

ILLNESS REPRESENTATIONS, TREATMENT BELIEFS, MEDICATION
ADHERENCE AND HOSPITAL READMISSION IN ELDERLY
INDIVIDUALS WITH CHRONIC HEART FAILURE

by

STEPHANIE TURRISE

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Dr. Charlotte Thomas-Hawkins

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ABSTRACT OF THE DISSERTATION

Illness Representations, Treatment Beliefs, Medication Adherence and Hospital

Readmission in Elderly Individuals with Chronic Heart Failure

By STEPHANIE TURRISE

Dissertation Director:
Dr. Charlotte Thomas-Hawkins

The purpose of this study was to investigate the relationships among illness representations, treatment beliefs, medication nonadherence, and hospital readmission in elderly individuals with chronic heart failure (HF). Theoretically derived antecedents to hospital readmission included illness identity, illness consequences, illness timeline, illness control, the difference between specific medication necessity and concern beliefs and medication adherence. The sample was comprised of 96 patients, discharged to home from a medical surgical or cardiac telemetry unit between August 2012 and March 2013. Data were collected during telephone surveys and from electronic medical record reviews. Hypotheses were tested using correlational and regression analyses. Significant correlations indicated that the belief that one has little to no personal control over their HF is significantly related to medication adherence, when medication necessity beliefs were stronger than medication concerns. Subjects were highly adherent to their medications, and individuals who did not believe their treatment was effective in controlling their HF were readmitted within 30 days of hospital discharge. In logistic regression analysis, necessity- concern differential remained a significant predictor of

medication adherence while personal control was not a significant predictor. This study contributed to the body of knowledge regarding factors related to 30-day hospital readmission in older individuals with chronic heart failure. Additional investigation is needed to further explore these relationships using objective measures of medication adherence and additional dimensions of illness representations, such as emotional factors.

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Table of Contents

Abstract	ii
Acknowledgments	iv
List of Tables	viii
List of Figures	ix
CHAPTER 1. THE PROBLEM	1
Antecedents to Hospital Readmission: Medication Adherence	6
Illness Representations and Medication Adherence	7
Treatment Beliefs and Medication Adherence	8
Medication Adherence as a Mediator	10
Statement of the Problem	11
Sub Problems	11
Definitions	13
Delimitations	15
Significance of the Study	16
CHAPTER 2. REVIEW OF THE LITERATURE	18
Theoretical Framework	18
The Common-Sense Model of Self-Regulation	18
Necessity-Concerns Framework	20
Literature Review	21
Illness Representations and Medication Adherence	21
Illness Representations and Illness Outcome	33
Treatment Beliefs and Medication Adherence	40
Treatment Beliefs and Illness Outcome	42
Medication Adherence as a Mediator	44
Hypotheses	46
CHAPTER 3. METHODS	51
Research Setting	51
Sampling Methods	52
Instruments	53
Brief Illness Perception Questionnaire	53
Beliefs about Medicines Questionnaire	57
Medication Adherence Report Scale	60

Hospital Readmission	61
Demographic Questionnaire	62
Procedure for Data Collection	62
Data Analysis	64
Human Subjects Protection.....	66
CHAPTER 4. DATA ANALYSIS	68
Demographics of Study Sample.....	68
Description of the Study Variables	70
Results of Hypothesis Testing	73
Hypotheses 1–4	74
Hypothesis 5.....	75
Hypotheses 6–9.....	76
Hypothesis 10.....	76
Hypotheses 11–15	77
Ancillary Findings	77
Tests of Moderation	81
CHAPTER 5. DISCUSSION OF THE FINDINGS	87
Illness Representations and Medication Adherence	87
Necessity-Concerns Differential and Medication Adherence.....	93
Illness Representations and 30-Day Hospital Readmission.....	94
Necessity-Concerns Differential and 30-Day Hospital Readmission.....	99
Adequacy of the CSM for Explaining Medication Adherence and Hospital Readmission in Older Adults with CHF.....	100
CHAPTER 6. SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS	101
Summary	101
Limitations	104
Conclusions and Implications for Nursing	105
Recommendations.....	107
REFERENCES	109
CURRICULUM VITAE.....	133

List of Tables

	Page
Table 1. Study Sample Demographic Characteristics.....	69
Table 2. Descriptive Statistics of the Study Variables.....	70
Table 3. Alpha Coefficients for Study Instruments	71
Table 4. Distribution of Scores for Study Variables	73
Table 5. Correlation Coefficients between Study Variables.....	73
Table 6. Odds of Personal Control and NCD Predicting Medication Adherence	78
Table 7. Moderating Effects of Years with CHF on Relationship between Illness Identity and Medication Adherence	82
Table 8. Moderating Effects of Depression on the Relationship between Personal Control and 30-Day Hospital Readmission.....	83
Table 9. Moderating Effects of Emotional Representations on the Relationship between Illness Consequences and 30-Day Hospital Readmission.....	85
Table 10. Moderating Effects of Illness Concern on the Relationship between Illness Identity and Medication Adherence	86

List of Figures

	Page
Figure 1. Correlates of medication adherence	48
Figure 2. Correlation of hospital readmission	48
Figure 3. Mediation Model A	48
Figure 4. Mediation Model B	49
Figure 5. Mediation Model C	49
Figure 6. Mediation Model D	49
Figure 7. Mediation Model E.....	49
Figure 8. Theoretical Model	50

