4 variables] and medication regimen [2 variables]), medication adherence (2 variables), and GHP have a direct effect on HRQOL (2 variables). Multiple linear regression will be used to examine joint associations between EF, comorbid conditions, vitality, age, gender, income, prescription insurance, social support, medication regimen, medication adherence, and GHP on HRQOL.

2.5 RESULTS

2.5.1 Sample Characteristics

The sample (N = 161) was predominantly older (M = 56.09 ± 11.74 years, range 21 - 82), white (n = 150, 93.2%), married (n = 126, 78.3%), and with 12 years or greater education (n = 146, 90.7%). Forty nine (30.4%) were female. Thirty-seven (23.0%) were employed either full or part time. Eighty-one (50.3%) had an annual household income of $30,000 or more. One hundred eleven (68.9%) had prescription insurance coverage. EF ranged from 10% to 65% with a mean of 30.0% ± 11.0%. EF of 35% or more was reported in 27.3% (n = 44) of the sample. The type of cardiomyopathy was mostly idiopathic (n = 97, 60.2%) and ischemic (n = 57, 35.4%). Comorbid conditions ranged from 0 to 7 with a mean of 2.52 ± 1.55; 80 (49.7%) subjects had 3 or more comorbidities. The top five comorbid conditions were dysrhythmias (n = 55, 34.2%), coronary artery disease (n = 48, 29.8%), hypertension (n = 46, 28.6%), diabetes (n = 41, 25.5%), and myocardial infarction (n =37, 23%). The number of medications prescribed ranged from 1 to 18 with a mean of 6.64 ± 2.94. Almost half (n = 74, 46.0%) had seven or more medications prescribed. The number of times per day medications is prescribed ranged from 1 to 4 with a mean of 2.34 ± 0.77; 60 (37.3%) subjects took medications 3 to 4 times per day.

2.5.2 Predictors of Vitality

Table 1 presents the results of simple linear regression and multiple linear regression to identify independent variables associated with Vitality. Greater belonging support (β = .297, p = <.001), greater self-esteem support (β = .356, p = <.001), and greater tangible support (β = .311, p = <.001) were each significantly related to higher vitality. Women (β = -.245, p = .002) and those with more comorbid conditions (β = -.255, p = .001) and more prescribed medications (β = -.198, p = .012) reported significantly lower vitality than men and those with fewer comorbid conditions and fewer prescribed medications. In the multiple linear regression analysis, increased self-esteem support (β = .225, p = .035) was independently associated with increased vitality, while more comorbid conditions (β = -.206, p = .024) and increased appraisal support (β = -.266, p = .016) were significantly and independently associated with lower vitality with 27% of the variance explained (R2 = .272).

Table 1. Regression Analysis with Vitality

Simple Linear Regression (SLR) and Multiple Linear Regression (MLR) Predicting Symptom Status: Vitality Measured from the Medical Outcomes Study (MOS) Short Form-36 (SF-36) (*N* = 161)

	Vitality					
	SLR			MLR		
Variable	b (SE)	β	*p* value	b (SE)	β	*p* value
Biological and Physiological						
Ejection Fraction (>35%)	4.183 (4.092)	.081	.308	2.500 (4.012)	.048	.534
Comorbid Conditions (3 or more)	-3.811 (1.145)	-.255	**.001**	-3.070 (1.342)	-.206	**.024**
Characteristics of the Individual						
Age (years)	-.066 (.156)	-.034	.672	.013 (.157)	.007	.933
Female	-12.309 (3.855)	-.245	**.002**	-6.511 (3.834)	-.130	.092
Income (>$30,000)	5.669 (3.631)	.123	.120	4.028 (3.443)	.087	.244
Prescription Insurance	4.590 (3.937)	.092	.245	2.345 (3.891)	.047	.548
Characteristics of the Environment						
Appraisal Support	.458 (.298)	.121	.127	-1.007 (.413)	-.266	**.016**
Belonging Support	1.348 (.344)	.297	**<.001**	.862 (.616)	.190	.164
Self-Esteem Support	1.801 (.375)	.356	**<.001**	1.138 (.533)	.225	**.035**
Tangible Support	1.960 (.475)	.311	**<.001**	1.010 (.616)	.160	.103
Prescribed Medications (7 or more)	-1.558 (.611)	-.198	**.012**	-.390 (.749)	-.050	.603
Times/Day Prescribed (3 - 4)	1.065 (2.369)	.036	.654	4.452 (2.356)	.149	.061

Note. Biological and Physiological (Ejection Fraction [>35%] and Comorbid Conditions [3 or more]; Characteristics of the Individual (Age [years], Female, Income [>$30,000], and Prescription Insurance); and Characteristics of the Environment (Interpersonal Support Evaluation List [ISEL]: Appraisal, Belonging, Self-Esteem, and Tangible Support); Prescribed Medications (7 or more), and Times/Day Prescribed (3 - 4). b = unstandardized regression coefficients; SE = Standard Error; β = standardized coefficients.

2.5.3 Predictors of Medication Adherence

Table 2 reports simple and multiple linear regression to identify predictors of days adherence. Each variable was examined individually as a predictor of days adherence. Subjects with higher income (>$30,000 annually) had significantly increased days adherence (β = -.218, p = .005). Additionally, those with greater number of times per day medication is prescribed (3 or 4 times/day) had significantly decreased days adherence (β = .204, p = .009). In the multiple linear regression model, only higher income (β = -.192, p = .023) was identified as a significant independent predictor of increased days adherence (R2 = .109).

In Table 3, the results of simple linear and multiple linear regression are shown for on-time adherence. Higher EF (β = -.189, p = .016) and higher income (β = -.187, p = .018), were each significant individual predictors of increased on-time adherence, while greater times/day medication is prescribed (β = .331, p < .001) was a significant individual predictor of decreased on-time adherence. Multiple linear regression showed that increased EF (β = -.179, p = .032) was independently associated with increased on-time adherence, and greater number of times per day medication is prescribed (β = .270, p = .002) was independently associated with decreased on-time adherence (R2 = .181).

