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SOCIAL SUPPORT, RELATIONSHIP QUALITY, AND SELF-CARE BEHAVIORS IN
PATIENTS WITH HEART FAILURE

Dissertation

A dissertation submitted in partial fulfillment of the requirements for the
degree of Doctor of Philosophy in the
College of Nursing at the University of Kentucky

By

Majdi Mohammad Rababa

Lexington, KY

Director: Dr. Misook L. Chung, Professor of Nursing

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ABSTRACT OF DISSERTATION

SOCIAL SUPPORT, RELATIONSHIP QUALITY, AND SELF-CARE BEHAVIORS IN PATIENTS WITH HEART FAILURE

The purpose of this dissertation was to examine the associations among social support, gender, relationship quality, and self-care behaviors in patients with heart failure (HF). Specific aims were to: 1) compare the psychometric properties of the 12-item and the 9-item European Heart Failure Self-Care Behavior Scale (EHFScBS) when used to measure self-care behaviors in patients with HF in the United States; 2) determine whether gender moderated the association between perceived social support and daily sodium intake in patients with HF; and 3) determine whether a patient's gender and relationship with the primary family caregiver (spousal or non-spousal) moderated the association between relationship quality and HF self-care.

For the first specific aim, reliability and validity of the 12-item and the 9-item EHFScBS were compared by measures of internal consistency of reliability, item analysis, exploratory factor analysis, and hypothesis testing. The 12-item and the 9-item EHFScBS were valid and reliable when used to measure self-care behaviors in the United States. The 9-item EHFScBS was more homogenous with dimensions closer to the originally proposed dimensions when compared to the 12-item EHFScBS. The second specific aim was addressed by secondary analysis of data from The RICH Heart Program HF Registry. A hierarchical multiple regression model was used to determine whether gender moderated the association between social support and daily sodium intake. In our study, gender did not moderate the association between social support and daily sodium intake. The third specific aim was addressed using hierarchical multiple regression analyses to determine whether gender or relationship type moderated the association between relationship quality and HF self-care. Baseline data from an ongoing longitudinal, randomized controlled trial of a patient-caregiver dyadic intervention program were used in the analysis. Relationship quality was measured using the patient version of the Dyadic Relationship Scale, which consists of two subscales: positive dyadic interaction and negative dyadic strain. Heart failure self-care was measured using the 9-item EHFScBS. Positive dyadic interaction was associated with better HF self-care in female patients or patients with a non-spousal relationship with their family caregiver.

This dissertation has fulfilled important gaps in the evidence base for the self-care of patients with HF. The findings from this dissertation provided evidence for the validity and reliability of the 9-item EHFSBS when used to measure HF self-care behaviors. It also provided recommendations for future research to measure directed social support to adopt a specific behavior, such as eating low sodium diet, instead of measuring the social support in general. It also emphasized the importance of examining the quality of the relationship between patients and their family caregivers. The findings also pointed to the need for interventions targeting the relationship quality to be tailored according to the patients' gender or their relationship type with their family caregiver (spousal or non-spousal). A better understanding of how social factors can impact self-care behaviors in patients with HF is essential, as it gives researchers and healthcare providers the prospect of developing effective interventions to improve HF self-care.

KEYWORDS: Heart Failure, Self-Care, Relationship Quality, Social Support, Gender.

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August 10, 2018 .
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SOCIAL SUPPORT, RELATIONSHIP QUALITY, AND SELF-CARE BEHAVIORS
IN PATIENTS WITH HEART FAILURE

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Dedicated to my wonderful deeply missed mom

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CHAPTER ONE

Introduction

1. Heart Failure: Definition, Outcomes, and Statistics

Heart failure (HF) is a complex, chronic and progressive condition in which the heart muscles cannot pump enough blood to meet the body's need for nutrients and oxygen. The clinical pattern of HF may result from any structural or functional impairment of ventricular filling or ejection of blood, that can be caused by disorders of the pericardium, myocardium, endocardium, heart valves, or great vessels or from specific metabolic abnormalities, but most patients with HF have symptoms due to impaired left ventricular (LV) myocardial function.¹ Heart failure is associated with high mortality rates, high hospitalization rates, high health care costs, and poor quality of life.²

Based on the National Health and Nutrition Examination Survey (NHANES) data from 2011 to 2014, approximately 6.5 million Americans had HF.³ It is expected that the prevalence of HF in the United States will increase 46% by 2030, resulting in more than 8 million people having a diagnosis of HF.⁴ According to the American Heart Association (AHA), there are more than 960,000 new HF cases each year in United States.³ Heart failure was listed as the primary cause of over 68,000 deaths and a secondary cause in another 240,350 in 2014 in the United States.³

The annual medical costs of treating patients with HF is estimated at 31 billion dollars.⁴ These costs are expected to increase 127% to reach \$70 billion in 2030.⁴ Heart failure is responsible for 28% of all hospital readmissions.⁵ Around one million patients with HF are readmitted each year.⁶ In 2011, there were 257,000 outpatient department visits for HF, while in 2012; there were 509,000 visits to the emergency department for

HF in the United States. Readmission rates are higher when psychosocial and socioeconomic factors limit adherence to the medical regimen, self-monitoring, and follow-up.⁷

Patients with HF were found to have a poorer quality of life than patients with other chronic illnesses.⁸ Quality of life decreases as the New York Heart Association (NYHA) functional class worsens.^{8,9} Poor quality of life is a significant predictor of mortality and HF-related hospitalizations,¹⁰ and hence has become another essential outcome to assess the efficacy of HF treatment. Researchers found that patients who engage in consistent self-care have better outcomes.² Therefore, improving patients' engagement in self-care is essential to decrease the medical costs of HF, reduce symptoms of HF, and improve clinical outcomes.^{11,12}

2. Heart Failure Self-Care

Self-care is defined as behaviors performed by patients to maintain physiological stability (self-care maintenance), such as monitoring symptoms and adherence to medical treatment, and implement proper responses to symptoms when they occur (self-care management).¹³ To maintain optimal health, patients with HF are required to take their medication as prescribed, eat low sodium diet, limit their total fluid intake, and perform routine exercises.² Also, it is imperative for patients with HF to monitor signs and symptoms of HF exacerbation (such as shortness of breath, peripheral edema, weight gain, or increased fatigue), and to engage in preventative measures (such as quit smoking, limit alcohol consumption, and keep up with immunizations).² Proper responses to signs of HF exacerbation include recognizing the change in the symptoms and taking appropriate actions such as calling the doctor or the nurse, or/and taking an extra diuretic

dose.

Several factors can make adherence to self-care behaviors challenging for patients with HF. These factors include managing comorbidities, depression, anxiety, sleep disturbances, poor health literacy, age, and gender.² Although estimates of adherence vary widely among studies, adherence to self-care behaviors remains problematic. Reported medication adherence rates varied between 2%-90%,² while adherence rates to a restricted sodium diet ranged between 50% to 88%.^{14,15} Researchers have found that 41–58% of patients with HF do not follow the guidelines for exercise.¹⁴⁻¹⁷ Approximately 23% of patients did not divide their activities over the day, and 18% did not rest during the day.¹⁴ Adherence to alcohol recommendations ranged from 56% to 94%, approximately 90%, stated they were non-smokers,¹⁴⁻¹⁷ and 68% were adherents to infection prophylaxis recommendations.¹⁷

Consequently, researchers continue to test interventions to increase adherence to self-care behaviors in patients with HF. Examples of these interventions include improving patients skills required to perform self-care behaviors, such as how to read and understand food labels, preparing low sodium meals, improving patients' knowledge about signs and symptoms of HF, how to evaluate and respond to these signs and symptoms of HF exacerbation.²

3. Social Support: Definition, and Association with HF Self-Care and Outcomes

Receiving support from social networks has beneficial effects on HF outcomes by decreasing social isolation and improving self-care.² Social support refers to the quality and functional content of social relationships, which include supportive behaviors that provide emotional, instrumental, and informational support.¹⁸ Social support plays a

significant role in the immune, endocrine and cardiovascular functioning, recovery from illness and injury, and maintaining a healthy status.^{19,20} Social support affects health through lessening stress, influencing affective states, and changing behaviors.²¹ Additionally, social support affects the ability to adjust to and live with an illness.¹⁹ Biological effects of social support may occur through hormonal and neuroendocrine influences on the immune system, while behavioral effects of social support may occur by changing lifestyle and health behaviors.²² There is growing evidence that positive social support is associated with fewer hospitalizations and decreased risk of mortality caused by HF,^{23,24} and evidence among the broader range of chronically ill patients that social support is associated with better treatment adherence.²⁵ It was proposed that different types of social support may have different effects on biological and behavioral mechanisms that link social support with cardiovascular-related morbidity and mortality.²⁶

Low levels of social support were significantly related to poor HF outcomes including higher rehospitalization²⁷⁻²⁹ and mortality rates,^{30,31} poorer quality of life, greater anxiety and depressive symptoms,³² and poorer adherence to HF self-care.³²⁻³⁵ Researchers found significant evidence of an association between social support and adherence to self-care behaviors in patients with HF such as medication and diet adherence, fluid restriction, daily weighing, consulting a health care provider for weight gain, getting a flu shot, and performing regular exercises.³³⁻³⁵ Therefore, scientists have focused on the significant role social support plays in HF self-care mainly from family members who are the primary source of social support.³⁶⁻³⁹

4. Relationship Quality between Patients and their Family Caregivers

Approximately five million family members serve as caregivers for patients with HF.⁴⁰ The patient-caregiver dyadic relationship is an interdependent relationship in HF self-care.^{41,42} Relationship quality was proposed to be a pathway through which social support affects health outcomes.⁴³ Partner support is significantly related to the relationship quality.⁴³ For example, individuals with higher levels of spousal support score higher in domains of relationship quality including satisfaction with their relationship with their partner, demonstration of sexual and affectionate relationship, and having an agreement on critical issues about their relationship.⁴⁴

There is emerging evidence that relationship quality affects HF self-care. Sebern and Riegel⁴⁵ utilized a cross-sectional study of 75 HF dyads to examine the contribution of supportive relationships to HF self-care. According to the authors, the patient-caregiver relationship is composed of three interpersonal processes: communication (exchange of emotions and information), decision-making (a patients' capacity to look for and evaluate information and take actions accordingly), and reciprocity (partners' ability to engage in reciprocal actions).⁴⁵ The authors found that the process of patient decision-making was moderately correlated with the ability to carry out daily self-care activities and confidence in self-care ability. Patient communication and reciprocity were weakly related to self-care confidence. They also found that caregiver decision-making was weakly correlated with taking actions to maintain physiological stability and with confidence in self-care ability, while caregiver reciprocity was weakly related to self-care confidence.⁴⁵ Therefore, it is important to study the effects of relationship quality on HF self-care to support these results. Because relationship quality is a modifiable factor, it is

possible to develop interventions improving relationship quality, which in turn may have significant improvement in patients' self-care of HF.

5. Gender Differences in Social support and HF Self-Care

Levels of perceived social support differ according to gender. In general, females tend to report higher levels of perceived social support than males.⁴⁶⁻⁴⁹ However, this is not the case in the HF population. Females with HF are more likely to be single, widowed or divorced, living alone than males with HF, and therefore, they tend to report lower levels of social support.^{50,51} It was also reported in recent two reviews of the literature that HF self-care could vary between males and females.^{52,53} Although researchers recommend examining gender as a predictor of HF self-care, findings on the role of gender on HF self-care have been inconsistent.^{52,53} While males demonstrated better engagement in some HF self-care behaviors such as recognizing symptoms of HF exacerbation; females demonstrated better adherence and engagement in other HF self-care behaviors such as eating low sodium diet.^{52,53} Given these findings, understanding the role of gender on the association between social support and HF self-care behaviors will help researchers to develop gender-directed strategies to promote HF self-care.

While researchers found significant associations between social support, relationship quality, and HF self-care,^{35,45,54,55} other personal factors, such as gender and patient-caregiver relationship type (spousal vs. non-spousal) that can affect these associations have not been adequately examined. Understanding how these factors can impact relationship quality and social support is essential for advancing our understanding of how to improve HF self-care and outcomes.

6. Knowledge Gap in Social support and HF Self-Care

Several gaps in measuring HF self-care and in understanding the associations between social support, relationship quality, gender, and HF self-care behaviors were identified in the literature. One of the first gaps is identifying a valid measure of HF self-care. The two versions (the 12-item and the 9-item) of the European Heart Failure Self-Care Behavior Scale (EHFScBS) were validated as measures of HF self-care in European and Asian countries. Scientists are using both versions to assess HF self-care in many countries including the United States.⁵⁶⁻⁶⁰ However, only 9-item EHFScBS was examined for validity and reliability in the United States.⁶¹ Therefore, evidence of the psychometric properties of the 12-item EHFScBS in comparison to the 9-item EHFScBS is needed so researchers can determine which tool should be used to assess HF self-care behaviors in the United States.

One of the most long-standing HF self-care behaviors is following a low sodium diet (LSD).⁶² There is evidence that social support and gender may have an interaction effect on daily sodium intake in patients with HF.^{50,51,63} However, the moderation effect of gender on the association between social support and daily sodium intake has not been examined. Consequently, it is not known whether gender moderates the association between social support and daily sodium intake in patients with HF. Identifying gender differences in the association between social support and daily sodium intake will give scientists better understanding on which gender that is more likely to benefit from social support interventions aiming to improve patients' adherence to LSD.

The quality of the relationship between patients and their family caregiver is a determinant of providing and perceiving support.⁶⁴ There is increasing evidence in other

populations but not in HF, that the quality of the relationship between patients and their family caregivers plays a significant role in patients' self-care.⁶⁵⁻⁶⁹ Also, the role of gender and the type of relationship (spousal or non-spousal) in that association has not yet been determined. It is essential to examine the association between relationship quality and self-care in patients with HF and to examine the moderation effect of gender and relationship type on that association, which will provide evidence on which gender and relationship type is more likely to benefit from interventions targeting the relationship quality to improve HF self-care.