CHAPTER 1. THE PROBLEM

Adherence to therapeutic treatment regimens is a necessary behavior in the management of chronic illness. According to a report by the World Health Organization (Sabaté, 2003), adherence to long-term therapies averages 50% in developed countries. In a recent survey of Medicare beneficiaries aged 65 and older in the United States, only 60% reported adherence to their medications during the past year (Wilson et al., 2007). In addition, it was observed that medication nonadherence linearly increased as the number of chronic conditions increased with just over half of individuals with three or more chronic conditions reporting nonadherence (Wilson et al., 2007). Since medication adherence is a potentially modifiable behavior, understanding the factors that affect adherence is critical in developing strategies that effectively increase adherence and thereby prevent negative outcomes. One possible negative outcome in the elderly who do not adhere to medication regimens is hospital readmission.

The rate of hospital readmissions has increased in the past few decades (Anderson & Steinberg, 1984; Tierney & Worth, 1995) and accounts for 50% of all hospital admissions (Weinberger, Oddone, & Henderson, 1996). Readmission is defined by the Oxford dictionary (2010) as admitting someone to a place or organization again. Hospital readmission then is defined as the return of an individual to any hospital setting as an inpatient after having been previously discharged or released from that level of care, but not necessarily the same institution (Merriam-Webster, 2009; Trigoboff, 1997). While increased readmission rates are not directly related to age, in the elderly, hospital readmission is a prevalent problem (Naylor et al., 2004). The most common diagnosis

for hospitalization and readmission in individuals over age 65 is heart failure (Fonarow, 2008; Proctor, Morrow-Howell, Li, & Dore, 2000).

Heart failure (HF) is a progressive condition that has become a significant public health problem and is one that increases as individuals age (Rosamond et al., 2008). HF is a syndrome that results from injury to the heart muscle and as a consequence of other cardiovascular diseases such as cardiomyopathy, valvular disorders and hypertension. A heart that is unable to maintain adequate blood supply to the tissues characterizes HF. According to the American Heart Association (2013), data based on the 2007-2010 National Health and Nutrition Examination Survey (NHANES) indicate that an estimated 5.1 million Americans suffer from this chronic condition. This has increased from 5 million in 2005.

Despite advances in the treatment of HF, there has been no improvement in mortality and hospital readmission among elderly patients with HF (Curtis et al., 2008; Kosiborod et al., 2006; Ross et al., 2010). In fact, in a study of elderly Medicare beneficiaries with HF conducted between 2001 and 2005, nearly 25% were readmitted within 30 days of their index hospitalization (Curtis et al., 2008). Over half of these were due to cardiovascular events with 25% due to heart failure (Curtis et al., 2008). Individuals with HF have periods of acute exacerbations that result in over 1 million hospital admissions annually (Rosamond et al., 2008). For example, researchers have reported that approximately 30% to 50% of patients with HF are readmitted within six months of hospitalization (Krumholz et al., 1997; Vinson, Rich, Sperry, Shah, & McNamara, 1990), and it is estimated that up to 50% of these readmissions can be prevented (Vinson et al., 1990). In a more recent study, Ghali and colleagues (2010)

studied 100 patients readmitted within 30 days of discharge for HF and found that factors such as no outpatient follow up (33%), diet noncompliance (21%), medication noncompliance (25%) and fluid noncompliance (22%) were the major contributors to readmission. In a recent systematic review examining hospital readmissions that are preventable, it was reported that the median proportion was 27.1% but ranged from 5% to 79% (van Walraven, Bennett, Jennings, Austin, & Forster, 2011). However, these findings were not specific to HF and suggest that due to notable deficits in study methodologies, the proportion of avoidable hospital readmissions is still unclear.

Heart failure is primarily a condition seen in persons older than 65 years of age (Kannel & Belanger, 1991) but the risk of cardiovascular disease increases with age. For males, risk begins to increase at age 45 and for women at age 55 (Thom et al., 2006). Approximately 80% of patients hospitalized for HF are older than 65 (Masoudi, Havranek, & Krumholz, 2002) and hospital readmissions for HF are more common in the elderly (Gooding and Jette, 1985; Krumholz et al., 1997; Vinson et al., 1990). Therefore, the widely recognized “aging of the population” not only contributes to the increasing incidence and prevalence of HF, but will likely underscore the prevalence of HF among elders and hospital readmissions for HF in this population as important public health issues in the coming years (O’Connell, 2000; Thomas & Rich, 2007). In addition, advances in the treatment of heart disease including HF, are allowing individuals to survive cardiac events and live longer, and live with HF longer. These factors have an additive effect to the aging of the population, making this a priority for health care professionals.

Heart failure treatment requires a complex treatment plan of dietary changes, medications and symptom monitoring. Based on the qualitative research, there are many challenges for individuals not only living with HF, but attempting to adhere to the regimen HF demands. For instance, one individual reported not really understanding, even with the swelling, that after being hospitalized, he would still need to continue the treatment. It was only after a long period of worsening symptoms that he understood the ongoing need for adherence, even when asymptomatic (Scotto, 2005).