Table 2. Regression Analysis with Days Adherence

Simple Linear Regression (SLR) and Multiple Linear Regression (MLR) Predicting Medication Adherence: Percentage of Days with the Prescribed Number of Administrations (Days Adherence) (N = 161)

	Days Adherence					
	SLR			MLR		
Variable	b (SE)	β	*p* value	b (SE)	β	*p* value
Biological and Physiological						
Ejection Fraction (>35%)	-.163 (.099)	-.129	.103	-.199 (.109)	-.158	.069
Comorbid Conditions (3 or more)	.025 (.029)	.068	.390	.017 (.037)	.048	.639
Symptom Status						
Vitality	-.002 (.002)	-.063	.424	-.001 (.002)	-.049	.595
Characteristics of the Individual						
Age (years)	-.001 (.004)	-.021	.793	-.002 (.004)	-.047	.593
Female	.069 (.097)	.057	.476	.018 (.105)	.015	.860
Income (>$30,000)	-.245 (.087)	-.218	**.005**	-.216 (.094)	-.192	**.023**
Prescription Insurance	-.036 (.096)	-.030	.707	-.005 (.105)	-.004	.959
Characteristics of the Environment						
Appraisal Support	.002 (.007)	.024	.766	.003 (.011)	.035	.777
Belonging Support	.001 (.009)	.008	.916	-.001 (.017)	-.009	.951
Self-Esteem Support	-.008 (.010)	-.061	.443	-.009 (.015)	-.072	.544
Tangible Support	.010 (.012)	.063	.427	.016 (.017)	.105	.338
Prescribed Medications (7 or more)	.008 (.015)	.043	.592	-.021 (.020)	-.112	.291
Times/Day Prescribed (3 - 4)	.149 (.057)	.204	**.009**	.111 (.064)	.152	.087

Note. Biological and Physiological (Ejection Fraction [>35%] and Comorbid Conditions [3 or more]; Characteristics of the Individual (Age [years], Female, Income [>$30,000], and Prescription Insurance); and Characteristics of the Environment (Interpersonal Support Evaluation List [ISEL]: Appraisal, Belonging, Self-Esteem, and Tangible Support); Prescribed Medications (7 or more), and Times/Day Prescribed (3 - 4). b = unstandardized regression coefficients; SE = Standard Error; β = standardized coefficients. Days adherence = percentage of days with the prescribed number of administrations. b = unstandardized regression coefficients; SE = Standard Error; β = standardized coefficients. Log based 10 transformation to the reflected adherence variable.

Table 3. Regression Analysis with On-Time Adherence

Simple Linear Regression (SLR) and Multiple Linear Regression (MLR) Predicting Medication Adherence: Optimal Inter-dose Intervals (On-Time Adherence) (N = 161)

	On-Time Adherence					
	SLR			MLR		
Variable	b (SE)	β	*p* value	b (SE)	β	*p* value
Biological and Physiological						
Ejection Fraction (>35%)	-.218 (.090)	-.189	**.016**	-.206 (.095)	-.179	**.032**
Comorbid Conditions (3 or more)	.027 (.026)	.080	.313	.013 (.032)	.039	.693
Symptom Status						
Vitality	.001 (.002)	.057	.470	.001 (.002)	.064	.465
Characteristics of the Individual						
Age (years)	.002 (.003)	.041	.607	-.002 (.004)	-.039	.648
Female	.031 (.088)	.028	.729	-.019 (.092)	-.017	.838
Income (>$30,000)	-.192 (.080)	-.187	**.018**	-.160 (.082)	-.156	.053
Prescription Insurance	-.113 (.087)	-.102	.199	-.120 (.092)	-.108	.195
Characteristics of the Environment						
Appraisal Support	.009 (.007)	.110	.165	.007 (.010)	.087	.466
Belonging Support	.011 (.008)	.111	.160	.007 (.015)	.074	.614
Self-Esteem Support	.002 (.009)	.019	.815	-.008 (.013)	-.069	.544
Tangible Support	.018 (.011)	.128	.105	.004 (.015)	.030	.776
Prescribed Medications (7 or more)	.018 (.014)	.104	.188	-.013 (.018)	-.074	.465
Times/Day Prescribed (3 - 4)	.220 (.050)	.331	**<.001**	.179 (.056)	.270	**.002**

Note. Biological and Physiological (Ejection Fraction [>35%] and Comorbid Conditions [3 or more]; Characteristics of the Individual (Age [years], Female, Income [>$30,000], and Prescription Insurance); and Characteristics of the Environment (Interpersonal Support Evaluation List [ISEL]: Appraisal, Belonging, Self-Esteem, and Tangible Support); Prescribed Medications (7 or more), and Times/Day Prescribed (3 - 4). b = unstandardized regression coefficients; SE = Standard Error; β = standardized coefficients. On-Time Adherence = percentage of days with the prescribed number of administrations and optimal inter-dose intervals. b = unstandardized regression coefficients; SE = Standard Error; β = standardized coefficients. Log based 10 transformation to the reflected adherence variable.

2.5.4 Predictors of General Health Perceptions

Refer to Table 4 for simple and multiple linear regression analyses for GHP. In simple linear regression analysis, higher EF ($\beta = .209$, $p = .008$), increased vitality ($\beta = .611$, $p < .001$), increased belonging support ($\beta = .197$, $p = .012$), increased self-esteem support ($\beta = .256$, $p = .001$), and increased tangible support ($\beta = .254$, $p = .001$), were each individually associated with increased GHP, while greater comorbid conditions ($\beta = -.302$, $p < .001$) and greater number of prescribed medications ($\beta = -.325$, $p < .001$) were associated with decreased GHP. In the multiple linear regression, increased vitality ($\beta = .560$, $p < .001$) was the only significant independent predictor of increased GHP (R2 = .459).

Table 4. Regression Analysis with General Health Perceptions (GHP)

Simple Linear Regression (SLR) and Multiple Linear Regression (MLR) Predicting General Health Perceptions (GHP) (*N* = 161)

	GHP					
	SLR			MLR		
Variable	b (SE)	β	*p* value	b (SE)	β	*p* value
Biological and Physiological						
Ejection Fraction (>35%)	9.045 (3.361)	.209	**.008**	4.457 (2.963)	.103	.135
Comorbid Conditions (3 or more)	-3.779 (.945)	-.302	**<.001**	-.944 (1.003)	-.076	.348
Symptom Status						
Vitality	.511 (.053)	.611	**<.001**	.469 (.060)	.560	**<.001**
Characteristics of the Individual						
Age (years)	.012 (.131)	.007	.927	.179 (.115)	.109	.120
Female	-6.235 (3.292)	-.149	.060	2.849 (2.825)	.068	.315
Income (>$30,000)	4.190 (3.045)	.108	.171	.903 (2.554)	.023	.724
Prescription Insurance	1.458 (3.308)	.035	.660	.089 (2.863)	.002	.975
Characteristics of the Environment						
Appraisal Support	.282 (.250)	.089	.261	-.080 (.309)	-.025	.796
Belonging Support	.747 (.296)	.197	**.012**	-.179 (.454)	-.047	.694
Self-Esteem Support	1.087 (.325)	.256	**.001**	.109 (.399)	.026	.785
Tangible Support	1.341 (.404)	.254	**.001**	.551 (.455)	.104	.229
Prescribed Medications (7 or more)	-2.140 (.494)	-.325	**<.001**	-.912 (.551)	-.139	.100
Times/Day Prescribed (3 - 4)	-3.194 (1.968)	-.128	.107	-.959 (1.804)	-.038	.596
Functional Status						
Days Adherence	.083 (.069)	.096	.227	-.068 (.076)	-.078	.372
On-Time Adherence	.067 (.044)	.119	.132	.072 (.051)	.129	.159

Note. Biological and Physiological (Ejection Fraction[>35%] and Comorbid Conditions (3 or more); Characteristics of the Individual (Age [years], Female, Income(>$30,000), and Prescription Insurance); and Characteristics of the Environment (Interpersonal Support Evaluation List [ISEL]: Appraisal, Belonging, Self-Esteem, and Tangible Support); Prescribed Medications (7 or more), and Times/Day Prescribed (3 - 4); Functional Status (Days Adherence [percentage of days with the prescribed number of administrations]), and On-Time Adherence [percentage of days with the prescribed number of administrations and optimal inter-dose intervals]). General Health Perceptions (General Health Perceptions measured by MOS SF-36. b = unstandardized regression coefficients; SE = Standard Error; β = standardized coefficients.