Therefore, the purpose of this dissertation was to address these gaps in knowledge and to provide recommendations for future research. The chapters of this dissertation represent the initial studies in my program of research focused on the interactive roles of patients and their family caregivers in HF self-care behaviors and outcomes.

7. Summary of Subsequent Chapters

Chapter Two describes a study conducted to provide evidence of the psychometric properties of the 12-item version in comparison with the 9-item version of the European Heart Failure Self-Care Behavior Scale (EHFScBS) using a sample of 105 patients with HF in the United States. Although the 12-EHFScBS has been modified and shortened to the 9-EHFScBS, researchers still use both versions to measure HF self-care in studies.^{61,70-79} However, only the 9-EHFScBS was examined for validity and reliability to measure HF self-care in the United States.⁶¹ Therefore, the specific aims of the study were (1) to determine the reliability of the 12-EHFScBS as a measure of HF self-care behaviors in patients with HF (2) to provide evidence for construct validity of the 12-item EHFScBS when used in patients with HF in the United States, and (3) and compare the

psychometric properties between the 12-item EHFSBS and 9-item EHFSBS. Internal consistency was used to determine the reliability of the EHFSBS. To assess the construct validity, we utilized exploratory factor analysis to determine the dimensionality of the EHFSBS. In addition, we assessed construct validity of the EHFSBS by hypothesis testing based on empirical evidence that patients who engaged better in HF self-care behaviors would have a better quality of life.⁸⁰

Chapter Three describes a study to determine whether gender moderates the association between social support and daily sodium intake in patients with HF. In previous research, gender was found to be a predictor of adherence to low sodium diet; females were found to be more adherent than males.⁸¹ In addition, gender has been examined as a key factor that could influence the relationship between social support and health outcomes. Researchers found that male patients with HF who reported high levels of social support were less likely to experience a functional decline, to drop out of the study due to increased illness, or to die within one year of an acute HF exacerbation. On the other hand, female gender did not affect levels of perceived social support and adverse outcomes.⁵⁰ The role of patients' gender on the relationship between social support and daily sodium intake in patients with HF has not explicitly been identified. Therefore, the purpose of this study was to determine whether gender moderates the association between social support, measured using the Multidimensional Scale of Perceived Social Support,⁴⁷ and daily sodium intake measured by the 24-hour urinary sodium in patients with HF. This study addressed the need for a better understanding of how social support, gender, and daily sodium intake are associated. A hierarchical multiple linear regression was used for the analysis of data from 217 patients with HF.

The results will help in designing tailored social support interventions for improving adherence to LSD in both genders.

Chapter Four is a description of a study conducted to examine the moderation effect of gender and the type of the patient-family caregiver relationship (spousal vs. non-spousal) on the association between relationship quality and HF self-care. Although many researchers have focused on the social support and self-care, the role of relationship quality on HF self-care is not clear. The findings will provide insight into the interactions between patients and their family caregivers, as perceived by patients, and the role of this interaction on patients' self-care, which will fill an important gap in the literature. It will also expand our understanding of whether gender and relationship type moderate the association between relationship quality and HF self-care. Unlike previous researchers who focused only on the role of social support on HF self-care, we included the role of relationship quality on HF self-care. Data from 105 patients with HF analyzed using linear and multiple regressions to determine the associations between relationship quality, gender, relationship type, and HF self-care. HF self-care was measured using the 9-EHFScBS.⁷¹ The relationship quality was assessed using the patient version of the Dyadic Relationship Scale.⁸²

Chapter Five is an integrated discussion in which the findings of the three studies are synthesized to advance the state of the science of HF self-care and make recommendations for practice and future research.

CHAPTER TWO

A Comparison between the Psychometric Properties of the 12-Item and the 9-Item European Heart Failure Self-Care Behavior Scale in the United States

1. Introduction

Improving self-care is crucial for patients with HF to maintain health status, improve health outcomes and to manage consequences of heart failure (HF).⁷⁰ To achieve proper HF self-care, patients are required to monitor symptoms of HF exacerbation, and to adopt lifestyle modifications. Examples of behaviors recommended to patients with HF to achieve optimal self-care include taking all medications as prescribed, limiting their sodium and alcohol intake, monitoring any signs and symptoms of fluid overload (such as shortness of breath, peripheral edema, weight gain, or increased fatigue), maintaining current immunizations, and smoking cessation.² Health professionals and researchers have developed and implemented different interventions and strategies to assess and improve HF patients' self-care.^{79,83,84} Short and user-friendly but valid and sensitive instruments are needed to assess patients' self-care and to determine the effectiveness of interventions to improve HF self-care skills in hospitals, outpatient clinics, or at patients' homes.

The European Heart Failure Self-Care Behavior Scale (EHFScBS)⁷⁰ and the Self-Care of Heart Failure Index (SCHFI)⁸⁵ are the most commonly used instruments to assess self-care behaviors in patients with HF and have been demonstrated to be valid and reliable. While SCHFI was developed and primarily used in the United States, the EHFScBS was developed and has been primarily used in Europe countries. Since researchers have been using the EHFScBS in the United States, it is important to evaluate the psychometric properties of the EHFScBS in patients with HF in the United States,

which was the focus of this study.

The EHFSBS was developed by Jaarsma et al.⁷⁰ in 2003 as a self-administered scale to measure self-care behaviors in patients with HF. The authors defined self-care behaviors as activities that patients with HF perform to maintain life, healthy functioning, and well-being, such as adherence to medication, diet and exercise; and decisions patients take when symptoms occur, such as seeking help or increasing the medicine dose.⁷⁰ When the authors developed the first version of the instrument, it consisted of 20 items with possible responses of yes or no. The authors proposed that the original instrument consists of three dimensions: complying with the regimen (nine items), asking for help (seven items), and adapting activities (four items). However, when the authors conducted factor analysis in a sample of 197 Dutch patients with HF, the dimensions were not fully supported.⁷⁰ The results demonstrated that many items loaded on more than one factor.⁷⁰ In addition, the reliability results of each of the proposed dimensions and the total scale were low ($< .68$).⁷⁰ Therefore, the scale was reviewed by two international panels of HF experts who modified the instrument and shortened it to 12 items based on the importance (low, medium, or high) and relevance of each item to HF self-care. They also changed the response format from yes/no to a five-point Likert scale. The authors conducted another exploratory factor analysis and found that only four items loaded on one factor, which was called “contacting a health care professional,” while the other items loaded on more than one factor. Therefore, the authors recommended using the total score of the 12 items. The authors tested the updated version, the 12-item EHFSBS, for validity and reliability in a sample of 442 patients with HF from Netherlands, Sweden, and Italy.⁷⁰ The reliability of the 12-item EHFSBS improved to .81.⁷⁰ The 12-

item EHFSBS has been translated into more than 14 languages including English, and was tested for validity and reliability in different populations from different countries, with inconsistent findings on the multidimensionality of the scale.^{86,87} However, the psychometric properties of the 12-item EHFSBS has not been examined in the United States.

In 2009 Jaarsma et al.⁷¹ examined the psychometric properties of the 12-item EHFSBS in a pooled sample (2592 patients with HF) from six European countries: Sweden, Netherlands, United Kingdom, Italy, Germany, and Spain. Additional evidence of content validity was established by interviewing HF experts and patients with HF, and by reviewing guidelines on HF treatment guidelines from the European Society of Cardiology and the Heart Failure Society of America. Construct validity was examined using item analysis, confirmatory factor analysis (CFA), and convergent and discriminant validity by examining the correlation of the EHFSBS with the HF Compliance Questionnaire and the Minnesota Living with Heart Failure Questionnaire respectively. The authors defined only one reliable subscale (consulting behaviors) with a Cronbach's alpha of .85. Based on the findings of that study, the authors deleted three items (items 2, 7, and 11), which resulted in a modified version called the 9-item EHFSBS.⁷¹ Cronbach's alpha improved from .77 for the 12-item EHFSBS to .80 for the 9-item EHFSBS. Convergent and discriminant validity were supported for the 9-item EHFSBS in that study.⁷¹ Evidence of the validity and reliability the 9-item EHFSBS has been established in different countries including the United States.^{61,73,76,78,88} Internal consistency of the 9-item EHFSBS was also examined with Cronbach's alpha ranging from .66 to .82.^{61,73,76,78,88} However, results regarding multidimensionality of the 9-item

EHFScBS have been inconsistent.^{61,73,76,78,88}

Although the authors of the EHFScBS recommend using the 9-item of the scale, researchers are still using both the 12-item and the 9-item EHFScBS to assess HF self-care and to assess the effectiveness of interventions aiming to improve patients' self-care, including studies conducted in the United States.⁵⁶⁻⁶⁰ However, the 12-item EHFScBS has not been tested for validity and reliability in the United States. Therefore, the aim of this study was to compare the psychometric properties between the 12-item EHFScBS and the 9-item EHFScBS. Internal consistency of reliability (Cronbach's alpha and item analysis) and construct validity (exploratory factor analysis and hypothesis testing) were examined to compare between the 12-item and the 9-item EHFScBS.

2. Methods

2.1. Design

This study was a secondary analysis of combined data from the Sodium Watcher Program (SWaP) study and the Family SWAP, two 2-group randomized controlled trial designed to examine the effects of SWaP on low sodium diet adherence and symptom distress in patients with HF or/and their family caregivers. In the SWaP study, patients with HF were randomly assigned to either the intervention group or to the usual care group, while in the Family SWaP study, patients and their family caregiver were randomly assigned to the intervention group or to the usual care group. Because eligibility of patients with HF were same for both studies, we selected patients with HF who had completed baseline data of the EHFScBS in this analysis.

2.2. Sample

One hundred and five (105) participants with data available on the study variables

were included in the analysis. Patients were eligible if they (1) had a diagnosis of chronic HF confirmed by their cardiologist, (2) were on stable doses of HF medication for at least one month, and (3) were able to speak and write English. Patients were excluded if they were younger than 20 years old, had been referred for heart transplantation, had a co-existing terminal illness, or had a dietary prescription at odds with following a 2-3 gram sodium diet (e.g., the clinician does not support the use of a low sodium diet).

2.3. Setting

Patients were referred to the original project by physicians and nurse practitioners or by self-referral from cardiology clinics at two hospitals in a central U.S. state: one academic medical center and one community hospital. A trained nurse research assistant with cardiovascular nursing background screened referred participants for eligibility. Eligible patients signed the consent form if they were willing to participate in the study and after receiving information about the study.

2.4. Measures

Demographics and clinical variables. Demographic information (i.e., gender; age; ethnicity; marital status; and education) and clinical variables (i.e., New York Heart Association (NYHA) classification; left ventricular ejection fraction (LVEF); prescribed medications; and comorbidities) were obtained by patient interview and medical record review.

HF self-care behaviors. Self-care behaviors for patients with HF were measured using the EHFS CBS.⁷⁰ In accord with the instrument, HF self-care behaviors are those behaviors needed to sustain life and to maintain healthy functioning and well-being. The EHFS CBS is self-administered and consists of 12 items for the 12-item EHFS CBS and

nine items for the 9-item EHFSBS. We used patients' responses on the 12 items to examine the psychometric properties of the 12-item EHFSBS. To determine the reliability and validity of the 9-item EHFSBS, we excluded patients' responses on the three items that were deleted by the authors when they shortened the 12-item EHFSBS to obtain the 9-item EHFSBS. The three excluded items were: item 2 "*If I get SOB I take it easy,*" item 7 "*I take a rest during the day,*" and item 11 "*I get a flu shot every year.*" Item response options are on a 5-point Likert scale that ranges from 1 (I completely agree) to 5 (I don't agree at all). A total score is calculated by summing the item responses, ranging from 12 to 60 for the 12-item EHFSBS and 9 to 45 for the 9-item EHFSBS. A high total score indicates poorer self-care behavior. Internal consistency of reliability of the 12-item EHFSBS and the 9-item EHFSBS were supported with Cronbach's alpha of .80 and .81 respectively.

Heart failure health-related quality of life (HF HRQoL). Defined as the degree to which HF impacts different domains of well-being including physical, emotional, and social functioning as perceived by patients,⁸⁹ and was measured using the Minnesota Living with Heart Failure Questionnaire (MLHFQ).⁹⁰ This instrument consists of 21 questions on how much patients perceive the effect of their HF and its treatment on their life. These items form three subscales: physical, emotional, and social.^{91,92} Items are rated on a scale from 0 'no effect' to 5 'very much.' The total score is obtained by summing all the responses to the 21 items, and can range from 0 to 105; higher scores reflect the worse quality of life. Construct (factorial, convergent and divergent) validity of this scale has been reported in many studies.⁹¹⁻⁹³ Cronbach's alpha of the MLHFQ in this study was 0.94, indicating excellent internal consistency reliability.

3. Data Analysis

3.1. Sample Characteristics

Analyses were performed using the Statistical Package for Social Sciences V24 (SPSS Inc., Chicago, IL, USA). Descriptive statistics frequency, proportion, mean, and standard deviation, were used to characterize the participants.

3.2. Reliability

Cronbach's alpha and item analysis were used to examine internal consistency of both versions of the EHFSBS. We followed George and Mallery's (2003) guidelines for the interpretation of Cronbach's alpha and considered $\geq .70$ to be acceptable.⁹⁴

Item analysis. The item-item correlation and the item-total correlation of the items were analyzed. For the item-item analysis, correlation coefficients value between .20 and .80 were considered ideal, values less than .20 indicated little in common with other items, and if the value of the correlation coefficients was higher than .80 that would indicate redundancy.⁹⁵ For item-total correlations, coefficients $\geq .30$ were considered acceptable. Cronbach's alpha for each item if deleted was also analyzed.