Symptom recognition is crucial to being able to manage the disease and engage in self-care (Carlson, Riegel, & Moser, 2001). National Hospital Quality Measures have attempted to address this. For instance, teaching patients what to monitor for such as worsening symptoms and what to do, monitoring weight, diet, activity and medication are required elements of hospital discharge instructions. However, in the elderly where multiple co-morbidities are likely, symptoms can be attributed to illnesses other than HF (Carlson et al., 2001). In addition, confidence in the ability to treat symptoms was found to be low, which could result in a delay in seeking help until symptoms are clearly indicative of something serious (Carlson et al., 2001). Moreover, Winters (1999) described the uncertainty individuals with heart failure experience. For example, the individuals in this study had difficulty distinguishing between illness symptoms and changes that occur due to aging. Moreover, this uncertainty was observed not just in those with new onset of HF but also those with a long-standing history. Uncertainty also occurred when symptoms or treatments changed and/or information was incomplete (Winters, 1999).

Many antecedents to hospital readmission in patients with HF are identified in the empirical literature. In an integrative systematic review, Anderson and colleagues (2006) in their integrative systematic review identified many factors as antecedents to hospital readmission that included nonadherence to medications, inadequate knowledge about the disease, and patient misperceptions. Nonadherence to medications is problematic in this population as the cornerstone of treatment in HF includes a therapeutic regimen of medications (Evangelista & Dracup, 2000). Therefore, adherence to the treatment regimen, including medication prescriptions, is necessary to be effective.

Adherence to medical treatment remains a major clinical factor in the management of HF. Medication nonadherence rates of approximately 50% have been reported in samples of individuals on long-term medication regimens (Monane, Bohn, Gurwitz, Glynn, & Avorn, 1994). A study of medication adherence in 7247 elderly patients with HF by Monane and colleagues (1994) found that only 10% filled enough prescriptions to fulfill the prescribed amount of digoxin. A more recent study by Mockler and colleagues (2009) reported that in 183 patients with HF, 53 (29%) had an occurrence of nonadherence to their medications with approximately 33 (62%) of them experiencing nonadherence for a reason other than medical (i.e. adverse event, justified medical reason). Additionally, nonadherence was associated with increased hospitalization, clinical visits and increased levels of anxiety and depression.

The literature is clear on this point; pharmacological therapies improve survival, provide symptom relief and management and decrease the risk of morbidity and mortality (Quaglietti, Atwood, Ackerman, & Froelicher, 2000). Indeed a study by Frankel and colleagues (2006) found that beta-blocker therapy was a powerful predictor of survival in

patients with advanced heart failure. These findings are supported by evidence based treatment guidelines that give all pharmacological therapies, except for pneumonia and flu vaccination, a recommendation grade of A or B, whereas lifestyle and behavior modifications only earn recommendation grades of B and C (AHRQ Guidelines, 2007). These recommendations are made based on strength of evidence.

Antecedents to Hospital Readmission: Medication Adherence

Medication adherence is generally defined as the extent to which patients take their medications as prescribed by their health care providers (Osterberg & Blaschke, 2005). Medication nonadherence has been a concern of caregivers since the beginning of formalized medicine in the time of Hippocrates (Evangelista & Dracup, 2000; Osterberg & Blaschke, 2005) and remains an important problem due to its negative effect on health. Research has shown that nonadherence to medications in individuals with HF can result in increased risk of morbidity and mortality (Chin & Goldman, 1997; Hope, Wu, Tu, Young, & Murray, 2004; Li, Morrow-Howell & Proctor, 2004; Miura et al., 2001), increased numbers of emergency room visits for cardiovascular events (Hope et al., 2004) and worsening symptoms (Ghali, Kadakia, Cooper, & Ferlinz, 1988; Michalsen, Konig, & Thimme, 1998; Tsuyuki et al., 2001). Moreover, it has been well documented that medication nonadherence is related to hospital admission in individuals with HF (Cherrington, Lawson, & Clark, 2006; Ghali et al., 1988; Hope et al., 2004; Miura et al., 2001; Murray et al., 2009; Vinson et al., 1990). Two factors that may contribute to hospital readmissions in elderly individuals with HF through their effects on adherence are these individuals' beliefs about HF and its treatment (Leventhal, Brissette, & Leventhal, 2003).

Illness Representations and Medication Adherence

Many factors that contribute to medication nonadherence and, in turn, hospital readmission have been described. Illness representations and treatment beliefs are two factors known to contribute to poor illness self-management, often by promoting medication nonadherence, and thereby causing adverse health outcomes in persons with chronic illness (Leventhal et al., 2003; Leventhal & Cameron, 1987; Leventhal, Diefenbach, & Leventhal, 1992).

Illness representations refer to the product of a person's efforts to organize, analyze, and interpret diverse types of information about an illness and its symptoms. Illness representations are multifaceted and include its identity, timeline, cause, controllability, and consequences (Diefenbach & Leventhal, 1996). Illness identity is defined as one's experience of symptoms and associated diagnostic labels. Timeline indicates the individual's beliefs about the course of the illness, such as acute, chronic or cyclical, as well as the time factor associated with symptoms (i.e., the pain is intermittent). The cause dimension represents beliefs about the determinants of the illness or disease for example, a virus or genetics. Consequence is defined as the anticipated and experienced consequences of the illness and its treatment which may involve physical, emotional, social, and economic outcomes. The final dimension, control/cure, pertains to anticipated and perceived responsiveness of the condition to self-treatment and expert intervention (Diefenbach & Leventhal, 1996; Hagger & Orbell, 2003).