2.5.5 Predictors of HRQOL

Table 5 contains the results of simple and multiple linear regression models for mental HRQOL. In simple linear regression, increased vitality (β = .573, p < .001), higher income (β = .209, p = .008), increased appraisal support (β = .249, p = .001), increased belonging support (β = .392, p < .001), increased self-esteem support (β = .441, p < .001), and increased tangible support (β = .308, p < .001) were each significantly associated with increased mental HRQOL. Conversely, older age (β = -.222, p = .005) and women (β = -.241, p = .002) had significantly lower mental HRQOL than younger age and men. In multiple linear regression, increased vitality (β = .482, p < .001) and increased on-time adherence (β = .182, p = .043) were significant independent predictors of increased mental HRQOL, whereas women (β = -.141, p = .033) and those with prescription insurance covering the cost of medication (β = -.144, p = .032) had significantly decreased mental HRQOL (R2 = .490).

Table 6 shows the simple and multiple linear regression models of physical HRQOL. Higher EF (β = .185, p = .019), increased vitality (β = .687, p < .001), increased belonging support (β = .163, p = .039), increased self-esteem support (β = .271, p = .001), increased tangible support (β = .233, p = .003), and increased GHP (β = .697, p < .001) were each significantly related to increased physical HRQOL, while greater comorbid conditions (β = -.396, p < .001) and fewer number of prescribed medications (β = -.393, p < .001) were each significantly related to decreased physical HRQOL. In the multiple regression analysis, increased vitality (β = .389, p < .001), and increased GHP (β = .372, p < .001) were significant independent predictors of increased physical HRQOL, while greater number of prescribed

medications (β = -.142, p = .038) was a significant independent predictor of decreased physical HRQOL (R2 = .652).

Table 5. Regression Analysis with Mental Health-related Quality of Life (HRQOL)

Simple Linear Regression (SLR) and Multiple Linear Regression (MLR) Analysis Predicting Health-Related Quality of Life Mental Component Score (Mental HRQOL) (*N* = 161)

	Mental HRQOL					
	SLR			MLR		
Variable	b (SE)	β	*p* value	b (SE)	β	*p* value
Biological and Physiological						
Ejection Fraction (>35%)	-.395 (1.830)	-.017	.829	-.914 (1.550)	-.040	.556
Comorbid Conditions (3 or more)	-.246 (.528)	-.037	.642	.714 (.522)	.107	.173
Symptom Status						
Vitality	.255 (.029)	.573	**<.001**	.215 (.037)	.482	**<.001**
Characteristics of the Individual						
Age (years)	-.012 (.004)	-.222	**.005**	.002 (.060)	.002	.976
Female	-5.391 (1.720)	-.241	**.002**	-3.162 (1.471)	-.141	**.033**
Income (>$30,000)	4.302 (1.595)	.209	**.008**	2.023 (1.326)	.098	.129
Prescription Insurance	-.678 (1.762)	-.030	.701	-3.210 (1.486)	-.144	**.032**
Characteristics of the Environment						
Appraisal Support	.421 (.130)	.249	**.001**	.130 (.160)	.077	.419
Belonging Support	.793 (.148)	.392	**<.001**	.270 (.236)	.133	.254
Self-Esteem Support	.995 (.161)	.441	**<.001**	.393 (.207)	.174	.060
Tangible Support	.864 (.212)	.308	**<.001**	-.206 (.238)	-.073	.387
Prescribed Medications (7 or more)	.015 (.278)	-.004	.958	.431 (.289)	.123	.137
Times/Day Prescribed (3 - 4)	.425 (1.056)	-.032	.688	-.618 (.937)	-.046	.511
Functional Status						
Days Adherence	.038 (.037)	.037	.082	-.051 (.040)	-.110	.200
On-Time Adherence	.024 (.024)	.024	.082	.054 (.027)	.182	**.043**
General Health Perceptions						
General Health Perceptions	.204 (.039)	.039	.383	.035 (.043)	.067	.412

Note. Biological and Physiological (Ejection Fraction [>35%] and Comorbid Conditions [3 or more]; Characteristics of the Individual (Age [years], Female, Income [>$30,000], and Prescription Insurance); Characteristics of the Environment (Appraisal, Belonging, Self-Esteem, and Tangible Support; Prescribed Medications (7 or more), and Times/Day Prescribed (3 - 4); Functional Status (Days Adherence [percentage of days with the prescribed number of administrations]), and On-Time Adherence [percentage of days with the prescribed number of administrations and optimal inter-dose intervals]); and General Health Perceptions (General Health Perceptions measured by MOS SF-36). b = unstandardized regression coefficients; SE = Standard Error; β = standardized coefficients.

Table 6. Regression Analysis with Physical Health-related Quality of Life (HRQOL)

Simple Linear Regression (SLR) and Multiple Linear Regression (MLR) Predicting Health-Related Quality of Life Physical Component Score (Physical HRQOL) (*N* = 161)

	Physical HRQOL					
	SLR			MLR		
Variable	b (SE)	β	*p* value	b (SE)	β	*p* value
Biological and Physiological						
Ejection Fraction (>35%)	4.427 (1.869)	.185	**.019**	.673 (1.330)	.028	.614
Comorbid Conditions (3 or more)	-2.738 (.504)	-.396	**<.001**	-.703 (.448)	-.102	.119
Symptom Status						
Vitality	.318 (.027)	.687	**<.001**	.180 (.032)	.389	**<.001**
Characteristics of the Individual						
Age (years)	-.074 (.072)	-.081	.305	-.013 (.052)	-.014	.805
Female	-3.554 (1.821)	-.153	.053	1.702 (1.262)	.073	.180
Income (>$30,000)	3.026 (1.678)	.142	.073	1.072 (1.138)	.050	.348
Prescription Insurance	.959 (1.830)	.042	.601	-.323 (1.275)	-.014	.800
Characteristics of the Environment						
Appraisal Support	.050 (.139)	.028	.721	-.223 (.137)	-.127	.107
Belonging Support	.343 (.165)	.163	**.039**	-.064 (.202)	-.030	.752
Self-Esteem Support	.635 (.179)	.271	**.001**	.153 (.178)	.065	.391
Tangible Support	.679 (.225)	.233	**.003**	.172 (.204)	.059	.401
Prescribed Medications (7 or more)	-1.431 (.226)	-.393	**<.001**	-.518 (.248)	-.142	**.038**
Times/Day Prescribed (3 - 4)	-1.508 (1.092)	-.109	.169	.129 (.804)	.009	.873
Functional Status						
Days Adherence	.066 (.038)	.137	.083	.040 (.034)	.084	.238
On-Time Adherence	.019 (.025)	.061	.441	-.025 (.023)	-.081	.271
General Health Perceptions						
General Health Perceptions	.386 (.031)	.697	**<.001**	.206 (.037)	.372	**<.001**