3.3. Construct Validity

Exploratory factor analysis (EFA). We used EFA to determine how many dimensions emerged in our population, and which items are loaded on those dimensions. To determine the adequacy of the sample size for the analysis, we used Tabachneck and Fidell⁹⁶ recommendations of a minimum of 5 cases for each item in the scale (5 cases * 12 items = 60 cases at least were needed for this analysis). This study included 105 patients, which satisfied this requirement. Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett's test of sphericity were used to verify the adequacy of the sample size for factor

analysis. A KMO value of less than .60 was considered unacceptable to proceed with the factor analysis.⁹⁷ A significant Bartlett's test of sphericity ($p < .05$) was used to determine that the correlation matrix is not an identity matrix, which would indicate that the data are suitable for factorial analysis.⁹⁸

We used principal component analysis (PCA) and Varimax rotation to examine the dimensionality of both versions of the EHFSBs. Only factors with an eigenvalue of 1.0 or more were retained, and a scree plot was used to verify the eigenvalues of the factors. Items with loadings less than 0.4 on any factor were deleted.⁹⁸

Hypothesis testing. Based on the evidence that better engagement in HF self-care behaviors leads to improvement in HF HRQoL in patients with HF,^{80,99} a hierarchical multiple regression model was used to determine whether HF self-care, assessed by the EHFSBs, was a significant predictor of HF HRQoL, as measured by the MLHFQ, to determine how much of variance can be explained by HF self-care. In the first block, HF self-care was entered into the model. The control variables age, gender, ethnicity, marital status, education level, and NYHA classification were included in the second block. We hypothesized that HF self-care would be an independent predictor of HF health-related quality of life.

4. Results

4.1. Sample Characteristics

The clinical and sociodemographic characteristics of the sample are presented in Table 2.1. Of the 105 participants, 65 were males (62%), with a mean age of 61 years. Most participants were Caucasians (72%), married or cohabitate with another person (53%), and spent 13 years on average in education. Among the participants, 66% had

NYHA I/II. The mean scores on the 12-item and 9-item of the EHFSBS were 30 and 24 respectively. The mean score of the MLHFQ was 43.

4.2. Psychometric properties of the 12-item EHFSBS

Reliability. Cronbach's alpha was .80 indicating an acceptable internal consistency of reliability.

Item analysis. Results of the item analysis are presented in Table 2.2. The mean inter-item correlations was .25. The item-item correlations ranged from <.01 to .63. Item 2 "*If I get SOB I take it easy,*" item 7 "*I take a rest during the day,*" and item 11 "*I get a flu shot every year*" had the most frequent weak item-item correlations; item 2 had six item-item correlation coefficients less than 0.20, item 7 had ten item-item correlation coefficients less than 0.20, and item 11 had nine item-item correlations coefficients less than 0.20. The item-total correlation results demonstrated that items 7 and 11 had correlation coefficients of less than 0.30. The item-total correlation coefficients for the other ten items ranged from 0.32 to 0.67. Cronbach's alpha improved to .80 if item 7 was deleted and to .81 if item 11 was deleted (Table 2.2).

Construct Validity

Exploratory factor analysis (EFA). In principle component analysis, the KMO coefficient for sampling adequacy (0.74) and the significant Barlett's test of sphericity ($p < .001$) showed that the data were appropriate for factor analysis. Varimax rotation and Kaiser normalization showed four factors with an eigenvalue greater than one, which was verified by the scree plot. The four factors explained 62.7% of the total variance (Table 2.3).

Eight items loaded on one factor; items 3 "*If SOB increases I contact my doctor*"

or nurse” and 4 “*If leg/feet are more swollen, I contact doctor or nurse*” loaded on factor 1; items 1 “*I weigh myself every day*” and 9 “*I eat a low salt diet*” loaded on factor 2; items 11 “*I get a flu shot every year,*” 12 “*I exercise regularly,*” and 10 “*I take my medication as prescribed*” loaded on factor 3; while item 7 “*I take a rest during the day*” loaded on factor 4. The remaining items (8 “*If I experience fatigue I contact doctor or nurse,*” 2 “*If I get SOB I take it easy,*” 5 “*If I gain weight I contact doctor or nurse,*” and 6 “*I limit the amount of fluids*”) cross-loaded on two factors; item 8 cross-loaded on factors 1 and 2, item 2 cross-loaded on factors 1 and 4, item 5 cross-loaded on factors 1 and 2, item 6 cross-loaded on factors 2 and 4. By examining each factor and the items that were loaded or cross-loaded, we identified four factors based on the commonalities between the items and the loading values. Factor 1, (consulting behaviors) included items “*If my shortness of breath increases, I contact my doctor or nurse*”, “*If my feet/legs become more swollen than usual, I contact my doctor or nurse*”, “*If I experience increased fatigue, I contact doctor or nurse*”, and “*If I gain 2 kg in 1 week, I contact my doctor or nurse,*” with a Cronbach’s alpha of .75. Factor 2 (adherence to treatment) consisted of 3 items: “*I weigh myself every day,*” “*I eat a low salt diet,*” and “*I limit the amount of fluids I drink (not more than 1.5–2 L/day),*” with Cronbach’s alpha of .60. Factor 3 (maintaining well-being) included “*I get a flu shot every year,*” “*I exercise regularly,*” and “*I take my medication as prescribed,*” with a Cronbach’s alpha of .44. Factor 4 (adapting activities) included “*If I get short of breath, I take it easy*” and “*I take a rest during the day,*” with Cronbach’s alpha of .15.

Hypothesis testing. A hierarchical multiple linear regression was conducted to test the hypothesis that HF self-care was an independent predictor of HF HRQoL. The

assumptions of linearity, independence of errors, homoscedasticity, and normality of residuals were met. The HF self-care, when entered in the first block, was significantly associated with HF HRQoL ($B = .30, p = .002$). The model resulted from the first block was significant ($p < .002$) and explained 8% of the variance. When the control variables age, gender, ethnicity, marital status, education level, and NYHA classification were entered in the second block, HF self-care remained as significant predictor of HF HRQoL ($B = .21, p = .030$) (Table 2.4). The model resulted from the second block was also significant ($p < .001$) and explained 23% of the variance. As hypothesized, better engagement in HF self-care behaviors was a significant predictor of better quality of life in patients with HF.

4.3. Psychometric properties of the 9-Item EHFSBS Scale

Reliability. Cronbach's alpha for the 9-item EHFSBS was .81, indicating a good internal consistency reliability.

Item analysis. The mean inter-item correlation was .33. Items 3, 5, 6, and 12 had two item-item correlation coefficients less than 0.20, while items 1, 4, 9, and 10 had one item-item correlation coefficients less than 0.20. The item-total correlation coefficients for the nine items ranged from 0.36 to 0.71. Deleting any of the nine items did not produce any improvement in Cronbach's alpha. The range of Cronbach's alpha when each item deleted was from .77 to .81 (Table 2.2).

Construct Validity

Exploratory factor analysis (EFA). Kaiser-Meyer-Olkin (KMO) coefficient for sampling adequacy was 0.78, and the Barlett's test of sphericity was statistically significant ($p < .001$), indicating that the data are appropriate for factor analysis. Principal

components analysis results demonstrated three factors that were supported by scree plots and Eigenvalue tests. The three factors explained 65.3 % of the total variance. When using Varimax rotation method, five items loaded on one factor, items 3 “*If SOB increases I contact my doctor or nurse*” and 4 “*If leg/feet are more swollen, I contact doctor or nurse*” loaded on factor 1; items 9 “*I eat a low salt diet*” and 6 loaded on factor 2, and item 12 “*I exercise regularly*” loaded to factor 3. The remaining items 8 “*if I experience fatigue I contact doctor or nurse*,” 1 “*I weigh myself every day*”, and 5 “*I gain weight I contact doctor or nurse*” cross-loaded on two factors (Table 2.3). Item 10 “*taking medication as prescribed*” had two weak loadings (.38 on factor 1 and .26 on factor 3), but we recommend keeping it because it is an essential behavior of self-care. After further examining each factor and the items that were loaded or cross-loaded to these factors, we identified three factors. Factor 1 ‘consulting behaviors’, which included items “*If my shortness of breath increases, I contact my doctor or nurse*”, “*If my feet/legs become more swollen than usual, I contact my doctor or nurse*”, “*if I experience increased fatigue, I contact doctor or nurse*”, and “*If I gain 2 kg in 1 week, I contact my doctor or nurse*,” with a Cronbach’s alpha of .83. Factor 2 (adherence with treatment) included “*I weigh myself every day*,” “*I eat a low salt diet*,” and “*I limit the amount of fluids I drink (not more than 1.5–2 L/day)*,” with a Cronbach’s alpha of .60. Factor 3 (maintaining well-being) included “*I exercise regularly*,” and “*I take my medication as prescribed*,” with a Cronbach’s alpha of .28.

Hypothesis testing. The assumptions for the hierarchical regression model were met. In the first block, the 9-item EHFScBS was significantly associated with HF HRQoL ($B = .32, p = .001$), resulting in a significant model ($p < .001$) that explained 9%

of the variance. When the control variables were entered in the second block, HF self-care ($B = .24, p = .011$) remained a significant predictor. The model resulted from block 2 was significant ($p < .001$) and explained 25% of the variance. Better engagement in HF self-care behaviors was a significant predictor of better quality of life in patients with HF (Table 2.4).

5. Discussion

We were the first to test the reliability and validity of the 12-item EHFSBS in a sample of HF patients in the United States. We also compared the reliability and validity between the 12-item and the 9-item EHFSBS.

For the 12-item EHFSBS, the internal consistency reliability was acceptable. Inconsistent findings were reported in other studies with Cronbach's alpha ranging from .64 to .82.^{70-72,74,75,77,86,87,100} In the EFA that we performed, we found four dimensions. Similar findings were reported in other studies.^{75,87} We identified one reliable factor 'consulting behaviors,' which consisted of four items, with Cronbach's alpha of .80. In previous studies, Shuldham et al.⁸⁷ found four dimensions that explained 59% of the variance in a sample from the United Kingdom, while Baydemir et al.⁷⁵ found four factors that explained 61% of the variance in a sample from Turkey. When the authors developed the original scale in 2003, it consisted of 20 items and had three proposed dimensions: 'complying with the regimen,' 'asking for help,' and 'adapting activities,' which was partially confirmed in that study by PCA. However, the factor analysis revealed that only four items (3, 4, 5 and 8) loaded on a single factor, 'asking for help.' The other items loaded on more than one factor.⁷⁰ In our study, items 1, 3, 4, 7, 9, 10, 11, and 12 loaded on one factor, while the remaining items (2, 5, 6, and 8) loaded on more

than one factor. To make a final decision about the cross-loaded items, we examined these items (i.e., items 2, 5, 6, and 8) for communalities with each item from each factor. In 2009, Jaarsma et al.⁷¹ found three factors in a sample of 2592 participants from six different European countries. However, the factor ‘adapting activities’ consisted of items 2 and 7 only. The authors deleted these two items because they showed weak item-total correlation. They also removed item 11 due to weak factor loadings.⁷¹ Yu et al.¹⁰⁰ tested the Chinese version of the 12-item EHFSBS and found three factors through a CFA and only two factors by a PCA, which explained 31.2% of the variance.¹⁰⁰ In only one study the 12-item EHFSBS was found to be unidimensional.⁸⁶ The authors of that study tested the Japanese version of the 12-item EHFSBS on 116 participants who were recruited from a single hospital in Tokyo and found that EHFSBS is a one-dimensional scale.⁸⁶ With regard to the construct validity of the 12-item EHFSBS, the convergent and divergent validity of this instrument were supported in previous studies by analyzing the relationship between the 12-item EHFSBS total score with other scales that measure other concepts such as the revised HF Compliance Questionnaire and the MLHFQ.^{70-72,86,87} In our study, we were the first to examine the construct validity of the 12-item EHFSBS by hypothesis testing. As we hypothesized, better engagement in HF self-care, measured by the 12-item EHFSBS, was a significant predictor of better HF HRQoL. The relationship between HF self-care and HF HRQoL was established before.^{80,99}

With regard to the 9-item EHFSBS, we found that, similar to the 12-item EHFSBS, it had good internal consistency reliability with more homogenous items. In previous studies, Cronbach’s alpha of the 9-item EHFSBS ranged from .66 to .82.^{61,71,73,76,78,88} In our study, EFA demonstrated three dimensions of the 9-item

EHFScBS with only one reliable factor 'Consulting behaviors. Our results are consistent with results from previous studies.^{76,78,88} Köberich et al.⁸⁸ tested the German version of the 9-item EHFScBS and found three factors by conducting PCA, which explained 62.6% of the variance.⁸⁸ Lambrinou et al.⁷⁶ examined the Greek version of the 9-item EHFScBS using PCA and found three factors explaining 53.4% of the variance.⁷⁶ In addition, Vellone et al.⁷⁸ examined the factorial structure of the 9-item EHFScBS in a sample of patients from Italy by conducting CFA, which confirmed the three factorial structure.⁷⁸ Two studies that examined the reliability of the sub-factors of the 9-item EHFScBS found that only the factor 'consulting behaviors' to be reliable with Cronbach's alpha of .85.^{61,71} However, Lambrinou et al.⁷⁶ found that Cronbach's alpha for the 'consulting behaviors' factor was .57. To our knowledge, no single study used the factor 'consulting behaviors'. The inconsistency of the findings suggests using the total score of the scale.

We also examined the construct validity of the 9-item EHFScBS by hypothesis testing and found that better engagement in HF self-care was a significant predictor of better HF HRQoL. Consistent with our findings, Doris et al.⁷³ examined the construct validity of the 9-item EHFScBS via hypothesis testing and found a moderate but significant association between social support and HF self-care.⁷³

In our study, about 62% of the participants were males, and 66% of the patients in this study had NYHA I or NYHA II. This information should be considered before generalizing the findings to other patients with HF. These results can be generalized to individuals with similar characteristics. Since the United States is composed of people from different backgrounds, we do not know yet the validity of this instrument when used by people with English as a second language.