Studies in different chronic disease populations have indicated that illness representations predict an individual's engagement in a variety of health-related

behaviors (Griva, Myers, & Newman, 2000; Hampson, Glasgow, & Toobert, 1990; Hampson, Glasgow, & Zeiss, 1994; Petrie, Weinman, Sharpe, & Buckley, 1996). In particular, researchers have found that illness representations are both related to and predict medication adherence. For example, Jessop and Rutter (2003) explored the influence of cognitive and emotional representations on medication adherence in 330 individuals with asthma and found that the dimensions of control/cure, illness label, and cause predicted adherence. Another study examining illness beliefs and medication adherence in adults with asthma found that beliefs about disease chronicity (timeline) were associated with adherence (Halm, Mora, & Leventhal, 2006). Only one study explored illness representations and medication adherence in a sample of elderly patients with chronic heart failure. Findings indicated that perceptions of serious illness consequences predicted less medication adherence (Molloy et al., 2009). Based on theory and empirical findings, illness representations are one factor to consider when examining medication adherence in elderly individuals with HF.

Treatment Beliefs and Medication Adherence

Treatment beliefs are defined as the ideas an individual holds about their illness treatment, including its appropriateness. Beliefs about medication are also postulated as significant antecedents to medication adherence (Horne, 1997, 2003; Horne & Weinman, 1999, 2002). In one study, Horne and Weinman (1999) found that, in individuals with a chronic physical illness, medication beliefs more strongly predicted adherence than either clinical or demographic variables. Horne (2003) suggested that to more fully understand and explain medication adherence, it is necessary to consider an individual's treatment or medication beliefs.

Medication beliefs may focus on medications in general or those specifically prescribed for a particular illness (Horne, 1997, 2003; Horne, Weinman, & Hankins, 1999). Although medications prescribed for an illness may be viewed as necessary for personal health benefit, the individual also may have concerns about negative effects (Horne, 2003; Horne & Weinman, 2002; Horne et al., 1999). These necessity and concern medication beliefs may then influence an individual's decision to adhere, or not, to their prescribed treatment regimen (Horne & Weinman, 2002). For example, in a study of 250 individuals chronically taking prescribed medications, Phatak and Thomas (2006) found that specific concerns about medications were positively associated with nonadherence and medication-specific necessity was positively associated with adherence.

In addition, Horne and Weinman (1999) suggested that when individuals make decisions about adherence behaviors, they conduct a cost-benefit analysis by weighing necessity beliefs about medication benefits against concerns about side effects. If necessity outweighs concerns, individuals take their medications. If concerns outweigh necessity, individuals do not take their medications. The outcome of this process is known as the necessity-concerns differential. Horne and Weinman (1999) found that the necessity-concerns differential was a stronger predictor than necessity or concerns alone. Furthermore, Aikens, Nease, Nau, Klinkman, and Schwenk (2005) found that in patients with depression on maintenance antidepressant therapy, adherence was highest when necessity exceeded concerns and lowest when concerns exceeded necessity.

Medication Adherence as a Mediator

Theorists (e.g., Leventhal et al., 2003) posit that illness self-management behaviors such as medication adherence may mediate the relationships linking illness representations and treatment beliefs to illness outcomes. However, research that has tested the mediating role of illness self-management behaviors has revealed mediation in some studies (Fortune, Richards, Griffith, & Main, 2002; Heijmans, 1998; Scharloo et al., 1998) and not in others (Benyamini, Gozlan, & Kokia, 2004; Rutter & Rutter, 2002). The equivocal findings for the role of illness self-management behaviors as a mediator between illness representations, treatment beliefs, and health outcomes point to the need for more research in this area. In fact, no studies have examined the mediating effect of medication adherence on the relationship between illness representations and hospital readmission, or that of treatment beliefs and hospital readmission. Furthermore, research findings have suggested that illness representations are better predictors of health outcomes than illness self-management behaviors (Heijmans, 1998; Weinman, Petrie, Moss-Morris, & Horne, 1996; Orbell, Johnston, Rowley, Espley, & Davey, 1998; Vaughn, Morrison & Miller, 2003). In addition, no studies have examined the illness outcome of hospital readmission (Heijmans, 1998; Moss-Morris, Weinman, & Petrie, 1996; Orbell et al., 1998; Scharloo et al., 1998) or conducted a study with a sample of patients with chronic HF guided by the Common-Sense Model (CSM) of Self-Regulation that examines these relationships. Therefore, there is a need to examine the relationships among illness representations, treatment beliefs, medication adherence, and hospital readmission in individuals with chronic HF. This study will address these gaps in

knowledge and build on previous researchers work examining hospital readmission in the elderly (Naylor et al., 2004).