Note. Biological and Physiological (Ejection Fraction [>35%] and Comorbid Conditions [3 or more]; Characteristics of the Individual (Age [years], Female, Income [>$30,000], and Prescription Insurance); Characteristics of the Environment (Appraisal, Belonging, Self-Esteem, and Tangible Support; Prescribed Medications (7 or more), and Times/Day Prescribed (3 - 4); Functional Status (Days Adherence [percentage of days with the prescribed number of administrations]), and On-Time Adherence [percentage of days with the prescribed number of administrations and optimal inter-dose intervals]); and General Health Perceptions (General Health Perceptions measured by MOS SF-36). b = unstandardized regression coefficients; SE = Standard Error; β = standardized coefficients.

2.6 DISCUSSION

This study of patients with HF in the United States further tested all of the domains and influencing factors in the Wilson and Cleary (1995) model. This was the first study using the Wilson and Cleary model to measure mental and physical HRQOL with the SF-36. The findings of this study supported some, but not all, of the proposed relationships.

Comorbid conditions, female, belonging support, self-esteem support, tangible support and number of prescribed medications were individually related to vitality, while comorbid conditions, appraisal support, and self-esteem support were significant independent predictors of vitality in the multiple linear regression model. This finding is consistent with Lerner and colleagues (1994) who studied 1,319 working men and women who completed a modified Job Content Questionnaire, a health distress scale, and the MOS SF-36 Health Survey to assess job strain and HRQOL in adults (Lerner, Levine, Malspeis, & D'Agostino, 1994). In this study, two thirds of the subjects reported one or more chronic conditions. The higher the number of chronic conditions, the association with all nine of the MOS subscales decreased (vitality included). General social support was also found to be an influence on vitality (Lerner et al., 1994). In contrast, Heo et al. (2008) found that comorbid conditions and female were not predictors of physical symptom status. Unlike this study, other studies have found that age was an important predictor of physical symptom status (Clark et al., 2003; Heo et al., 2005). Perhaps the difference is due to the mean ages of the subjects in these studies being higher (63 and 73 years, respectively) compared to this study at 56.09 years, keeping in mind that the dropped subjects with some missing data were younger than the overall sample. The number of medications and

its influence on vitality in HF patients has not been found in the literature. However, nonadherence with the prescribed regimen can result in worsening symptoms (Van Der Wal, Jaarsma, & Van Veldhuisen, 2005).

Comorbid conditions were not found to be associated with either days adherence or on-time adherence, which is different than previous findings (Soumerai et al., 2006). Higher EF was independently related to on-time adherence. This result is not consistent with Kethrong and colleagues (2008) who concluded that EF had a negative direct effect on function in Thai HF subjects. However, function was measured by the New York Heart Association functional classification. Our study operationalized function by medication adherence. Income emerged as a significant predictor of days adherence as well as on-time adherence. Increased income was related to increased days adherence and on-time adherence. Income has been ruled out as a factor on medication adherence in a previous study (Dunbar-Jacob et al., 2003). The number of times per day medication is prescribed impacted both days and on-time adherence. As the number of times per day medication is prescribed increased, the lower the days adherence and on-time adherence. This finding is consistent with the literature that medication regimen complexity contributes to decreased adherence (Bohachick et al., 2002; Wu, Moser, Chung, & Lennie, 2008). Additionally, Nieuwenhuis and colleagues (2012) specified that the number of doses per day and not the total number of prescribed medications affects adherence (Nieuwenhuis, Jaarsma, van Veldhuisen, & van der Wal, 2012).

EF, vitality, belonging support, self-esteem support, and tangible support had positive associations with GHP. Comorbid conditions and number of prescribed medications had negative associations with GHP. EF findings are in contrast to other studies where EF was found

to have no significant association with GHP (Clark et al., 2003; Kethrong et al., 2008). This result may be due to degree of EF in those HF subjects. In both studies, most subjects had an EF greater than 40%, whereas in this study most subjects (72.7%) had an EF less than 35%. Greater comorbid conditions were related to lower GHP in this study. Again, this was in contrast to other studies that found comorbid conditions were not related to GHP (Clark et al., 2003; Kethrong et al., 2008). The compositions of the subjects are also different. One had a mean Charlson score of 3.68 (Clark et al., 2003) and Kethrong and colleagues (2008) reported 54.3% with no comorbid conditions. This study had 49.7% with three or more comorbid conditions. Other studies had results similar to this study in which comorbid conditions were found to have negative associations with GHP (Lerner et al., 1994; Suwanno, Petpichetchian, Riegel, & Issaramalai, 2009). The finding that vitality has a direct positive effect on GHP is consistent with other studies (Arnold et al., 2005; Carlson et al., 2013; Kethrong et al., 2008). Belonging, self-esteem, and tangible social support were positively associated with GHP, which is consistent with other studies (Johansson et al., 2007; Kethrong et al., 2008; Lerner et al., 1994). Psychosocial function and breathlessness/physical function directly affect global perceived health (Johansson et al., 2007). In Thai HF patients, social support had a significant positive direct effect on GHP while the number of prescribed medications had a direct negative relationship with GHP (Krethong et al., 2008). The more medications prescribed, the lower the GHP reported. Managing multiple medical prescriptive therapies has been associated with decreased overall perception of health (Carlson et al., 2013). Age was found to have both positive (Clark et al., 2003) and negative (Suwanno et al., 2009) effects on overall perceived

health or health status. This study found no significant relationship between age and GHP. These mixed findings warrant further testing and evaluation of these variables.

The biological and physiological variables (EF and comorbid conditions) were associated with physical HRQOL. Higher EF was associated with increased physical HRQOL and more comorbid conditions were associated with decreased physical HRQOL. These findings are unique. Other studies found no relationship between the biological and physiological variables and HRQOL (Clark et al., 2003; Heo et al., 2005; Juenger et al., 2002). Symptom status (vitality) was significantly associated with mental and physical HRQOL in both simple and multiple linear regression analyses. This result is not unique as other studies have shown that physical symptom status is not only a predictor, but a strong predictor of HRQOL (Heo et al., 2005; Heo et. el., 2008; Kethrong et al., 2008). Age was significantly related to mental HRQOL, which has been reported in previous studies (Clark et al., 2003; Heo et al., 2005). Female had a negative association with mental HRQOL in our study, but Heo reported gender had no significant effect on HRQOL (Heo et al., 2005). The social support variables had individual, significant, positive relationships with HRQOL (appraisal, belonging, self-esteem, and tangible support with mental HRQOL; belonging, self-esteem, and tangible support with physical HRQOL). In contrast, increased social support was related to a decrease in HRQOL in Thai HF patients (Kethrong et al., 2008), whereas Heo et al. (2005) found no relation with social support in community hospital HF patients. Income had a direct positive effect on mental HRQOL. These findings are consistent with the literature that increased socioeconomic status or greater income was related positively to HRQOL (Azevedo et al., 2008; Clark et al., 2003). Insurance covering the cost of medication had an independent negative association with mental HRQOL.