6. Recommendation for Future Research

We found that the factorial structures of both the 12-item EHFS CBS and 9-item EHFS CBS were partially confirmed the originally proposed dimensions. Although both versions were valid and reliable, we recommend using the 9-item EHFS CBS to measure self-care in patients with HF from the United States because it demonstrated better homogeneity and closer structure to the originally proposed dimensions than the 12-item EHFS CBS. We recommend using the total score of the EHFS CBS.

7. Conclusion

Although both versions of the EHFS CBS were valid and reliable, the 9-item EHFS CBS was more homogenous with a similar structure to the originally proposed dimensions compared to the 12-item EHFS CBS. Further validation in a more diverse population including patients with NYHA class III –IV and female is recommended in future research.

Table 2.1. Characteristics of the sample of 105 patients with HF

Characteristics	Mean \pm SD or N (%)
Age, years	61 \pm 14
Gender (male)	65 (62%)
Ethnicity:	
Caucasian	76 (72%)
Other	29 (28%)
Marital Status:	
Married/ Cohabitate	56 (53%)
Other	49 (47%)
Education, years	13 \pm 3
NYHA functional class:	
I/II	69 (66%)
III/IV	36 (34%)
Hypertension*	73 (70%)
Diabetes	41 (39%)
12-item EHFSBS	30 \pm 9
9-item EHFSBS	24 \pm 8
MLHFQ	43 \pm 24

*Three missing cases

Abbreviations: NYHA: New York Heart Association functional classification; ACEI's: angiotensin-converting enzyme inhibitors; ARB's: angiotensin receptor blockers; EHFSBS: European Heart Failure Self-Care Behavior Scale, MLHFQ: Minnesota Living with Heart Failure Questionnaire.

Table 2.2. Item analysis of the EHFSBS scale (n=105)

Item	Mean ± SD	12-item EHFScBS				9-item EHFScBS			
		Item-total correlation	No. of inter-item correlations		Cronbach's Alpha if deleted	Item-total correlation	No. of inter-item correlations		Cronbach's Alpha if deleted
			<.20	>.80			<.20	>.80	
1. I weigh myself every day	3.32 ± 1.59	.47	3	-	.78	.46	1	-	.80
2. If I get SOB I take it easy	1.54 ± .84	.32	6	-	.79				
3. If SOB increases I contact my doctor or nurse	2.45 ± 1.59	.50	4	-	.78	.55	3	-	.79
4. If leg/feet are more swollen, I contact doctor or nurse	2.16 ± 1.43	.57	3	-	.77	.58	1	-	.79
5. If I gain weight I contact doctor or nurse	2.92 ± 1.64	.63	5	-	.76	.66	2	-	.77
6. I limit the amount of fluids	3.35 ± 1.56	.46	3	-	.78	.43	2	-	.80
7. I take a rest during the day	2.06 ± 1.29	.26	10	-	.80				
8. If I experience fatigue I contact doctor or nurse	3.24 ± 1.43	.67	2	-	.76	.71	-	-	.77
9. I eat a low salt diet	2.73 ± 1.42	.48	3	-	.78	.49	1	-	.80
10. I take my medication as prescribed	1.27 ± .76	.40	4	-	.79	.38	1	-	.81
11. I get a flu shot every year	2.01 ± 1.61	.18	9	-	.81				
12. I exercise regularly	3.00 ± 1.45	.38	4	-	.79	.36	2	-	.81

➤ Mean inter-item correlation for the 12-item EHFSBS was .248 and .326 for the 9-item EHFSBS

Table 2.3. Exploratory factor analysis of EHFScB scale (n=105)

Item	Four factor model, 12-item EHFScBS				Three factor model, 9-item EHFScBS *		
	Factor I	Factor II	Factor III	Factor IV	Factor I	Factor II	Factor III
3. If my shortness of breath increases, I contact my doctor or nurse	.86				.88		
4. If my feet/legs become more swollen than usual, I contact my doctor or nurse	.78				.86		
8. If I experience increased fatigue, I contact doctor or nurse	.64	.51			.58		.47
2. If I get short of breath, I take it easy	.53			.52	-	-	-
1. I weigh myself every day		.74				.53	.45
5. If I gain 2 kg in 1 week, I contact my doctor or nurse	.45	.72			.60	.59	
9. I eat a low salt diet		.64				.71	
6. I limit the amount of fluids I drink (not more than 1.5–2 L/day)		.58		.56		.82	
11. I get a flu shot every year			.77		-	-	-
12. I exercise regularly			.68				.90
10. I take my medication as prescribed			.45		.38		.26
7. I take a rest during the day				.77	-	-	-
<i>Cronbach's alpha</i>	.75	.60	.44	.15	.83	.60	.28

*Items 2, 7, 11 deleted.

Table 2.4. Hierarchical Multiple Linear Regressions for Variables Predicting HF health-related quality of life (n = 201)

Variable	12-item EHFSBS					9-item EHFSBS				
	B	β	P-value	Adjusted R^2	Model P-value	B	β	P-value	Adjusted R^2	Model P-value
<i>First Block</i>				.08	.002				.09	.001
HF self-care	.76	.30	.002			.92	.32	.001		
<i>Second Block</i>				.23	< .001				.25	< .001
HF self-care	.53	.21	.030			.70	.24	.011		
Age (years)	-.36	-.21	.030			-.36	-.21	.025		
Gender (male)	-.03	-.001	.996			.30	.01	.950		
Education (years)	-1.90	-.26	.005			-1.93	-.26	.004		
Ethnicity (Caucasian)	-3.73	-.07	.500			-3.52	-.07	.476		
Marital status (married/cohabitate)	-2.87	-.06	.540			-3.28	-.07	.477		
NYHA (I/II)	17.27	.34	< .001			16.93	.34	< .001		

Abbreviations: NYHA = New York Heart Association Functional Classification; EHFSBS: European Heart Failure Self-Care Behavior Scale.

For categorical variables reference category in parentheses

CHAPTER THREE

Gender is not a moderator on the association between social support and daily sodium intake in patients with heart failure

1. Introduction

More than 6.5 million people are living with heart failure (HF) in the United States today.³ Consequences of HF include high rates of mortality and rehospitalizations, and increased medical costs,³ which were linked to high sodium intake.¹⁰¹ Therefore, patients with HF are strongly recommended to eat low sodium diet (LSD),⁶² which is associated with lower HF symptoms burden and longer cardiac event-free survival.¹⁰² While adherence to the recommended treatment is essential for better HF patient outcomes; many patients find adherence difficult.¹⁰³ It is estimated that the rate of adherence to LSD does not exceed 55% in the HF population.¹⁰⁴

Social support is associated with better adherence to LSD in patients with HF.³⁵ Social support has been linked to human behavior and health outcomes. Patients with HF who reported high levels of social support were more likely to take their medicine, adhere to dietary recommendations, limit daily fluid intake, weigh themselves daily, consult a health care provider for weight gain, get flu shot, and perform regular exercises than those with low levels of social support.³³⁻³⁵ Low levels of social support were significantly associated with poor HF outcomes including increased rehospitalizations and mortality rates, poorer quality of life, and poorer adherence to HF self-care.³³⁻³⁵ Thus, providing social support for patients with HF is important to help patients adopt healthy behaviors, such as adherence to LSD, which eventually will lead to improving HF

outcomes.

Gender has been found to influence the relationship between social support and health outcomes. For instance, male patients with HF who perceived high levels of social support were less likely to experience a functional decline, to drop out of the study due to increased illness, or to die within one year of an acute HF exacerbation than male patients with low levels of perceived social support. There was no such relationship for females.⁵⁰ Moreover, it was reported, in a review of the literature of qualitative studies that examined gender influences on HF self-care,⁵¹ that female patients reported lower social support, especially from their families, and that female patients had more negative perceptions about the consequences of HF, their future and their social roles than male patients do.⁵¹

Gender has also been associated with adherence. Females with HF had better adherence to LSD than males,^{81,105,106} and they had a better knowledge and a better understanding of signs and symptoms of fluid overload caused by high sodium intake such as edema, and actions needed when complications attributed to high sodium intake occur compared to males.¹⁰⁶ Although there are differences in levels of perceived social support and adherence to LSD between male and female patients, there is lack of evidence whether gender difference impacts the association between social support and daily sodium intake in patients with HF. Therefore, the purpose of this study was to determine whether gender moderates the association between perceived social support and daily sodium intake in patients with HF.

2. Methods

2.1. Design

Data for this secondary analysis were obtained from The RICH Heart Program HF Registry, a database that includes data from multiple sites representing the Kentucky, Indiana, and Georgia. Detailed information about the original data has been previously described.¹⁰⁷ Local Institutional Review Boards (IRB) approved each study of the contributors to the data registry. The University of Kentucky approved the formation of the registry to contain de-identified patients' data.

2.2. Sample

A sample of 217 participants with data available on all of the study variables was included in the analysis. Patients were eligible if they (1) had a confirmed diagnosis of chronic HF, (2) were on stable doses of HF medication for at least one month, (3) and had no cognitive impairment that precluded giving informed consent. Patients were excluded if they had life-threatening comorbidities such as cancer or end-stage renal disease.

2.3. Setting

Patients recruited from outpatient clinics or inpatient units were referred to the original project by physicians and nurse practitioners or by self-referral. A trained nurse research assistant with cardiovascular nursing background screened participants for eligibility. Eligible patients signed the consent form if they were willing to participate in the study and after receiving information about the study. Then, participants completed questionnaires on psychosocial and sociodemographic variables of interest. Medical charts were reviewed for clinical variables.

2.4. Measures

Demographic and Clinical Characteristics. Demographic variables were age, gender (the moderator), marital status, living arrangement, ethnicity, and educational level. Clinical variables included New York Heart Association (NYHA) functional classification, left ventricular ejection fraction (LVEF), body mass index (BMI), and presence of comorbidities (hypertension and diabetes). Data on these variables were obtained by patient interview and medical record review.

Sodium intake. Daily sodium intake was measured using the 24-hour urinary sodium (24-hr UNA), which is considered the gold standard for measuring daily sodium intake.¹⁰⁸ Patients were given instructions and equipment for urine collection (urinals for men and hats for women). Results of the 24-hr UNA in mmol/day were multiplied by 22.99 to obtain results in mg/day. The value 3000 mg/day was used to define adherence to LSD. The cut point of 3000 mg/day was chosen because many patients were instructed to follow a 2-3 gram sodium diet.

Perceived social support. Perceived social support was defined as the perception of help received from others,¹⁰⁹ and was measured using the Multidimensional Scale of Perceived Social Support (MSPSS).⁴⁷ The MPSS consists of three subscales that represent sources of social support: family, friends, and significant others. This is a 12-item scale, and participants choose the best response from 7-Likert responses ranging from 1 'very strongly disagree' to 7 'very strongly agree.' The total score is obtained by summing the 12 items and ranges from 12 to 84. Higher scores indicate higher levels of perceived social support. The MSPSS had an excellent internal consistency reliability and

demonstrated evidence of construct validity when used to measure perceived social support in patients with HF.¹¹⁰ Cronbach's alpha of the MSPSS in this study was 0.95.

2.5. Data analysis

Analyses were performed using the Statistical Package for Social Sciences V24 (SPSS Inc., Chicago, IL, USA). Descriptive statistics frequency, proportion, mean, and standard deviation were used to characterize the participants. Differences in demographic information and clinical variables between males and females were examined using *t*-test (Mann-Whitney U test was used for gender differences in LVEF) and Chi-square test. A *p* value of .05 was set as the threshold of significance.

To test whether gender moderated the association between social support and daily sodium intake, we used Hayes¹¹¹ and Aiken et al.¹¹² as a guide for the analysis. In a hierarchical regression model, social support (the predictor) was entered to the first block. In the second block, gender (the moderator) was added. The interaction (social support \times gender) was added to the third block. A significant interaction would indicate that gender moderated the association between social support and daily sodium intake. PROCESS¹¹¹ macro for SPSS was utilized to obtain simple slopes for male and female patients.

3. Results

3.1. Sample characteristics

Characteristics of the 217 patients and comparison of characteristics between males and female are presented in Table 3.1. Of the 217 participants, 151 were males (70%), with a mean age of 62 years. Most participants were Caucasians (73%), married or cohabitate with another person (59%), and spent 13 years on average in education. The

mean patient BMI was 31 with a mean LVEF of 35%. Among the participants, 42% had NYHA III/IV, 71% had had hypertension, and 38% had diabetes. The mean patient 24-hr UNa was 3821 ± 1964 mg/day. Only 39% of patients were adherent to the LSD at the level of 24-hr UNa <3000 mg/day.

Compared to male patients, female patients had significantly lower 24-hr UNa (4122 vs. 3131, $p=0.001$). Female patients had higher proportions of minorities (36% vs 22%, $p=0.045$), single, widowed, or separated (56% vs 34%, $p=0.003$), and adherence to LSD (58% vs 31%, $p<.001$) when compared with male patients. There was no significant difference in mean perceived social support scores between female and male patients.

3.2. Gender moderation of the association between perceived social support and daily sodium intake

In a hierarchical regression (Table 3.2), perceived social support was not a significant predictor of daily sodium intake in the first block ($B = -3.237$, $p = .662$). When gender was added as a moderator in the second block, gender was the only significant predictor of daily sodium intake ($B = -991.16$, $p = .001$). The interaction (perceived social support X gender) when added in the third block was not significant ($B = -16.19$, $p = .286$). As results of simple slope analysis (Figure 3.1), the slopes of the association between social support and daily sodium intake for both male and female were not significant.