In summary, medication nonadherence in elderly individuals with chronic HF may be a function of both illness representations (Leventhal et al., 1992; Meyer, Leventhal, & Gutmann, 1985; Petrie et al., 1996) and treatment beliefs (Horne & Weinman, 1999, 2002) which, in turn, may affect hospital readmission in this population. The purpose of this study is to examine the relationships among illness representations, treatment beliefs, medication adherence, and hospital readmission in elderly individuals with chronic HF.

Statement of the Problem

What are the relationships among illness representations, treatment beliefs, medication adherence, and hospital readmission in older adults with chronic heart failure?

Sub Problems

1. What is the relationship between the necessity-concern treatment beliefs differential and medication adherence in older adults with chronic heart failure?
2. What is the relationship between illness timeline and medication adherence in older adults with chronic heart failure?
3. What is the relationship between illness control and medication adherence in older adults with chronic heart failure?
4. What is the relationship between illness consequences and medication adherence in older adults with chronic heart failure?

5. What is the relationship between illness identity and medication adherence in older adults with chronic heart failure?
6. What is the relationship between illness cause and medication adherence in older adults with chronic heart failure?
7. What is the relationship between illness timeline and hospital readmission in older adults with chronic heart failure?
8. What is the relationship between illness control and hospital readmission in older adults with chronic heart failure?
9. What is the relationship between illness consequences and hospital readmission in older adults with chronic heart failure?
10. What is the relationship between illness identity and hospital readmission in older adults with chronic heart failure?
11. What is the relationship between illness cause and hospital readmission in older adults with chronic heart failure?
12. What is the relationship between medication adherence and hospital readmission in older adults with chronic heart failure?
13. Does medication adherence mediate the relationship between illness timeline and hospital readmission in older adults with chronic heart failure?
14. Does medication adherence mediate the relationship between illness control and hospital readmission in older adults with chronic heart failure?
15. Does medication adherence mediate the relationship between illness consequences and hospital readmission in older adults with chronic heart failure?

16. Does medication adherence mediate the relationship between illness identity and hospital readmission in older adults with chronic heart failure?
17. Does medication adherence mediate the relationship between illness cause and hospital readmission in older adults with chronic heart failure?
18. Does medication adherence mediate the relationship between necessity-concern treatment beliefs differential and hospital readmission in older adults with chronic heart failure?

Definitions

Hospital readmission is theoretically defined as the return of an individual to any hospital setting as an inpatient after having been previously discharged or released from that level of care, but not necessarily the same institution (Merriam-Webster, 2009; Trigoboff, 1997). Readmission is operationally defined as the number of unplanned inpatient hospital admissions for a heart failure related cause or heart failure exacerbation over a one-month period.

Coping procedures are theoretically defined as action plans that are the activities individuals utilize to reduce illness threat to their health (Leventhal et al., 2003). In this study, the activity of concern is medication adherence. Medication adherence is theoretically defined as the extent or degree to which a person's medication taking behavior corresponds with agreed recommendations from a health care provider (Sabate, 2003). Medication adherence is operationalized as 1) a subject's score on the Medication Adherence Report Scale (MARS; Ediger et al., 2007; Mardby, Akerlind, & Jorgenson, 2007; Menckeberg et al., 2008).

Illness representations are theoretically defined as the person's efforts to organize, analyze, and interpret diverse types of information about an illness and its symptoms including its identity, timeline, cause, controllability and consequences (Leventhal, Breland, Mora, & Leventhal, 2010).

Controllability is theoretically defined as an individual's understanding of the threat and their perception of the susceptibility of that threat to control (Leventhal et al., 2010).

Timeline is the rate of onset of the health threat, its duration and time trajectory such as whether the threat is acute, chronic or cyclic (Leventhal et al., 2003, 2010).

Consequences are theoretically defined as the imagined or anticipated repercussions of the health threat; how the illness will affect the person's life including the physical, psychological, social and economic domains (Leventhal et al., 2003, 2010).

Identity is theoretically defined as what the illness threat is called, a statement that represents the threat and how it is experienced, which includes symptoms and functional changes an individual identifies in oneself (Leventhal et al., 2003, 2010).

Illness cause is defined as perceived contact with something that caused the illness such as a pathogen, stress, age, etc. (Leventhal et al., 2003, 2010).

Illness representation dimensions are operationalized as the subject's score on the respective items on the Brief Illness Perception Questionnaire (Brief IPQ; Broadbent, Petrie, Main, & Weinman, 2006).

Treatment beliefs are theoretically defined as the individual's beliefs about whether the illness warrants treatment and if so, if that treatment is appropriate (Horne, 1997, 2000, 2003). Treatment beliefs have two dimensions and include beliefs about

medicines in general and those specifically prescribed for an illness. The specific dimension is comprised of treatment concerns and treatment necessity. Treatment concerns are theoretically defined as worries that an individual has about the negative aspects of taking the medication such as side effects (Horne, 1997, 2000, 2003; Horne et al., 1999). Treatment necessity is the feeling that taking the medications is necessary to maintain health or treat symptoms (Horne, 1997, 2000, 2003; Horne et al., 1999). Treatment concerns and treatment necessity is operationalized as a score on the Beliefs about Medicines Questionnaire (BMQ; Horne et al., 1999).