This result suggests that having insurance that covers the cost of medication is associated with lower mental HRQOL, which seems counter-intuitive. The literature is lacking information on relationships of prescription insurance with HRQOL. In an attempt to explain this finding, a correlational analysis was run between prescription insurance coverage and the other variables in this study. Older age ($r = -.299$, $p = <.001$) and being employed full or part time ($r = -.272$, $p = <.001$) were significantly correlated with lack of prescription insurance coverage. Having prescription insurance coverage may explain more variance in mental HRQOL than variables related to prescription insurance, specifically age and employment status. Also, it may be that prescription insurance coverage related to disability insurance is predictive of decreased mental HRQOL. The number of prescribed medications has an independent negative effect on physical HRQOL. As number of prescribed medications increased, HRQOL decreased, which others have reported (Demir & Unsar, 2011). On-time adherence was independently related to mental HRQOL. Hauptman (2008) determined that medication adherence may be a contributing factor to HRQOL. GHP were also independently associated with physical HRQOL. This finding is consistent with other studies that found that GHP had a strong association with HRQOL (Heo at al., 2005).

2.6.1 Limitations

This study was a secondary analysis of existing data, which did not allow the researchers to identify other variables for the model. Data were not collected in the parent study with this research proposal as the focus, which limited the information sought. However, evaluation of

the measures used in the parent study supported their use to test the aims in this study. Errors in the original data collection were not visible in this secondary analysis. The descriptive correlational design limits the ability to make causal inferences about the effects of the predictors on HRQOL. The sample size adjustment was also a limitation since utilizing the subjects with only completed data resulted in a significantly older sample than the parent study. Thus, the findings are generalizable to only an older HF population. GHP, vitality, and HRQOL (mental and physical) were measured from the MOS SF-36 rather than independent measures. This study examined unidirectional relationships in the Wilson and Cleary (1995) model. Wilson and Cleary noted that the relationships could be considered in a bi-directional fashion.

2.7 CONCLUSIONS AND IMPLICATIONS

In summary, both mental and physical HRQOL were associated with most of the model predictors. Vitality, belonging support, self-esteem support, and tangible support were associated with both mental and physical HRQOL. Age, female, income, prescription insurance, appraisal support, and on-time adherence were associated with mental HRQOL. EF, comorbid conditions, number of prescribed medications, and GHP were associated with physical HRQOL. Comorbid conditions, female, appraisal support, belonging support, self-esteem support, tangible support, and number of prescribed medications were related to vitality. Income and number of times per day medication is prescribed were associated with both days and on-time adherence. EF was associated with on-time adherence. GHP were affected by EF, comorbid conditions,

vitality, belonging support, self-esteem support, tangible support, and number of prescribed medications.

This study tested all of the domains and influencing factors from the Wilson and Cleary (1995) model with HF patients. The findings supported some of the proposed relationships as described above. This study confirms the multiple complexities of the important factors that influence HRQOL. Incorporating the associated variables to develop multifaceted interventions may reduce negative impacts on HRQOL and health outcomes in HF.

Future research directions include examining mediation proposed in the Wilson and Cleary model. This mediational analysis will likely include structural equation modeling, which is appropriate for examining mediation. Through path analysis, the predictive and mediational roles of the variables described in the Wilson and Cleary model can be tested.

APPENDIX A

PARENT STUDY CONSENT DOCUMENT

University of Pittsburgh

School of Nursing

3500 Victoria Street
Pittsburgh, Pennsylvania 15261
Fax: 412-624-2401

Approved: 02 / 10 / 98
Institutional Review Board
University of Pittsburgh
IRB Number: 970141

CONSENT TO ACT AS A SUBJECT IN A RESEARCH STUDY

TITLE: Medication Adherence and Quality of Life in Chronic Illness

PRINCIPAL INVESTIGATOR: Patricia Bohachick, Ph.D.,RN
Associate Professor of Nursing
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Pittsburgh, PA 15261
Telephone: 412-624-3597

SPONSOR: Jacqueline Dunbar-Jacob, Ph.D., RN.
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CONSULTANT: Srinivas Murali, M.D.
Associate Professor of Medicine
University of Pittsburgh Medical Center
Division of Cardiology/Heart Institute
200 Lothrop Street
Pittsburgh, PA 15213-2582
Telephone: 412-647-7168

SOURCE OF SUPPORT: NINR

Subject's Initials

DESCRIPTION

I understand that I have been asked to participate in this research study investigating adherence to a cardiac medication and quality of life with a chronic cardiac condition. Approximately 125 men and 125 women who are 21 years of age or older, diagnosed with a chronic cardiac condition and treated with a cardiac medication will be asked to enter the study. Because I am being treated with this type of medication, I am being asked to participate in this study.

If I consent to participate in the study, I will be asked to answer a few questions during an interview that takes approximately 20 minutes and answer a self-report questionnaire. The questionnaire asks me to respond on a checklist to a list of statements about (1) the support that I receive from others, (2) my feelings and emotions, and (3) the effect that my illness has had on my physical activities and life-style. It will take approximately 60 minutes to complete the questionnaire. Additionally, a monitor cap that has a counter useful for for providing information on medication taking will placed on the bottle containing my medication. The monitor cap will be used throughout a three month study period. I will bring the medication bottle with the monitor cap to my three month follow-up clinic visit or mail the medication monitor cap back to the principal investigator. At a three month follow-up, I may be asked to again answer the self-report questionnaire.

RISKS AND BENEFITS

There are no immediate benefits to me as a participant in this study. The use of the medication monitor poses no risk to the participants. Possibly, some people could become annoyed with completing self-report questionnaires. The risk of getting tired during testing will be minimized by allowing me to complete self-reported questionnaires at my convenience. The benefits of the study will be additional information about the patterns of medication adherence and physical and emotional well-being of patients with a chronic cardiac condition.

COST AND PAYMENTS

This study will involve no cost to me. To partially cover the inconvenience for the return of the medication monitor cap, I will receive $20.00 upon return of the cap to the investigator.

CONFIDENTIALITY

I understand that any information obtained about me from this research, including answers to questionnaires, interviews, medication monitor data, and data extracted from my medical record, will be kept confidential. All questionnaires and data will be coded with numbers and not identified with names. Such information which will carry personal identifying material will be kept in locked files and only the principal investigator of the study will have access to the files. Research records will be kept for a period of 5 years post termination of the study. I do understand that my research records, just like hospital records, may be subpoenaed by court order or may be inspected by federal regulatory authorities. It has been explained to me that my identity will not be revealed in any description or publication of this research. Therefore, I consent to such publication for scientific purposes.