4. Discussion

In this study, we examined the moderation effect of gender on the association between social support and daily sodium intake in patients with HF. We found that gender did not moderate the association between perceived social support and daily sodium intake. Surprisingly, there was no significant association between perceived social support and daily sodium intake. Others also found that social support was not associated with self-care behaviors.^{103,113,114}

Social support has been linked to improving human health in different ways including buffering stress or promoting health behaviors.²¹ Social support has also been linked with adherence to HF self-care behaviors, including eating LSD.^{35,55} For instance, Sayers et al. found that perceived social support, measured by the MSPSS, was moderately associated with better adherence to LSD, as assessed by the Eating Dietary Questionnaire, in patients with HF.³⁵ On the other hand, Luyster et al.¹¹⁴ found that there was no significant association between social support, measured by the ENRICH Social Support Inventory, and adherence to LSD, assessed by a single item question, in a sample of 88 patients with HF treated with implantable cardioverter defibrillator.¹¹⁴ Our findings do not necessarily imply that social support posed no influence on adherence to LSD. The instrument used in our study, the multidimensional scale of perceived social support, measures how patients perceive the social support from families, friends, and significant others. High levels of social support as measured by this scale do not mean that the perceived support was directed towards adhering to LSD. Congruence between the patient's need and the type of support should be present to obtain benefits of that

support.²¹ Since patients with HF find it difficult to adhere to LSD, the provided support must be directed to encourage patients to improve their adherence to LSD. Patients with HF reported that social pressure and encouragement to eat LSD from health care providers and family members had a positive effect on their adherence to LSD.¹¹⁵ These findings were supported by Chung et al.¹¹⁶ who found that patients whose family members followed an LSD demonstrated better adherence to LSD than patients whose family members did not follow the LSD.¹¹⁶ In addition, including family members in interventions targeting patients' adherence to LSD demonstrated to be effective. Dunbar et al.¹¹⁷ conducted a randomized controlled trial study to examine the efficacy of the family partnership intervention on improving LSD adherence in patients with HF.¹¹⁷ The family partnership intervention provided education and counseling to patients and their family caregivers on how to follow an LSD. It also focused on enhancing family support towards eating an LSD. The family partnership intervention improved levels of perceived support, as assessed by the patient version of the Family Care Climate Questionnaire. It was also effective in lowering the 24-hr UNA in patients with HF. The investigators also found that the participants' 3-day food record sodium intake was significantly decreased in both the family education intervention group and the family partnership intervention group.¹¹⁷ Therefore, examining the effect of dietary social support in particular, rather than studying the influence of the general social support will provide a better understanding on how support and encouragement from social networks can improve patients' adherence to LSD. Sallis et al.,¹¹⁸ developed an instrument to measure perceived dietary social support from family and friends to encourage patients to eat low fat and

low sodium foods.¹¹⁸ This is a ten-item scale that asks individuals to rate how often, during the past three months, their family and friends said statements or done actions that represent either participation in eating that diet, rewards or punishment for eating that diet.¹¹⁸ This scale was used in other studies where a significant association between dietary social support and healthy diet eating behaviors was reported.¹¹⁹⁻¹²⁴ Examining the association between dietary social support and adherence to LSD would be beneficial before developing interventions and strategies focusing on increasing levels of dietary social support provided to patients with HF. Examples of such strategies include improving families' participation in eating LSD and family partnership program.^{55,116}

Similar to previous findings, we found that females consumed less sodium food than males. Chung et al.¹⁰⁶ found that females are more adherent to LSD than males.¹⁰⁶ In their study, Chung et al.¹⁰⁶ found that females recognized signs and symptoms of high sodium intake more than males did. They also found that females had a better understanding of actions required to follow LSD, such as eating fresh food.¹⁰⁶ These findings suggest the need for gender-specific strategies to improve patients' adherence to LSD.

In our study, gender did not moderate the association between social support and daily sodium intake. In addition, there was no difference in levels of social support between males and females. Inconsistent findings on the moderation role of gender on the association between social support and health outcomes were noted in the literature. Bucholz et al.¹²⁵ examined gender differences in social support levels and the association between social support and health outcomes in young patients with recent acute

myocardial infarction. They found that social support levels, measured by ENRICH Social Support Inventory, did not differ between males and females and that there were no gender differences in the effect of social support on health outcomes.¹²⁵ On the other side, Wilson and Ampey-Thornill¹²⁴ examined whether gender moderated the association between dietary social support and adherence to low sodium diet. In that study, 184 African-American adolescents who participated in a hypertension prevention program were asked to fill out questionnaires about dietary social support and 24-hr UNA was obtained. They found that among adherent participants, females reported higher levels of family support compared to males. Among the non-adherent participants, females reported lower levels of family support than males did.¹²⁴ However, all of the previous studies did not include patients with HF. Therefore, future research is needed to determine the moderation effect of gender on the association between dietary social support and eating LSD in patients with HF.

Although researchers have developed different strategies to improve patients' adherence to LSD, the adherence rate still low. Congruent with previous findings, only 39% of the entire sample were adherent to LSD. It was reported that less than 55% of patients with HF are adherent to LSD using the 3000 mg sodium per day cut point.¹⁰⁴ Therefore, researchers are encouraged to develop innovative approaches to help patients with HF to lower their daily sodium intake.

This study has limitations. This was a secondary data analysis, which limited our control over the study variables. Since that half of patients with HF are females,³ the small proportion of women (30% of the total sample) limits the ability to generalize our

findings to the whole HF population. Future research with equal representation of males and females is encouraged. The instrument used in our study, the multidimensional scale of perceived social support, measures how patients perceive the social support from families, friends, and significant others. High levels of social support as measured by this scale do not mean that the perceived support was directed towards adhering to LSD. Therefore, using an instrument that measures the dietary social support will provide more information on the association between dietary social support and daily sodium intake in patients with HF. On the other hand, using 24-hr UNA to measure daily sodium intake is a significant strength of our study, especially that 210 patients were able to provide a 24-hr UNA sample.

In conclusion, although we found female patients consume less sodium daily than male patients. We also found that gender did not moderate the association between social support and daily sodium intake.

Table 3.1. Characteristics of the sample (N=217)

Characteristics	Mean \pm SD or N (%)			P-Value
	Total Sample (N = 217)	Male (n=151)	Female (n=66)	
	Mean \pm SD			
Age (years)	62 \pm 11	61 \pm 11	62 \pm 10	.670
Education, years	13 \pm 3	13 \pm 3	13 \pm 3	.396
BMI	31 \pm 7	31 \pm 6	31 \pm 8	.453
LVEF (%) ^A	35 \pm 14	32 \pm 12	40 \pm 16	.001 ^C
Perceived Social Support	67 \pm 18	67 \pm 18	67 \pm 19	.963
24-UNa (mg/day)	3821 \pm 1964	4122 \pm 1899	3131 \pm 1951	.001
	n (%)			
Ethnicity:				.045
Caucasian	159 (73)	117 (78)	42 (64)	
Other	58 (27)	34 (22)	24 (36)	
Marital Status:				.003
Married/ Cohabitate	129 (59)	100 (66)	29 (44)	
Other	88 (41)	51 (34)	37 (56)	
NYHA functional class:				.139
I/II	125 (58)	92 (61)	33 (50)	
III/IV	92 (42)	59 (39)	33 (50)	
Hypertension ^A	151 (71)	104 (71)	47 (72)	.870
Diabetes ^B	82 (38)	57 (38)	25 (38)	1.000
Adherence to LSD	84 (39)	46 (31)	38 (58)	<.001

A: missing five cases B: one missing case C: Mann-Whitney U Test was used

BMI: body mass index, LVEF: left ventricular ejection fraction, 24-UNa: 24-urinary sodium; LSD: low sodium diet

Table 3.2. Gender moderation of PSS and daily sodium intake (n = 217)

Block	Variable	<i>B</i>	β	<i>P</i> -value	<i>R</i> ²	<i>R</i> ² change	Model <i>P</i> -value
1	PSS	-3.237	-.030	.662	.001	-	.662
2	PSS	-3.156	-.029	.662	.055	.054	.002
	Gender	-991.161	-.233	.001			
3	PSS	2.480	.023	.781	.060	.005	.004
	Gender	94.289	.022	.929			
	Gender x PSS	-16.186	-.270	.286			
<i>Model statistics:</i>		Durbin-Watson = 2.14, <i>R</i> ² = .06, adjusted <i>R</i> ² = .047, model <i>F</i> statistic = 4.54, <i>p</i> < .004.					
Abbreviations: B = unstandardized coefficient; β : standardized coefficient; PSS= Perceived social support.							

Table 3.3. Slope information of the association between social support and daily sodium intake according to gender (n = 217)

Gender	<i>Slope</i>	SE	t-test	<i>P</i> -value
Male	2.4802	8.9211	.2780	.7813
Female	-13.7055	12.2046	-1.1230	.2627

SE: standard error

-This analysis was conducted using PROCESS macro

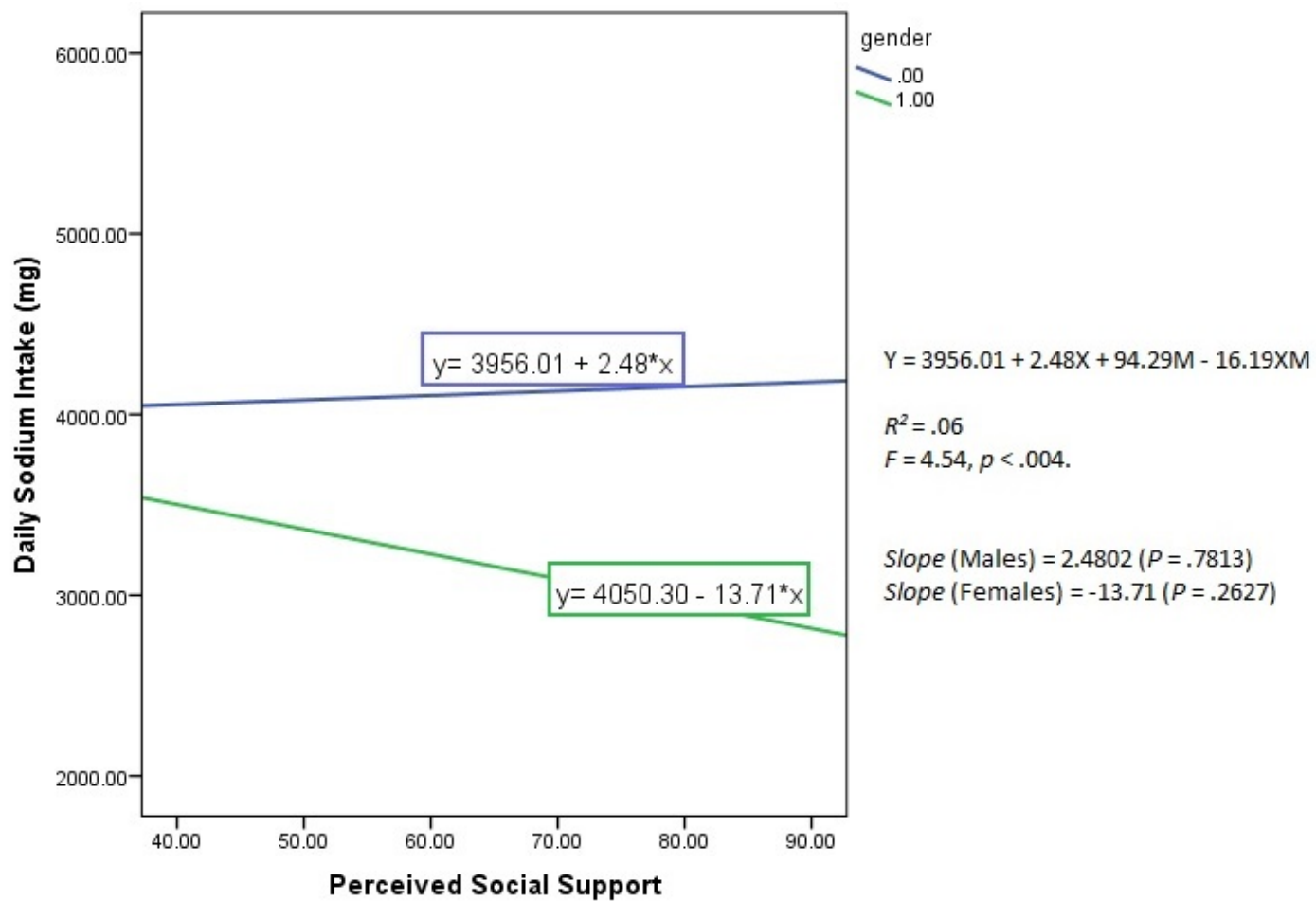


Figure 3.1. Slopes of the association between social support and daily sodium intake (mg) for male and female patients

CHAPTER FOUR

Positive Relationship Quality is Associated with Better Heart Failure Self-Care in Female Patients or Patients with Non-Spousal Relationship with their Family Caregivers

1. Introduction and Background

Heart failure (HF) is a public health issue in the United States characterized by high rates of mortality and rehospitalizations and high medical costs.³ Self-care is an important modifiable factor of the HF treatment that can help to decrease these costs, reducing symptoms of HF, and improving clinical outcomes.^{11,12} To achieve optimum self-care, patients are recommended to monitor their symptoms and to adopt healthy behavioral changes and new lifestyle modifications. Providing social support is essential to improve patients' self-care.¹²⁶

Family support is essential to improve patients' self-care.¹²⁷ Family caregivers provide emotional and informational support to patients by helping with monitoring signs and symptoms of HF exacerbation; encouraging patients to adhere to the medical treatment; regulating the patient's consumption of alcohol and providing help with performing activities of daily living (ADL).^{116,127-131} The patient-caregiver relationship is an interdependent and reciprocal relationship in the HF management, in which both partners may feel emotionally, financially, physically, or morally dependent and responsible for each another.¹³² In the interdependent and reciprocal relationship between two individuals, relationship quality, defined as the patients' appraisal of their relationship with their family caregiver, is considered as an indicator of how individuals

perceive support from their caregivers. Few studies focused on the role of patient-caregiver relationship quality on HF self-care and found a significant association between relationship quality and HF self-care.^{45,133}

Patients' gender and the relationship type with family caregivers (spousal vs. non-spousal) are factors that have been reported in the literature to be associated with both relationship quality and self-care.^{52,53,134} In recent two reviews of the literature, researchers concluded that gender plays a significant role on HF self-care; however, they found that findings from previous studies were inconsistent.^{52,53} While some researchers found that females had better HF self-care than males, other researchers reported that males engage better in HF self-care activities than females.^{52,53} Although healthy females tend to report higher levels of social support, connectedness and positive views of their relationship with partners than males do,⁴⁶⁻⁴⁸ females with HF were found to have lower levels of perceived social support than males.⁵⁰ These findings were attributed to the fact that females with HF are more likely to be single, widowed or divorced, and to live alone than males with HF.⁵⁰ With regards to the relationship type, it was reported that having a spouse is an indicator of having high levels of support while living with no spouse is an indication of having low levels of support.^{135,136} Moreover, patients with a spouse demonstrated better adherence to HF self-care activities, such as medication adherence than those without a spouse.¹³⁷ However, only one study, in which the association between the relationship type and HF self-care was examined, concluded that family caregivers with a non-spousal relationship with patients had a higher contribution to patients' self-management than those with the spousal relationship.¹³⁴ Although research

is growing in this area, exploring the impact of patients' gender and relationship type with their family caregivers on the association between relationship quality and self-care in patients with HF is still understudied. Therefore, the purpose of this study was to examine the moderation effect of gender and relationship type on the association between relationship quality and HF self-care among patients with HF.