Necessity-concern differential is theoretically defined as a cost-benefit assessment of personal beliefs about the necessity of medications to maintain or improve health weighed against concerns regarding the adverse effects of taking the medications (Horne & Weinman, 1999). Necessity-concerns differential will be operationalized as a calculated difference between the necessity scale score and the concerns scale score. Positive necessity-concerns differential scores indicate that the patient perceives benefits outweigh the cost, whereas negative scores indicate that there is a greater cost than benefit (Horne & Weinman, 1999).

Older adults are defined as those individuals aged 55 or older, as the term young-old refers to individuals as young as age 55 (Administration on Aging, 2009; Mosby, 2009; World Health Organization, 2009). Older adult will be operationally defined as an individual's self-reported age in years.

Delimitations

According to the literature, HF is more prevalent in those individuals who are 65 years of age and older, and they are the individuals in the U.S. population who experience

the highest rates of hospital readmission (Fonarow, 2008; Gooding & Jette, 1985; Krumholz et al., 1997; Proctor et al., 2000; Vinson et al., 1990). However, the risk of cardiovascular disease begins to increase with age, for men beginning at age 45 and women at age 55 (Thom et al., 2006). In addition, the pathology of HF and its subsequent impairment of perfusion as well as age related changes in cognitive functioning may affect an individual's ability to remember to take medications. Moreover, individuals discharged to nursing care facilities are given their medications by nursing staff. Therefore, the sample in this study will be limited to subjects with a medical diagnosis of heart failure, 55 years of age and older, without cognitive impairment as measured by the Short Blessed Test (Katzman et al., 1983) that are being cared for or live at home.

Significance of the Study

Hospital readmission is a concern for direct care providers, administrators, and policy makers involved in the care of people with HF due to the consequences that include a significant financial burden on the health care system (O'Connell, 2000). Currently in the U.S., efforts are underway to reform healthcare policy, and decreasing hospital readmissions is a major focus for the proposed changes because of the potential cost savings (Harris, 2009). HF is one of the five diagnoses responsible for 20% of the national health care costs, and is one of the most expensive conditions billed to Medicare (Andrews, 2008). In addition, HF was the most common reason for potentially preventable hospital admissions accounting for almost a third of total hospital costs for all preventable hospital admissions (Jiang, Russo, & Barrett, 2009).

Beyond the financial costs of hospital readmission in HF, there are personal costs to the individuals, families and caregivers dealing with the condition. Hospital

readmission negatively affects patients' quality of life (Candlish, Watts, Redman, Whyte, & Lowe, 1998). For instance, Candlish and colleagues (1998) assessed quality of life at baseline, three, six and twelve months in patients with HF. When comparing the group of patients who had hospital readmission to those who did not, there was a statistically significant difference ($p = 0.007$) at the twelve month follow-up. In a Canadian study of patients with a first hospitalization for HF where age, sex and major comorbidities were controlled for, it was found that mortality significantly increased after each hospitalization for HF (Setoguchi, Stevenson, & Schneeweiss, 2007). Additionally, Hodges (2009) in a mixed method study found that in a group of elderly patients with HF, as the numbers of hospital readmissions increased, individuals reported greater difficulty in managing their HF symptoms. For caregivers, frequent hospitalizations were associated with an increase in caregiver burden (Molloy, Johnston, & Witham, 2005).

In summary, the problem of hospital readmission in people with HF has broad personal and societal consequences. Findings from this study can be used to expand nursing knowledge about factors that affect medication adherence in elders with HF, and develop and test strategies designed to address modifiable psychosocial antecedents to medication adherence with the ultimate goal of decreasing hospital readmission in this vulnerable population.

CHAPTER 2. REVIEW OF THE LITERATURE

This chapter will examine theoretical and empirical literature as it relates to the determinants of medication nonadherence and hospital readmission in elderly adults with chronic heart failure. Specific determinants consist of constructs from the Common-Sense Model of Self-Regulation (CSM) and include illness identity, illness timeline, illness cause, illness control, and illness consequences. In addition, the determinant of treatment beliefs that include the construct of the necessity-concern differential (NCD) will be considered. The first section presents a discussion of the theoretical frameworks that will guide the study including the CSM and the Necessity-Concerns Framework. Secondly, a review of empirical literature that examines the relationships among the theory concepts to be tested in this study is presented. Lastly, gaps in the empirical literature are identified, the theoretical rationales for the research questions are summarized, and the study hypotheses are outlined.

Theoretical Framework

The Common-Sense Model of Self-Regulation

Leventhal, Meyer, and Nerenz (1980) originally proposed the Common Sense Model of Self-Regulation (CSM), a self-regulatory framework that was developed to describe the processes of health and illness behaviors (Leventhal et al., 2010). A basic assumption of the CSM is that individuals are active problem solvers when faced with an illness. The CSM is an information-processing model built on the proposition that individuals construct their own “common-sense” representations or lay models of an illness. According to the CSM, the individual is actively involved in (a) interpreting the meaning of his or her illness and its symptoms; (b) deciding how best to respond to these

experiences; (c) taking action; (d) evaluating the effectiveness of illness management strategies and (e) revising his or her understanding or the criteria for evaluating the effectiveness of illness management, thus entering successive cycles of self-regulation. This problem solving depends heavily on the individual's interpretation or representation of the illness. Illness representations, or lay models of illness, refer to a set of beliefs about an illness—whether medically sound or unsubstantiated—that guide the selection and execution of coping procedures, for illness self-management. Leventhal and colleagues (2003) define coping procedures as action plans that include activities individuals utilize to reduce the threat of illness to their health.