Subject's Initials

RIGHT TO REFUSE OR END PARTICIPATION

I understand that I may refuse to participate in this study or withdraw any time and that my decision will not adversely affect my care at this hospital or cause a loss of benefits to which I might otherwise be entitled. I also understand that I may be withdrawn from the study at any time by the investigators.

****

VOLUNTARY CONSENT

I certify that I have read the preceding, or it has been read to me, and I understand its contents. Any questions I have pertaining to the research have been, and will continue to be answered by the investigators listed at the beginning of this consent form at the phone numbers given. Any questions I have concerning my rights as a research subject will be answered by the Human Subjects Protection Advocate at the University of Pittsburgh IRB Office (412-692-4376). A copy of this consent form will be given to me. My signature below means that I have freely agreed to participate in this project.

_____ _____

Patient/Subject Signature Date

_____ _____

Witness Signature Date

INVESTIGATOR'S CERTIFICATION

I certify that the nature and purpose, the potential benefits, and possible risks associated with participation in this research study have been explained to the above individual and that any questions about this information have been answered.

_____ _____

Investigator's Signature Date

APPENDIX B

QUESTIONNAIRES

B.1 DEMOGRAPHICS QUESTIONNAIRE

Instrument Number: 428
(For internal use only)

Study ID: 018

Demographics

ID Number: _____ Administration Date: ___ / ___ / _____
(month) (day) (year)

Please keep these rules in mind when responding to the questions....

Shade circles like this: ●
Not like this: ⊗ ✓

For optimum accuracy, it is recommended that characters be written block style without touching the sides of the blocks, such as in the following examples. Place only one letter or one number in each box as shown....

0 1 2 3 4 5 6 7 8 9

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1. What is your gender? ○ 1 Male ○ 2 Female

2. What is your age? *(Please list your age at your last birthday)* ___ (years)

3. What is your current marital status?
   - ○ 1 Never married
   - ○ 2 Currently married
   - ○ 3 Separated
   - ○ 4 Divorced
   - ○ 5 Widowed
   - ○ 6 Other (specify): _____

4. How many people live in your household (including yourself)? ___ (people)

48852

ID Number: _ _ _ _ _ _ _ _ _ _ _ _ (for internal use only) Date: _ _ / _ _ / _ _ (for internal use only) Study ID: 0 1 8

5. What would you say is your own main racial or ethnic group?

- ○ 1 White (not of Hispanic origin)
- ○ 2 Black (not of Hispanic origin)
- ○ 3 Hispanic
- ○ 4 Asian or Pacific Islander
- ○ 5 American Indian or Alaskan native
- ○ 6 Other (specify): | | | | | | | | | | | | | | | | | |

6. What is the highest level of education you have reached?

- ○ 1 Grade school
- ○ 2 High school diploma
- ○ 3 Vocational school
- ○ 4 Some college
- ○ 5 Associate's degree
- ○ 6 Bachelor's degree
- ○ 7 Graduate degree
- ○ 8 Postgraduate degree

7. What is your current employment status? (Please choose ONE response only)

- ○ 1 Employed, full time
- ○ 2 Employed, part time
- ○ 3 Unemployed, due to lay off or employment factors
- ○ 4 Unemployed, due to disability
- ○ 5 Retired, not due to ill health
- ○ 6 Full time homemaker
- ○ 7 Student

8. If employed, what is your current occupation?

| | | | | | | | | | | | | | | | | | | | | | | |

ID Number: _ _ _ _ _ _ _ _ _ _ _ _ (for internal use only) Date: _ _ / _ _ / _ _ (for internal use only) Study ID: 0 1 8

9. What is your total gross household annual income (before taxes and deductions)?

- ○ 1 Less than $4,999 per year ($417 per month)
- ○ 2 $5,000 to $9,999 per year
- ○ 3 $10,000 to $19,999 per year
- ○ 4 $20,000 to $29,999 per year
- ○ 5 $30,000 to $39,999 per year
- ○ 6 $40,000 to $49,999 per year
- ○ 7 $50,000 or higher per year

10. Does your household income meet your financial needs? ○ 1 Yes ○ 2 No

11. Does your insurance cover the cost of your medication? ○ 1 Yes ○ 2 No

12. Approximately how much do you pay out of your pocket for your medications per month?

- ○ 1 Less than $4.99
- ○ 2 $5.00 to $24.99
- ○ 3 $25.00 to $49.99
- ○ 4 $50.00 to $99.99
- ○ 5 $100.00 or more

13. Have you modified your prescribed medication regimen (decreased or stopped taking a medication) due to the costs of the medication?

○ 1 Yes ○ 2 No

B.2 MEDICAL RECORD DATA

Instrument Number: 4 3 8 (For internal use only)

Study ID: 0 1 8

Medical Record Data Form
Center for Research in Chronic Disorders

ID Number: | | | | | | | | | | Administration Date: (month) / (day) / (year)

1. Date entered into study: (month) / (day) / (year)

2. Type of Cardiomyopathy:

- ○ 1 Idiopathic
- ○ 2 Inflammatory
- ○ 3 Toxic
- ○ 4 Metabolic
- ○ 5 Familial
- ○ 6 Ischemic
- ○ 7 Other (specify) ----> _____

(for office use only)

3. Concurrent Diagnosis:

a. Arthritis	○ 1 Yes	l. Hyperlipidemia	○ 1 Yes
b. Autoimmune Disorder	○ 1 Yes	m. Hypertension	○ 1 Yes
c. CAD	○ 1 Yes	n. MI	○ 1 Yes
d. CHF	○ 1 Yes	o. Musculoskeletal Disorder	○ 1 Yes
e. COPD	○ 1 Yes	p. Neurological Disorder	○ 1 Yes
f. Diabetes Mellitus	○ 1 Yes	q. Psychological Disorder	○ 1 Yes
g. Dysrhythmias	○ 1 Yes	r. PVD	○ 1 Yes
h. Gastrointestinal Disorder	○ 1 Yes	s. Renal Disorder	○ 1 Yes
i. Genitourinary Disorder	○ 1 Yes	t. Thyroid Disorder	○ 1 Yes
j. Gout	○ 1 Yes	u. TIA's	○ 1 Yes
k. Hematologic Disorder	○ 1 Yes	v. Other (specify)	○ 1 Yes

v _____

(for office use only)

4. Total number of Concurrent Diagnosis: | |

5. Is Date of onset of cardiac problems known?

○ 1 Yes ----> a. Date: ☐☐ / ☐☐ / ☐☐☐☐ (month) (day) (year)