2. Methods

2.1. Research design and sample

This study utilized descriptive, correlational, cross-sectional design that used baseline data of an ongoing longitudinal, randomized controlled trial of a patient-caregiver dyadic intervention. The intervention focused on improving HF outcomes by improving adherence to low sodium diet in patients with HF and their family caregivers. We included only patients in this study to gain a better understanding of how they perceive their relationship quality with their family caregivers and the association of relationship quality (as perceived by patients) with their self-care. Patients who had complete baseline data and met the following eligibility criteria were included in this study (1) had a confirmed diagnosis of chronic HF (2) were able to speak and write in English, and (3) had no cognitive impairment. Patients were excluded if they had a concurrent terminal illness or if they had no primary family caregivers.

2.2. Recruitment Sites and Ethical Approval

Eligible participants were recruited from multiple recruitment sites including cardiology outpatient clinics at two main hospitals in central Kentucky. Institutional Review Boards (IRB) approval was obtained from ethics committees at each site.

Informed consents were obtained from each patient before participation in the parent study.

2.3. Research Procedures

Eligible patients were screened using the inclusion/exclusion criteria. Participants signed consent forms and Health Insurance Portability and Accountability Act Authorization forms after they demonstrated an understanding of the study purposes, risks and benefits of participating in this study. At the baseline home visit, participants filled out questionnaires using RedCap system. Demographic characteristic and clinical data were obtained from a brief interview of participants using structured questionnaires and by reviewing their medical records. They completed surveys and other data collection according to the parent study's protocol.

2.4. Measures

Moderators and demographic characteristics. Demographic information (i.e., gender; age; ethnicity; marital status; and education) and clinical variables (i.e., New York Heart Association (NYHA) classification; left ventricular ejection fraction (LVEF); prescribed medications; and comorbidities) were obtained by patient interview and medical record review. The type of the relationship between patients and family caregivers was assessed by asking caregivers to answer a question on what is their relationship to the patient, with possible choices of: spouse, son or daughter, son or daughter in law, another relative, friend, or other relationship. Since we are interested in how relationship type (spousal vs. non-spousal) is associated with HF self-care, patient-caregiver relationship types were categorized to either spousal or non-spousal

relationships.

Self-care. Heart failure self-care was defined as behaviors that patients with HF perform to maintain life, healthy functioning, and well-being.⁷⁰ Heart failure self-care was measured using the 9- item European Heart Failure Self-Care Behavior Scale (EHFScBS).⁷⁰ This scale is consisted of nine items with 5-Likert scale responses ranging from 1 (I completely agree) to 5 (I don't agree at all), and asking participants to respond to each statement by circling the number they think best applies to them.⁷⁰ The score was calculated by summing up the item scores, resulting in a possible range of 9-45, with higher scores indicating worse HF self-care. Psychometrics of the 9- item EHFScBS were examined in a sample of patients with HF (n=200) in the United States with Cronbach's alpha of .80, indicating a good internal consistency of reliability. The convergent and discriminant validity of the 9- item EHFScBS were also supported in that study.⁶¹ In this study, Cronbach's alpha was .82 indicating a good internal consistency of reliability.

Relationship quality. Relationship quality defined as the patients' appraisal of their relationship with their family caregiver, was measured using the patient version of the Dyadic Relationship Scale.⁸² The scale consists of 10 responses rated on a 4-point Likert scale from 1 (strongly disagree) to 4 (strongly agree)). It has two subscales, positive dyadic interaction, and negative dyadic strain.⁸² The positive dyadic interaction subscale consists of six items that measure the positive feelings of the dyadic relationship as perceived by the patient. The negative dyadic strain subscale, on which patients evaluate their relationship as feeling stressed from their partner, is four items.⁸² The items of each subscale are summed with the total score ranging between 6 and 24 for the

positive interaction subscale, and from 4 to 16 for the negative dyadic strain score.

Higher scores of the positive dyadic interaction subscale indicate greater positive quality of the relationship, while higher scores of the negative dyadic strain subscale indicate higher levels of strain of the relationship. Both scales demonstrated a good internal consistency reliability in our study, with Cronbach's alpha of .80 for the positive dyadic interaction subscale, and .81 for the dyadic strain subscale. The construct, discriminant, and concurrent validity were previously established.⁸²

2.5. Data Analysis

The Statistical Package for Social Sciences V24 (SPSS Inc., Chicago, IL, USA) was used for data analysis. Descriptive statistics (frequency, proportion, mean, and standard deviation) were used to describe the sample characteristics. Descriptive statistics were run to examine the variables of interest (i.e., relationship quality and self-care) for problems with skewness or kurtosis. A comparison of demographic information and clinical variables by gender and relationship type (spousal vs. non-spousal) were examined using *t*-test and Chi-square test. A *p*-value of .05 was set as the threshold of significance.

Hierarchical regression model analyses were used to accomplish the specific aim of the study of determining the moderation effect of gender and relationship type (spousal vs. non-spousal) on the association between relationship quality and HF self-care, as guided by Hayes¹¹¹ and Aiken et al.¹¹² In the first block, the predictor (relationship quality) was entered into the model. In the second block, the moderator (gender or relationship type) was added. In the third block, the interaction (predictor \times moderator)

was added to the model. Moderation was determined to occur if there was a significant effect of interaction. Then PROCESS¹¹¹ macro for SPSS was used to obtain simple slopes and regions of significance for probing interactions.

3. Results

3.1. Sample Characteristics

Of the 92 participants included in the analysis, 54 were males (59%), and 38 were females (41%). Age ranged from 33 to 96 years ($M = 62$, $SD = 12$ years). The majority participants were Caucasians (83%), married or cohabitate with another person (84%), and had a spousal relationship with their primary family caregiver (77%). The mean LVEF was 27%, and the mean BMI for the total sample was 34 kg/m^2 . Sixty-two patients (71%) had hypertension, and 37 patients had diabetes (42%).

A comparison of demographic and clinical characteristics of the sample by gender and relationship type is presented in Table 4.1. Male patients had higher proportions of Caucasians (94% vs. 66%, $p=0.001$), married or cohabitate with their caregivers (93% vs. 71%, $p=0.007$), and with a spousal relationship with their family caregivers (91% vs. 58%, $p<.001$) compared with female patients. Patients with a spousal relationship with their caregivers had higher proportions of Caucasians (90% vs. 57%, $p=0.001$), married or cohabitate (97% vs. 38%, $p<.001$) than those with a non-spousal relationship with their caregivers. In addition, those with spousal relationship spent significantly more years in education than those with a non-spousal relationship with their caregivers (14 vs. 12, $p=0.01$).

Mean scores of HF self-care for the total sample was 22. Participants had a high

mean score of positive dyadic interaction ($M=18$) and a low mean score of negative dyadic strain ($M=7$). Relationship quality subscales scores and HF self-care scores were compared according to gender and the relationship type. The results are presented in Table 4.2. There were no significant differences in mean scores of self-care or relationship quality subscales by gender or relationship type.

3.2. Moderator effects of gender on the relationship between relationship quality and self-care

A hierarchical moderation analysis was conducted to test whether gender moderated the association between positive dyadic interaction and self-care (Model 1 - Table 4.3). In the first block, the positive dyadic interaction was a significant predictor of self-care ($B = -.52, p < .05$). In the second block, neither positive dyadic interaction nor gender predicted self-care. In the third block, the interaction (positive dyadic interaction \times gender) was significant ($B = -1.234, p = .021$) indicating significant moderation effect of gender on the association between positive dyadic interaction and self-care. The slope information of the association between the positive dyadic interaction and self-care are presented in Table 4.5. The association between positive dyadic interaction and self-care was significant only in female patients (Figure 1). For female patients, for every unit increase in positive dyadic interaction score, there were 1.29 units decrease in the self-care score. On the other side, positive dyadic interaction had no significant association with HF self-care in male patients ($B = -.054, p = .868$).

Results of the hierarchical moderation analysis of the moderation effect of gender on the association between negative dyadic strain and HF self-care are presented in

model 1 - Table 4.4. When negative dyadic strain was entered in the first block, there was no significant association between negative dyadic strain and self-care ($B = .18, p = .604$). Gender when was included in the second block ($B = 2.26, p = .192$), and the interaction (negative dyadic strain \times gender) when was added to the third block ($B = -1.09, p = .128$), were both non-significant. These results indicate that there was no association between negative dyadic strain and HF self-care, and gender did not moderate that association. Table 4.5 shows that negative dyadic strain scores were not significantly associated with HF self-care in both females and Males.

3.3. Moderator effects of relationship type on the association between relationship quality and HF self-care

In Model 2 - Table 4.3, the moderation effect of relationship type on the association between positive dyadic interaction and self-care was tested. The positive dyadic interaction was a significant predictor of self-care when added in the first block ($B = -.52, p < .05$). Relationship type was not significant when was added in block 2 ($B = .95, p = .636$). In block 3, where the interaction (positive dyadic interaction \times relationship type) was added, the interaction was marginally significant ($B = 1.03, p = .069$).

Examining the slope of the association (Table 4.5 & Figure 4.2) revealed that there was a significant association between positive dyadic interaction and HF self-care for patients who had non-spousal relationship with their family caregivers; for every unit increase in positive dyadic interaction scores, there was a 1.23 unit decrease in the self-care scores ($p < .01$). The simple slope analysis (Figure 4.2) demonstrated that as positive dyadic interaction scores increased, self-care scores increased as well in patients with a non-

spousal relationship with their family caregivers. There was no significant change in HF self-care as the positive dyadic interaction increased in patients with a spousal relationship with their caregivers.

In Model 2- Table 4.4, the results of testing whether relationship type moderated the association between negative dyadic strain and HF self-care are presented. There was no significant association between negative dyadic strain and self-care in the first block ($B = .18, p = .604$). Both relationship type when was added in the second block ($B = .38, p = .854$), and the interaction (negative dyadic strain \times relationship type) when added in the third model ($B = -.12, p = .893$) were not significant. These results indicate that there was no moderation effect of relationship type on the association between negative dyadic strain and HF self-care. Table 4.5 shows that negative dyadic strain scores were not significantly associated with HF self-care in patients with spousal or non-spousal relationships with their family caregivers.

4. Discussion

In this study, we investigated whether gender and relationship type with their family caregivers (spousal vs. non-spousal) moderated that association between relationship quality with their family caregivers and HF self-care. The relationship between positive dyadic interaction and self-care were only found in females, not males. These results can be explained and supported by the evidence that supportive relationships have more impact on health outcomes and behaviors in females than in males.¹³⁸ Shumaker and Hill¹³⁸ reported, in a critical review of the literature, that low level of social support was linked to increased risk of mortality and cardiovascular

diseases in females.¹³⁸ Because females tend to benefit more from emotional support compared to males who tend to benefit more from tangible support,⁴⁶ gender-specific interventions and research targeting improving the relationship quality are recommended in the future, which may improve HF self-care and outcomes.

In our study, there was a significant association between positive dyadic interaction and HF self-care. There are a few studies investigated the interpersonal relationship between patients and caregivers and self-care in patients with HF. Sebern and Riegel⁴⁵ found that patient with HF who had more interaction with their family in decision-making in the management of HF were more likely to report high levels of self-care maintenance and self-care confidence. Patients who reported better communication and reciprocity with their family members in the management had more self-care confidence. Hooker et al.¹³³ found that patients who reported better mutuality with their family caregivers had more confidence in HF self-care abilities. Patient self-care confidence was significantly associated with patient self-care maintenance. In addition, caregivers who reported better mutuality with the care recipients had more confidence in patients' self-care.¹³³ Both of the aforementioned studies^{45,133} used the Self-Care in Heart Failure Index to measure HF self-care. Similar findings were reported by Bidwell et al.¹³⁴ and Gallagher et al.³³ who used a single item question to measure relationship quality and found that the relationship quality was associated with better HF self-care.^{33,134}

We also found that positive dyadic interaction was associated with better HF self-care in patients who had a non-spousal relationship, not in those with spousal relationship with their primary family caregivers. Bidwell et al.¹³⁴ reported that non-spousal

relationship with family caregivers significantly contributed to Italian patients' self-care management.¹³⁴ In general, patients believe that it is their right to be served and taken care of by their spouses to honor their vows of “*in sickness and in health*.” On the other side, there is no such vow in the non-spousal relationship; the care provided by a non-spousal caregiver is voluntarily, and they are more likely to be their adult children. Therefore, patients appreciate and give gratitude to their non-spousal caregivers more than they do with their spousal caregivers, which may lead to more adherence to HF self-care behaviors. Therefore, positive dyadic interaction had more effect on HF self-care in patients with non-spousal caregivers than those with spousal caregivers.