Research has consistently shown that illness representations can consist of up to five core dimensions (Lau, Bernard, & Hartman, 1989; Leventhal et al., 1980) including identity, timeline, consequences, causes, and controllability (Leventhal et al., 2010). Identity reflects the beliefs about what the threat is called and its associated symptoms. Timeline is defined as the individual's beliefs about the onset, duration, and trajectory of the illness or its symptoms such as acute, chronic, or cyclical in nature. The cause dimension represents beliefs about the cause of the illness or its symptoms. Consequences are the beliefs about the physical, emotional, social, and/or economic outcomes of the illness. The final dimension, controllability, refers to one's anticipated and perceived responsiveness to self-treatment and expert intervention (Leventhal et al., 2010).

Leventhal and colleagues (1980) link illness representations with self-regulative behaviors or coping procedures. That is, a person's representation of an illness guides the selection and execution of strategies (coping procedures) to manage the problem

(Leventhal et al., 1992). Another premise of the CSM is that illness representations influence health outcomes (Leventhal, Leventhal, & Cameron, 2001). A key CSM proposition that guides this study is that illness representations, by directing coping procedures such as medication adherence, have an important influence on health outcomes such as hospital readmission (Leventhal et al., 2001). See Figure 7 for a diagram of these relationships.

Necessity-Concerns Framework

According to both theoretical and empirical literature, treatment adherence, a coping self-regulative procedure, is a function of both illness representations (Leventhal et al., 1992; Meyer et al., 1985; Petrie et al., 1996) and treatment beliefs (Horne & Weinman, 1999, 2002). Horne (1997) proposed an addition to Leventhal's self-regulatory model, the Necessity-Concerns Framework.

Horne (1997) stipulated that individuals are active problem solvers and have their own ideas about their illness and its treatment, or treatment beliefs. Treatment beliefs are based on an individual's perception of the necessity to take a prescribed treatment and concerns about doing so. The Necessity-Concerns Framework, as described by Horne, postulates that ill persons have ideas regarding the necessity of treatment and whether the prescribed treatment is appropriate or not. In particular, Horne and Weinman (1999) proposed that "adherence decisions are influenced by an interaction of personal beliefs about the *necessity* of the treatment for maintaining or improving health and *concerns* about the potential adverse effects of adhering to it" (p. 19). This weighing of the benefits and concerns of the treatment is essentially a cost-benefit analysis. Horne (1997) and Horne and Weinman (1999) referred to this as the necessity-concerns differential (NCD).

Furthermore, Horne (1997) suggested that a better understanding of the relationship between illness representations and treatment adherence may be uncovered by examining treatment beliefs.

In summary, Leventhal and colleagues (1980) proposed that illness representations influence self-regulative behaviors, that is, coping procedures, which in turn influence health outcomes. Horne (1997) proposed that treatment beliefs also influence self-regulative behaviors that in turn, influence health outcomes. See Figure 8 for a diagram of these theoretical relationships. These are the theoretical propositions that will be tested in the proposed study.

Literature Review

Illness Representations and Medication Adherence

In this section, empirical literature that investigates the relationship between the dimensions of illness representations and medication adherence is presented. Initially, the literature review was delimited to studies of populations with a chronic cardiovascular illness. However, since some relationships between several illness representation dimensions and medication adherence have not been studied in chronic cardiovascular disease, studies investigating other chronic illnesses such as asthma and diabetes were included because they also require medication adherence and lifestyle modifications. Thirteen studies met the criteria and will be included in this review.

One of the first studies to investigate the relationship between illness representations (IR) and treatment adherence, a coping procedure, was a study in which 230 individuals with hypertension (HTN) were interviewed at different stages of treatment and diagnosis (Meyer et al., 1985). This study aimed to determine factors that

affect medication nonadherence to treatment for HTN and to determine how participants' representations of HTN affected adherence behaviors. Four subject groups in this study were comprised of normotensive controls ($n = 50$); newly treated ($n = 65$) individuals being treated for the first time; continuing treatment ($n = 50$) subjects who had been in treatment for 3 months to 15 years; and reentry ($n = 65$) participants who had dropped out and then returned to treatment. Findings related to participants in the continuing treatment group were the focus of this published report because of the decreased likelihood of these persons dropping out of treatment. Meyer et al. (1985) reported that individuals who held the belief that variations in blood pressure caused symptoms were more compliant with the therapeutic regimen, which was defined as the absence of systematic misses of medication and adequacy of blood pressure control. Additionally, findings revealed that a chronic timeline representation was a significant factor for medication adherence in those in the continuing treatment group and for subjects in the newly treated group who were making decisions about dropping out of, or remaining in treatment. In the continuing treatment group, those individuals who believed that their illness timeline was chronic were less likely to report systematic misses of medication taking than those that held an acute and/or cyclic timeline view ($\chi^2=4.50$, df 1, $p<.05$). However, there was no relationship between timeline representation and the "as prescribed" or "random misses" categories of adherence. The researchers concluded that this negative finding may have been due to the small sample size of the continuing treatment group. Therefore, although study findings suggest a relationship between timeline representation and medication adherence, the small sample size in this study yielded limited evidence for this relationship.