○ 2 No

6. Date of first heart failure clinic visit: ☐☐ / ☐☐ / ☐☐☐☐ (month) (day) (year)

7. Number of heart failure clinic visits: ☐☐

8. Total Number of Medications: ☐☐

9. Number of times a day medication prescribed:

○ 1 once a day
○ 2 twice a day
○ 3 three times a day
○ 4 four times a day

10. Medication Classification:

a. Ace Inhibitors ○ 1 Yes
b. Angiotension II receptor blocker ○ 1 Yes
c. Anticoagulant ○ 1 Yes
d. Antidepressant ○ 1 Yes
e. Antidysrhythmic ○ 1 Yes
f. Anti-inflammatory ○ 1 Yes
g. Antisecretory drug ○ 1 Yes
h. Aspirin ○ 1 Yes
i. Beta blocker ○ 1 Yes
j. Calcium channel blocker ○ 1 Yes
k. Cardiac glycoside ○ 1 Yes
l. Cholesterol lowering agent ○ 1 Yes
m. Corticosteroid ○ 1 Yes
n. Diuretic ○ 1 Yes
o. Hormone replacement therapy ○ 1 Yes
p. Nitrate ○ 1 Yes
q. Oral antidiabetic agent ○ 1 Yes
r. Potassium supplement ○ 1 Yes
s. Sedative/hypnotic ○ 1 Yes
t. Vitamin/mineral ○ 1 Yes
u. Other (specify) ○ 1 Yes

V

_____ (for office use only) ☐☐

ID Number: _ _ _ _ _ _ _ _ _ _ (for internal use only) Date: _ _ / _ _ / _ _ (for internal use only) Study ID: 0 1 8

11. Ejection Fraction: . (%)

a. Computed by:
- ○ 1 Echocardiogram
- ○ 2 Muga Scan

b. Date of EF: / / (month) (day) (year)

12. 2nd Ejection Fraction?
- ○ 1 Yes ---> Percent: . (%)
- ○ 2 No

a. Computed by:
- ○ 1 Echocardiogram
- ○ 2 Muga Scan

b. Date of EF: / / (month) (day) (year)

13. Type of study medication tracked by mems:
- ○ 1 capoten
- ○ 2 vasotec (enalapril)
- ○ 3 zestril (prinivil; lisinopril)
- ○ 4 accupril
- ○ 5 cozaar (losartan)
- ○ 6 altace
- ○ 7 monopril
- ○ 8 mavik
- ○ 9 univasc
- ○ 10 lotensin

14. Study medication stored in mems?
- ○ 1 Yes
- ○ 2 No

15. Number of times subject will open mems?
- ○ 1 one
- ○ 2 two
- ○ 3 three
- ○ 4 four

16. Medication taking practice:
- ○ 1 takes pills from prescription bottle
- ○ 2 sets up pills for the day in a container
- ○ 3 uses 2 day pill box
- ○ 4 uses 7 day pill box
- ○ 5 uses 14 day pill box
- ○ 6 uses 21 day pill box

B.3 INTERPERSONAL SUPPORT EVALUATION LIST

Instrument Number: 4 3 6
(For internal use only)

Study ID: 0 1 8

ISEL

ID Number: | | | | | | | | | | | Administration Date: | | | / | | | / | | | | |
(month) (day) (year)

Please keep these rules in mind when responding to the questions....

Shade circles like this: ●
Not like this: ⊗ ✓

***Instructions*: This scale is made up of a list of statements each of which may or may not be true about you. For each statement, fill in the circle that corresponds to the response which best describes you. For example, choose "definitely true" if you are sure it is true about you; choose "probably true" if you think it is true but are not absolutely certain. Similarly, choose "definitely false" if you are sure the statement is false; choose "probably false" if you think it is false but you are not absolutely certain. Please fill in only one circle for each statement.**

	DEFINITELY FALSE 0	*PROBABLY FALSE* 1	*PROBABLY TRUE* 2	*DEFINITELY TRUE* 3
1. There are several people that I trust to help solve my problems.	○	○	○	○
2. If I needed help fixing an appliance or repairing my car, there is someone who would help me.	○	○	○	○
3. Most of my friends are more interesting than I am.	○	○	○	○
4. There is someone who takes pride in my accomplishments.	○	○	○	○
5. When I feel lonely, there are several people I can talk to.	○	○	○	○
6. There is no one that I feel comfortable talking to about intimate personal problems.	○	○	○	○

ID Number: _ _ _ _ _ _ _ _ _ _ (for internal use only) Date: _ _ / _ _ / _ _ (for internal use only) Study ID: 0 1 8

	DEFINITELY FALSE 0	PROBABLY FALSE 1	PROBABLY TRUE 2	DEFINITELY TRUE 3
7. I often meet or talk with family or friends.	○	○	○	○
8. Most people I know think highly of me.	○	○	○	○
9. If I needed a ride to the airport very early in the morning, I would have a hard time finding someone to take me.	○	○	○	○
10. I feel like I'm not always included by my circle of friends.	○	○	○	○
11. There really is no one who can give me an objective view of how I'm handling my problems.	○	○	○	○
12. There are several different people I enjoy spending time with.	○	○	○	○
13. I think that my friends feel that I'm not very good at helping them solve their problems.	○	○	○	○
14. If I were sick and needed someone (friend, family member, or acquaintance) to take me to the doctor, I would have trouble finding someone.	○	○	○	○
15. If I wanted to go on a trip for a day (example: to the mountains, beach, or country), I would have a hard time finding someone to go with me.	○	○	○	○
16. If I needed a place to stay for a week because of an emergency (for example: water or electricity out in my apartment or house), I could easily find someone who would put me up.	○	○	○	○
17. I feel that there is no one I can share my most private worries and fears with.	○	○	○	○
18. If I were sick, I could easily find someone to help me with my daily chores.	○	○	○	○
19. There is someone I can turn to for advice about handling problems with my family.	○	○	○	○
20. I am as good at doing things as most other people are.	○	○	○	○

ID Number: _ _ _ _ _ _ _ _ _ _ _ _ (for internal use only)

Date: _ _ / _ _ / _ _ (for internal use only)

Study ID: 0 1 8

	DEFINITELY FALSE 0	PROBABLY FALSE 1	PROBABLY TRUE 2	DEFINITELY TRUE 3
21. 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.	○	○	○	○
22. When I need suggestions on how to deal with a personal problem, I know someone I can turn to.	○	○	○	○
23. If I needed an emergency loan of $100, there is someone (friend, relative, or acquaintance) I could get it from.	○	○	○	○
24. In general, people do not have much confidence in me.	○	○	○	○
25. Most people I know do not enjoy the same things that I do.	○	○	○	○
26. There is someone I could turn to for advice about making career plans or about changing my job.	○	○	○	○
27. I often don't get invited to do things with others.	○	○	○	○
28. Most of my friends are more successful at making changes in their lives than I am.	○	○	○	○
29. 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.).	○	○	○	○
30. There is really no one I can trust to give me good financial advice.	○	○	○	○
31. If I wanted to have lunch with someone, I could easily find someone to join me.	○	○	○	○
32. I am more satisfied with my life than most people are with theirs.	○	○	○	○
33. If I was stranded 10 miles from home, there is someone I could call who would come and get me.	○	○	○	○
34. No one I know would throw a birthday party for me.	○	○	○	○
35. It would be difficult to find someone who would lend me their car for a few hours.	○	○	○	○