Finally, we found that negative dyadic strain was not associated with HF self-care. We also found that gender and relationship type did not moderate the association between negative dyadic strain and HF self-care. Although females in general report more frequent negative interactions and more negatively affected by marital conflicts than males do,⁴⁹ the participants in our study reported low levels of negative dyadic strain regardless their gender or relationship type. In previous studies, spousal caregivers reported higher caregiving burden than non-spousal caregivers.¹³⁹ Caregiver burden is associated with higher levels of caregivers' depression,¹⁴⁰ which is negatively associated caregivers' contribution to patients' self-care.¹⁴¹ Because we did not examine the caregivers' burden nor the caregivers' depression in this study, future research is needed to explore and understand how caregiving burden and depression are associated with the quality of the relationship between patients and their family caregivers.

Our findings provide significant evidence on the importance of targeting patient-

caregiver relationship quality in future research and interventions aiming to improve self-care in patients with HF. Emotionally Focused Couples Therapy that aims to create secure attachment bonds between the partners, and Behavioral Couple Therapy that focuses on skills and behavior change to accept and tolerate partner differences are examples of interventions that have been reported to improve the relationship quality between partners.¹⁴² Although these interventions are evidence-based couple and family programs, however, these interventions have not been examined for feasibility and efficacy in the HF population. Therefore, future research is needed to determine the feasibility and efficacy of these interventions when used to improve relationship quality between patients with HF and their family caregiver.

5. Limitations of this Study

As with all research, our study has some limitations. First, due to the cross-sectional design of this study, no causal relationship between the findings can be concluded. Only outpatients were included in this study, and therefore we cannot generalize the findings to inpatients. Since we used only data from patients, our results may not reflect the whole picture of caregiving and the interactions that occur in the relationship between patients and their caregivers. Therefore, we recommend future research to incorporate both data from patients and their family caregivers using dyadic approach to provide a holistic understanding of the association between relationship quality and HF self-care, and to examine the moderation role of gender and relationship type on that association.

6. Conclusion

This study has shed more light on the association between patient-caregiver relationship quality and HF self-care, and on how gender and relationship type may alter that association. We found that positive dyadic interaction is associated with better HF self-care only in female patients or patients who had non-spousal caregivers. These findings signify the importance of having tailored interventions according to patients' gender and their relationship type with their caregivers.

Table 4.1. Characteristics of patients with HF by gender and relationship type

Characteristics	All patients (n = 92)	Gender		<i>P</i> - value	Relationship Type		
		Male (n = 54)	Female (n = 38)		Spousal (n = 71)	Non-Spousal (n = 21)	<i>P</i> - value
	Mean ± SD						
Age, years	62 ± 15	63 ± 15	62 ± 15	.668	63 ± 14	61 ± 17	.708
Education, years ^A	14 ± 3	14 ± 3	14 ± 4	.879	14 ± 3	12 ± 3	.01
LVEF, % ^B	27 ± 21	28 ± 20	27 ± 24	.932	29 ± 21	23 ± 22	.308
	n (%)						
Ethnicity:				.001			.001
Caucasian	76 (83)	51 (94)	25 (66)		64 (90)	12 (57)	
Other	16 (17)	3 (6)	13 (34)		7 (10)	9 (43)	
Marital Status:				.007			<.001
Married/ Cohabitate	77 (84)	50 (93)	27 (71)		69 (97)	8 (38)	
Other	15 (16)	4 (7)	11 (29)		2 (3)	13 (62)	
Relationship type with caregiver:				< .001			
Spousal Relationship	71 (77)	49 (91)	22 (58)		-	-	
Non-Spousal Relationship	21 (23)	5 (9)	16 (42)		-	-	
Hypertension ^C	62 (71)	33 (64)	29 (81)	.071	16 (76)	46 (69)	.723
Diabetes ^C	37 (42)	21 (40)	16 (44)	.827	30 (45)	7 (33)	.450

Abbreviations: HF: Heart Failure, LVEF: Left ventricular ejection fraction.

A: 2 missing cases

B: 13 missing cases

C: 4 missing cases

Table 4.2. Self-care behaviors and relationship quality compared by gender and relationship type (M±SD)

Scale	Possible Range	Total Sample	Gender		P-value	Relationship Type		P-value
			Male	Female		Spousal	Non-Spousal	
European Heart Failure Self-Care Behavior Scale (9-item EHFScBS)	9-45	22 ± 8	22 ± 8	24 ± 9	.192	23 ± 7	22 ± 10	.755*
Dyadic Relationship Scale:								
Positive Dyadic Interaction	6-24	18 ± 3	18 ± 3	18 ± 3	.863	18 ± 3	17 ± 4	.214
Negative Dyadic Strain	4-16	7 ± 3	7 ± 3	7 ± 2	.940	7 ± 3	6 ± 2	.686

Scale Scores are presented as Mean ± Standard Deviation

*Mann-Whitney U test was used for this result.

Table 4.3. Hierarchical Regression analyses testing the moderation effect of gender and relationship type on the association between positive dyadic interaction and self-care (n = 92)

	Block 1 ^A			Model 1: Gender as Moderator (M)						Model 2: Relationship Type as Moderator (M)					
				Block 2			Block 3			Block 2			Block 3		
	<i>B</i>	β	<i>P</i> -value	<i>B</i>	β	<i>P</i> -value	<i>B</i>	β	<i>P</i> -value	<i>B</i>	β	<i>P</i> -value	<i>B</i>	β	<i>P</i> -value
Predictor (X)	-.52	-.21	.049	-.52	-.20	.051	-.05	-.02	.868	-.54	-.21	.045	-1.23	-.49	.009
Moderator (M)				2.19	.13	.197	24.20	1.48	.013	.95	.05	.636	-16.98	-.88	.091
Interaction (X \times M)							-1.23	-1.37	.021				1.03	1.02	.069
<i>R</i> ²	.042			.060			.115			.045			.080		
<i>R</i> ² change				.018			.055			.003			.035		
<i>F</i> =	3.976 (<i>p</i> = .049)			2.847 (<i>p</i> = .063)			3.824 (<i>p</i> = .013)			2.083 (<i>p</i> = .131)			2.555 (<i>p</i> = .060)		

A: Block 1 is the same for both models

Predictor (X): Positive dyadic interaction

References for gender and relationship type are male and non-spousal relationship respectively.

B: unstandardized regression coefficient, β : standardized coefficient

Table 4.4. Hierarchical Regression analyses testing the moderation effect of gender and relationship type on the association between negative dyadic strain and self-care (n = 92)

	Block 1 ^A			Model 1: Gender as Moderator (M)						Model 2: Relationship Type as Moderator (M)					
				Block 2			Block 3			Block 2			Block 3		
	<i>B</i>	β	<i>P</i> -value	<i>B</i>	β	<i>P</i> -value	<i>B</i>	β	<i>P</i> -value	<i>B</i>	β	<i>P</i> -value	<i>B</i>	β	<i>P</i> -value
Predictor (X)	.18	.06	.604	.18	.06	.595	.56	.17	.183	.18	.05	.612	.27	.08	.728
Moderator (M)				2.26	.14	.192	9.40	.57	.061	.38	.02	.854	1.13	.06	.849
Interaction (X \times M)							-1.09	-.48	.128				-.12	-.05	.893
<i>R</i> ²	.003			.022			.047			.003			.004		
<i>R</i> ² change				.019			.025			.000			.001		
<i>F</i> =	.271	$(p = .604)$.999	$(p = .372)$		1.461	$(p = .231)$.151	$(p = .860)$.106	$(p = .957)$	

A: Block 1 is the same for both models

Predictor (X): Negative dyadic strain

References for gender and relationship type are male and non-spousal relationship respectively.

B: unstandardized regression coefficient, β : standardized coefficient

Table 4.5. Slope information of the association between relationship quality and self-care according to gender and relationship type

Predictor		Moderator	<i>Slope</i>	SE	t-test	<i>P</i> -value
Positive Dyadic Interaction	Gender	Male	-.054	.32	-.17	.8676
		Female	-1.29	.42	-3.09	.0026
	Relationship Type	Spousal	-.20	.32	-.64	.5253
		Non-spousal	-1.23	.46	-2.69	.0086
Negative Dyadic Strain	Gender	Male	.56	.42	1.34	.1832
		Female	-.52	.57	-.92	.3609
	Relationship Type	Spousal	.15	.39	.39	.6965
		Non-spousal	.27	.77	.35	.7279

SE: standard error

-This analysis was conducted using PROCESS macro

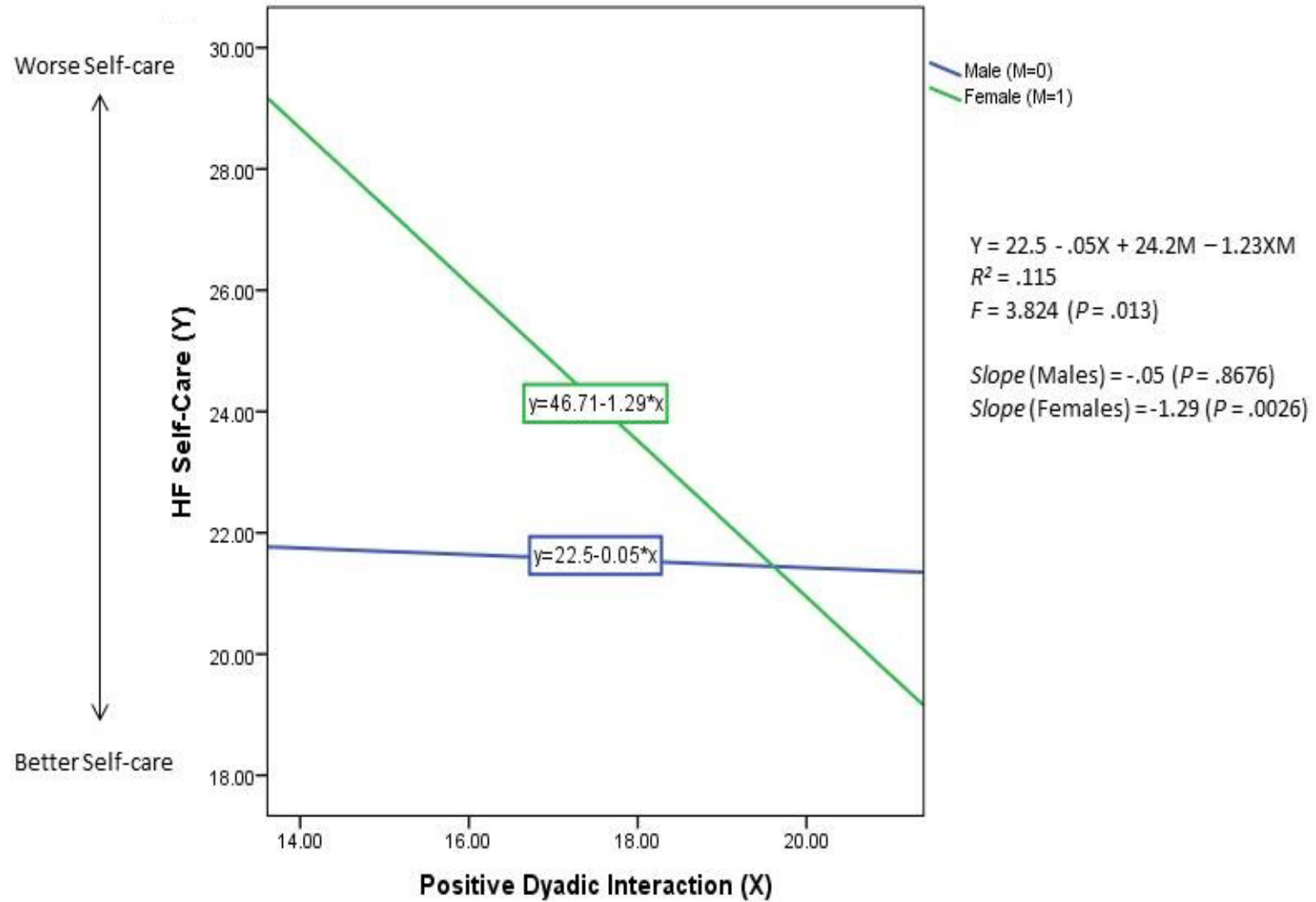


Figure 4.1. Slope of the association between positive dyadic interaction and HF self-care for males and females.