ID Number: __ __ __ __ __ __ __ __ __ __
(for internal use only)

Date: _ _ / _ _ / _ _
(for internal use only)

Study ID: 0 1 8

	DEFINITELY FALSE 0	*PROBABLY FALSE* 1	*PROBABLY TRUE* 2	*DEFINITELY TRUE* 3
36. If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it.	○	○	○	○
37. I am closer to my friends than most other people are to theirs.	○	○	○	○
38. There is at least one person I know whose advice I really trust.	○	○	○	○
39. If I needed some help in moving to a new house or apartment, I would have a hard time finding someone to help me.	○	○	○	○
40. I have a hard time keeping pace with my friends.	○	○	○	○

B.4 MEDICAL OUTCOMES STUDY SHORT FORM-36 (MOS SF-36)

Instrument Number: 2 0 2
(For internal use only)

Study ID: 0 1 8

MEDICAL OUTCOMES QUESTIONNAIRE (MOS-SF-36)

ID Number: _____ Administration Date: ___ / ___ / _____
(month) (day) (year)

Please use the following example to answer all questions:

Shade circles like this: ●
Not like this: ⊗ ✓

INSTRUCTIONS: **This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. Answer every question by marking the answer as indicated. If you are unsure about how to answer a question. please give the best answer you can.**

1. In general, would you say your health is: (choose one response only...)

○ 1 excellent
○ 2 very good
○ 3 good
○ 4 fair
○ 5 poor

2. Compared to one year ago, how would you rate your health in general now? (choose one response only...)

○ 1 much better now than 1 year ago
○ 2 somewhat better now than 1 year ago
○ 3 about the same
○ 4 somewhat worse now than 1 year ago
○ 5 much worse now than 1 year ago

ID Number: _ _ _ _ _ _ _ _ _ _ _ _ (for internal use only) Date: _ _ / _ _ / _ _ (for internal use only) Study ID: 0 1 8

3. The following items are about activities you might do during a typical day. **Does your health now limit you** in these activities? If so, how much? (choose one response on each line...)

	Yes, limited a lot 1	**Yes, limited a little** 2	**No, not limited at all** 3
a. vigorous activities, such as running, lifting heavy objects, or participating in strenuous sports	○	○	○
b. moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	○	○	○
c. lifting or carrying groceries	○	○	○
d. climbing several flights of stairs	○	○	○
e. climbing one flight of stairs	○	○	○
f. bending, kneeling, or stooping	○	○	○
g. walking more than a mile	○	○	○
h. walking several blocks	○	○	○
I. walking one block	○	○	○
j. bathing or dressing yourself	○	○	○

4. During the **past 4 weeks,** have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**? (choose one response only...)

	1	2
a. cut down the amount of time you spent on work or other activities	○ Yes	○ No
b. accomplished less than you would like	○ Yes	○ No
c. were limited in the kind of work or other activities	○ Yes	○ No
d. had difficulty performing the work or other activities (for example, it took extra effort)	○ Yes	○ No

ID Number: _ _ _ _ _ _ _ _ _ _ _ _ (for internal use only) Date: _ _ / _ _ / _ _ (for internal use only) Study ID: 0 1 8

5. During the **past 4 weeks,** have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?
(choose one response on each line...)

	1	2
a. cut down the amount of time you spent on work or other activities	○ Yes	○ No
b. accomplished less than you would like	○ Yes	○ No
c. did not do work or other activities as carefully as usual	○ Yes	○ No

6. During the **past 4 weeks**, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups? (choose one response only...)

○ 1 not at all
○ 2 slightly
○ 3 moderately
○ 4 quite a bit
○ 5 extremely

7. How much **bodily** pain have you had during **the past 4 weeks**? (choose one response only...)

○ 1 none
○ 2 very mild
○ 3 mild
○ 4 moderate
○ 5 severe
○ 6 very severe

8. During the **past 4 weeks**, how much did **pain** interfere with your normal work (including both work outside home and housework)? (choose one response only...)

○ 1 not at all
○ 2 a little bit
○ 3 moderately
○ 4 quite a bit
○ 5 extremely

ID Number: _ _ _ _ _ _ _ _ _ _ _ _ (for internal use only) Date: _ _ / _ _ / _ _ (for internal use only) Study ID: 0 1 8

9. These questions are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the **past 4 weeks**...? (choose one response on each line...)

	All of the time 1	**Most of the time** 2	**A good bit of the time** 3	**Some of the time** 4	**A little of the time** 5	**None of the time** 6
a. did you feel full of pep	○	○	○	○	○	○
b. have you been a nervous person	○	○	○	○	○	○
c. have you felt so down in the dumps nothing could cheer you up	○	○	○	○	○	○
d. have you felt calm and peaceful	○	○	○	○	○	○
e. did you have a lot of energy	○	○	○	○	○	○
f. have you felt down-hearted and blue	○	○	○	○	○	○
g. did you feel worn out	○	○	○	○	○	○
h. have you been a happy person	○	○	○	○	○	○
i. did you feel tired	○	○	○	○	○	○

10. During the **past 4 weeks**, how much of the time has your **physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)? (choose one response only...)

○ 1 all of the time
○ 2 most of the time
○ 3 some of the time
○ 4 a little of the time
○ 5 none of the time

ID Number: _ _ _ _ _ _ _ _ _ _ _ _ (for internal use only) Date: _ _ / _ _ / _ _ (for internal use only) Study ID: 0 1 8

11. Please choose the answer that best describes how **true** or **false** each of the following statements are for you: (choose one response on each line...)

	Definitely true 1	Mostly true 2	Don't know 3	Mostly false 4	Definitely false 5
a. I seem to get sick a little easier than other people	○	○	○	○	○
b. I am as healthy as anybody I know	○	○	○	○	○
c. I expect my health to get worse	○	○	○	○	○
d. My health is excellent	○	○	○	○	○

APPENDIX C

IRB APPROVAL LETTER

University of Pittsburgh
Institutional Review Board

3500 Fifth Avenue
Pittsburgh, PA 15213
(412) 383-1480
(412) 383-1508 (fax)
http://www.irb.pitt.edu

Memorandum

To: Susan Simms

From: Sue Beers, Vice Chair

Date: 2/7/2012

IRB#: PRO10100156

Subject: Age, Gender, Social Support, Medication Adherence, and Health-related Quality of Life of Adults with Heart Failure

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The above-referenced project has been reviewed by the Institutional Review Board. Based on the information provided, this project meets all the necessary criteria for an exemption, and is hereby designated as "exempt" under section
45 CFR 46.101(b)(4)

Please note the following information:

- If any modifications are made to this project, use the "**Send Comments to IRB Staff**" process from the project workspace to request a review to ensure it continues to meet the exempt category.
- Upon completion of your project, be sure to finalize the project by submitting a "**Study Completed**" report from the project workspace.

Please be advised that your research study may be audited periodically by the University of Pittsburgh Research Conduct and Compliance Office.

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