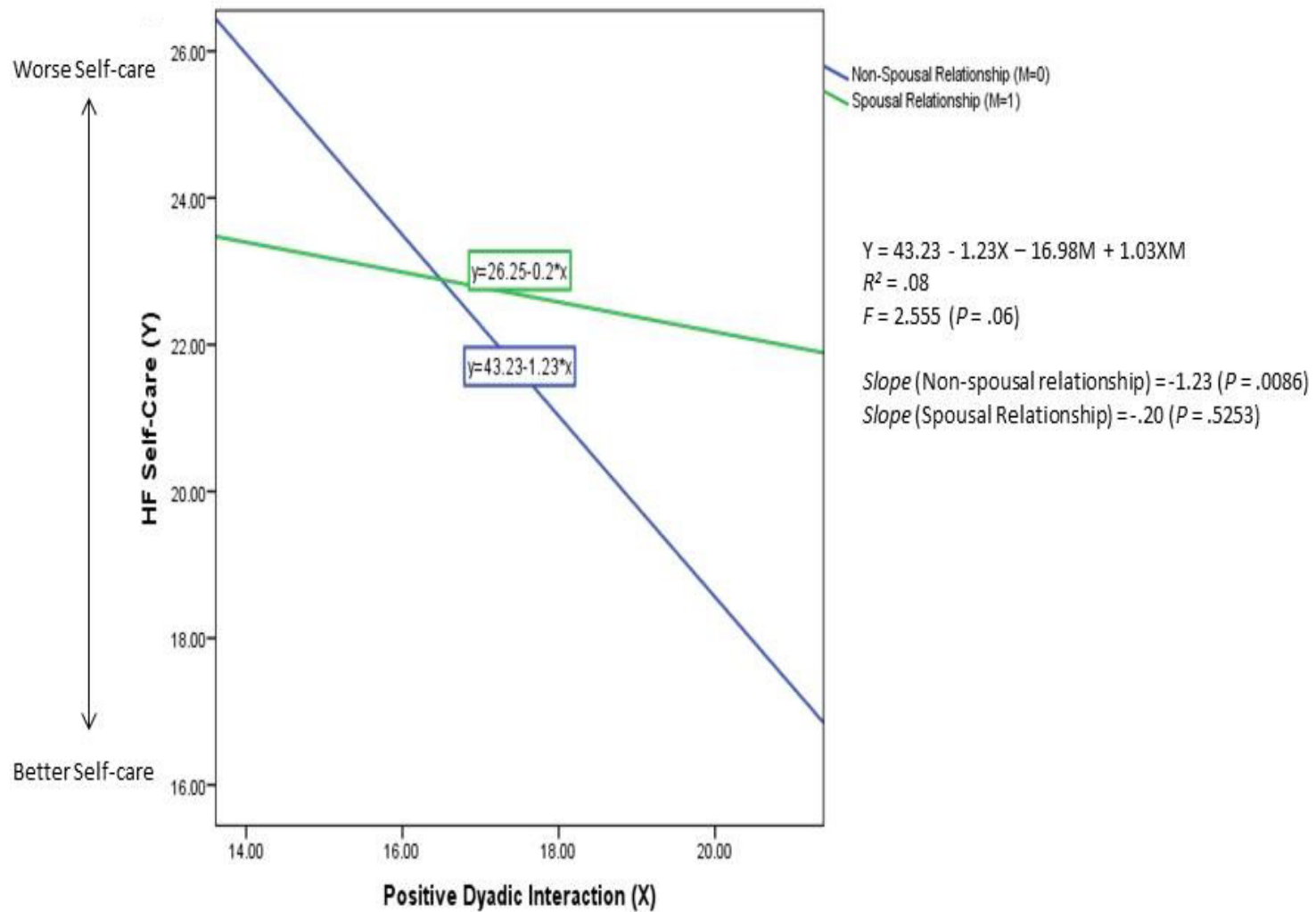


Figure 4.2. Slopes of the association between positive dyadic interaction and self-care for spousal and non-spousal relationships.

CHAPTER FIVE

Discussion and Synthesis

1. Background and purpose

There are more than 6.5 million patients diagnosed with heart failure (HF) in the United States alone, with around 960,000 new HF cases annually, and more than 68,000 deaths attributed primarily to HF.³ In addition, HF is characterized by high hospital readmission rates with medical costs approaching 31 billion dollars.⁴ Moreover, patients with HF have a poorer quality of life than patients with any other chronic conditions.⁸ Heart failure self-care is a significant modifiable factor that can improve HF outcomes.^{11,12} Consequently, researchers have been identifying factors and testing interventions that can improve patients' self-care.

To assess self-care behaviors in patients with HF, a valid and reliable scale is needed. Although both versions of the European Heart Failure Self-Care Behavior Scale (EHFScBS) were validated to assess HF self-care behavior in Europe and other countries, only 9-item EHFScBS was examined for validity and reliability in the United States. The evidence of the psychometric properties of the 12-item EHFScBS in comparison to the 9-item EHFScBS in the United States is still not determined. This gap was addressed in the second chapter of this dissertation.

Several factors have been linked with HF self-care, such as social support and patient-caregiver relationship quality.^{45,55,143} Because social support and relationship quality are modifiable factors, interventions to improve levels of perceived social support and relationship quality may be beneficial. Other sociodemographic factors, such as

gender and the type of the relationship between patients and their family caregiver (i.e., spousal vs. non-spousal), were also reported to be linked with both HF self-care social support.^{46-48,52,53,134} However, the moderation effect of these sociodemographic factors on the association between relationship quality and HF self-care, and the moderation role of gender on the relationship between social support on the self-care behavior of following a low sodium diet (LSD) in patients with HF have not been fully examined. Examining the moderation effect of these sociodemographic variables expands our understanding of the associations among social support, relationship quality, and HF self-care, which will lead to developing more effective interventions of HF self-care according to gender or relationship type. We addressed these gaps in Chapters Three and Four.

The purpose of this dissertation was to address these gaps and to expand our knowledge and increase our understanding of HF self-care. In this chapter, the findings of the three studies in this dissertation are synthesized, and recommendations for nursing practice and future research are provided.

2. Summary of findings

In the first study (Chapter Two), we addressed the need for determining the psychometric properties of the 12-item EHFSBS compared to 9-item EHFSBS when used in the United States. We fulfilled this need by examining the internal consistency reliability (Cronbach's alpha and item analysis) and the construct validity (exploratory factor analysis and hypothesis testing) for the two versions in a sample of 105 patients with HF. Although Cronbach's alpha of the 12-item EHFSBS demonstrated a good internal consistency of reliability, item analysis indicated questionable homogeneity of

the scale. The hypothesis testing results supported the construct validity of the 12-item EHFSBS; however, exploratory factor analysis (EFA) results partially supported the theoretical proposed dimensions of the scale. When the scale was developed,⁷⁰ the authors proposed that the scale consisted of three theoretical dimensions. In our study, EFA revealed four dimensions of the scale, with only one reliable dimension (consulting behavior). Conversely, the 9-item EHFSBS demonstrated a good internal consistency reliability with a greater homogeneity of the items compared to the 12-item EHFSBS. Construct validity was also supported for the 9-item EHFSBS by hypothesis testing. Results of the EFA revealed that the 9-item EHFSBS is consisted of three dimensions, indicating that closer dimensionality to the originally proposed dimensions compared to the 12-item EHFSBS. Therefore, the evidence supports using the 9-item EHFSBS to measure HF self-care in patients living in the United States. However, this scale still need validation in other population in the United States whose English is their second language.

In the third chapter, we addressed the need for a better understanding of how gender is associated with social support and daily sodium intake by conducting secondary data analysis of 217 patients with HF to determine the moderation role of gender on the association between social support and daily sodium intake. In this study, the interaction between gender and social support was not significant. Thus, gender did not moderate the association between social support and daily sodium intake. As previously reported, we found that female gender was associated with lower daily sodium intake. There was no association between perceived social support and daily sodium intake in this study. This

study expanded our understanding on the association between social support and low sodium intake in patients with HF and also provided recommendations for future research to examine the role of dietary social support on patients' adherence to LSD.

In the fourth chapter, we addressed the need for understanding the associations among gender, relationship type (spousal vs. non-spousal), relationship quality, and HF self-care by examining the moderation effect of gender and the type of the patient-family caregiver relationship on the association between relationship quality and HF self-care. Baseline data of an ongoing, longitudinal, and randomized-controlled trial of a patient-caregiver dyadic intervention program were used in the analysis, with a sample size of 105 patients with HF. Heart failure self-care was measured using the 9-item EHFSBS. Relationship quality was measured by the patient version of the Dyadic Relationship Scale, which consists of two subscales of relationship quality: positive dyadic interaction and negative dyadic strain. We found that positive dyadic interaction was significantly associated with better HF self-care, that is, HF self-care improved as the relationship demonstrated greater positive interaction. In this study, negative dyadic strain was not associated with HF self-care. We also found a significant interaction between gender and positive dyadic interaction and another significant interaction between relationship type and positive dyadic interaction. In female patients or those with a non-spousal relationship with their family caregivers, positive dyadic interaction was associated with better on HF self-care. There was no such association in male patients or those with a spousal relationship. In this study, gender and relationship type moderated the association between positive dyadic interaction and HF self-care. Therefore, our findings suggest that

developing interventions that include improving relationship quality to improve HF self-care are more likely to be useful for female patients or those with a non-spousal relationship with their caregivers.

3. Impact of Dissertation on the State of the Science

Achieving optimal self-care is essential for patients with HF to maintain physiological stability and to respond to signs and symptoms of HF exacerbation.¹⁴⁴ In addition, proper self-care was associated with better HF outcomes.^{11,12} Social support, relationship quality with their family caregivers, gender, and patient-caregiver relationship type (spousal or non-spousal) were reported to be associated with HF self-care behaviors.^{11,12,45,134} The results of this dissertation expanded our understanding of HF self-care in the following ways: 1) demonstrated that the 9-item EHFSBS is valid and reliable instrument and should be used to measure self-care behaviors in the United States, 2) highlighted the need for further validation for the EHFSBS in different population with English as second language, 3) found that gender did not moderate the association between social support and daily sodium intake in patients with HF, 4) provided evidence that positive interaction between patients and their family caregiver was associated with better HF self-care, and 5) demonstrated that gender and relationship type (spousal vs. non-spousal) moderated the association between positive dyadic interaction and HF self-care.

In Chapter Two, the 9-item EHFSBS demonstrated better psychometric properties compared to the 12-item EHFSBS. Although these findings are consistent with previous findings from other Europe countries,⁷¹ this was the first study to provide

evidence of the 12-item EHFSBS in comparison to the 9-item EHFSBS in the United States. Both the 12-item EHFSBS and 9-item EHFSBS demonstrated to be valid and reliable to measure HF self-care in the United States. However, the 9-item EHFSBS was more homogenous and demonstrated closer factorial structure to the originally proposed dimensions compared to the 12-item EHFSBS. These findings were consistent with previous findings of examining the German, Greek and the Italian versions of the scale.^{76,78,88} In Chapter Two, I advanced the state of the science of HF self-care by demonstrating substantial evidence of the validity and reliability of the 12-item EHFSBS and 9-item EHFSBS in the United States. The evidence supports the use of the 9-item EHFSBS to measure self-care in patients with HF.

In Chapter Three, we examined the associations among gender, social support, and daily sodium intake in patients with HF. This study was the first study to determine whether gender moderates the association between social support and daily sodium intake. Findings of this study demonstrated that gender did not moderate the association between social support and daily sodium intake. I advanced the state of science in HF self-care behaviors by demonstrating that perceiving general social support from social networks (family, friends, and significant others) may not be beneficial to adopt new lifestyle changes such as eating LSD. There should be congruence between the patient's need and the type of the social support.²¹ Therefore, our study suggests the need to examine social support directed towards specific actions or behaviors such as eating LSD. Thus, we recommend using specialized instruments to measure perceived social support specific to eating to eating LSD, such as the dietary social support scale,¹¹⁸ which

measures levels of perceived social support directed to individuals trying to improve their eating low fat and LSD,¹¹⁸ which will provide more understanding on the association between dietary social support and eating low sodium diet.¹¹⁸

The association between patient-caregiver relationship quality and HF self-care is still understudied. The study is the first to examine the moderation role of gender and relationship type (spousal vs. non-spousal) on the association between relationship quality and HF self-care. In this study, gender and relationship type moderated the association between positive dyadic interaction and HF-self-care; positive dyadic interaction was associated with better on HF self-care only in female patients or those with a non-spousal relationship with their family caregivers. The results of the study in Chapter Four expanded our understanding of the association between relationship quality and HF self-care, and how this association differs between males and females, and between patients with a spousal and non-spousal relationship with their family caregivers. Chapter Four demonstrates that developing interventions to improve relationship quality to improve HF self-care are more likely to be effective in female patients or those with a non-spousal relationship with their family caregivers.

4. Recommendations for nursing practice and research

Self-care is a modifiable factor that if appropriately achieved by patients with HF, will lead to improving HF outcomes, such as better quality of life, lower re-hospitalization rates and medical. Social support has desirable effects on HF outcomes, such as improving the quality of life and decreasing the risk of mortality. Also, social support was found to be associated with HF self-care behaviors. The quality of the

relationship between patients and their family caregivers is also a modifiable factor that is understudied in patients with HF but was found to have a significant impact on self-care in populations other than HF. The findings of this dissertation suggest many implications for nursing practice and future research.

First, based on findings from the first study in this dissertation, we recommend using the 9-item EHFSBS to measure HF self-care in the United States. Although both versions demonstrated to be valid and reliable, 9-item EHFSBS demonstrated more homogeneity and closer factorial structure to the originally proposed dimensions compared to the 12-item EHFSBS. In both versions of the EHFSBS, only the ‘consulting behavior’ subscale demonstrated to be reliable. Since the total score demonstrated to be valid and reliable, we recommend using the total score rather than using scores of the subscales. Future research is recommended to examine the sensitivity of the scale to interventions aimed to improve self-care behaviors in patients with HF.

Based on the findings of the third study, we recommend that future interventions aimed at HF self-care should include strategies for improving the quality of the relationship between patients and their family caregivers. Since relationship quality was associated with better HF self-care in female patients or patients with non-spousal relationship with their family caregivers, scientists should take into consideration that female patients or those with non-spousal relationship with their family caregiver are more likely to benefit from interventions aiming to improve relationship quality in order to enhance HF self-care behaviors than male patients or those with spousal relationship with their caregivers. Last, future research is recommended to incorporate dyadic

approach to examine the association between relationship quality and HF self-care, and to determine the moderation role of partners' gender and the relationship type on that association, which will give researchers better understanding of the association between relationship quality and HF self-care.

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Curriculum Vitae
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Education

<u>Institution</u>	<u>Degree</u>	<u>Date Conferred</u>	<u>Field(s) of Study</u>
Hashemite University	BSN	2007, June	Nursing
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Professional Experience

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Awards and Honors

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Publications

Journal articles

Rababaah, A., Ghazawi, S., Odeh, J., & **Rababa, M.** (2011). Bochdalek's Hernia: A Rare Underlying Cause of Acute Gastric Volvulus in Adult Patient. *Middle East Journal of Internal Medicine*, 4(1).

Book chapters, Reports, Monographs, Protocols

Critical Care Manual for Nursing Students (January 2008).

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