In contrast, timeline representation was found to be the only IR dimension related to higher medication adherence in a study by Byrne, Walsh, and Murphy (2005). This study examined the extent to which IR and beliefs about medications explained the performance of secondary preventive behaviors related to smoking, diet, exercise, alcohol consumption, and medication adherence in 1,084 persons with coronary heart disease recruited from a stratified, random selection of general medical practices. Results indicated that a belief that one's illness timeline was chronic significantly and independently predicted better medication adherence ($\beta = -0.10$, $P < 0.05$). However, when all the IR dimensions were taken together, they were weak predictors, accounting for only 1% of the variance in adherence scores. The authors suggested that this may be due to the asymptomatic nature of CHD and this sample's low level of illness identity.

Illness identity has been shown to be related to medication adherence but with limited exploration in cardiac samples. For instance, Byer and Myers (2000) studied the relationship of IR, beliefs about medicines and medication adherence in 64 patients with asthma. Medication adherence was operationalized as the number of preventer inhaler prescriptions, number of reliever inhaler prescriptions, and a self-report measure. Results indicated that illness identity (symptoms) was correlated with self-reported adherence ($r = 0.40$, $p < 0.01$) and explained seven percent of the variance (adjusted $R^2 = 0.228$, $\beta = 0.29$, $t = 2.20$, $p = 0.05$).

In a similar study, Jessop and Rutter (2003) investigated the role of IR to medication adherence in a sample of 330 individuals with asthma. Illness identity was operationalized according to the three subcomponents outlined by Leventhal: (a) Symptoms the individual experiences; (b) illness label, what the individual believes is

wrong or what they call the illness; and (c) monitoring, which refers to means the individual employs to check the status of their illness. Findings indicated that illness label significantly predicted adherence ($t(227) = 2.53, p < 0.05$). In other words, those individuals who labeled their illness as asthma were more likely to adhere to their medication.

Chen, Tsai, and Lee (2009) investigated the relationship between IR and three types of adherence in 277 Taiwanese individuals with HTN. Adherence was operationalized as a score on the Medication Adherence Inventory (MAI). The MAI has three subscales: (a) decreased type including decreased dosage, frequency and types of medication; (b) increased type where individuals added doses, frequency, and types of medication; and (c) unintentional type described as taking medication intermittently, drug holidays, deviations in timing or forgetting, and stopping medication. Identity in this study was operationalized as symptoms and symptom monitoring. Participants were provided a list of 32 symptoms and asked whether they were symptoms of HTN that they personally experienced. A higher identity score indicated more symptoms experienced. Symptom monitoring was measured by two items that asked whether they had experienced symptoms after the diagnosis of HTN and if they could predict high blood pressure through their symptoms. Findings indicated no relationship between identity and adherence and the authors suggested it may have been related to low mean identity scores. However, mean group differences in adherence and symptom monitoring were analyzed using ANOVA. Results showed significant differences by symptoms after diagnosis on decreased type of adherence ($F = 3.95, p = 0.02$) and increased type of adherence ($F = 3.64, p = 0.028$). In other words, individuals who reported more

symptoms and were uncertain about HTN as the source of symptoms, were more likely to be nonadherent to medications.

In a study of 93 individuals who had been invited to attend cardiac rehabilitation, Whitmarsh, Koutanji, and Sidell (2003) investigated IR, mood, and coping as predictors of attendance. Results indicate that identity (symptoms) was an independent predictor of attendance and that people who perceived fewer symptoms had poorer attendance or did not attend at all.

Molloy and colleagues (2009) investigated the relationship between IR and adherence to angiotensin converting enzyme inhibitors (ACEI) in 58 elderly (mean age 80.2 years) patients with chronic heart failure. Adherence was operationalized objectively as serum medication levels. Overall, 72% of participants were deemed adherent based on serum analyses. Using logistic regression, findings indicated that perceptions of serious illness consequences predicted less medication adherence (OR = 0.36, 95% CI (0.12 – 0.99), $p = 0.05$) and explained 10% of the variance. Similar findings were reported by Horne and Weinman (1999) in a sample of patients on hemodialysis where more severe consequences of the illness was associated with less medication adherence and in another study by Horne and Weinman (2002) in a sample of patients with asthma on preventer medications. These findings are surprising since they seem counterintuitive to the premise that one will adhere to treatment for an illness that is perceived as serious. One explanation is that there may be little to no coherence between the message by the health care provider, “take your medicine it will make you better” and the way individuals feel, not better, but worse when they comply (Horne, 1997). In addition, acute timeline representations approached significance in this study (OR = 0.40,

95% CI (0.15- 1.00), $p = 0.06$) and explained 11% of the variance in medication adherence (Molloy et al., 2009). When both variables were entered into the multivariate analysis, they were good predictors of adherence and explained 19% of the variance. In addition, with each 1-point increase in the timeline and consequence representation scores, subjects were 2.5 and 2.6 times less likely to adhere to medication, respectively. These findings suggest that individuals who believe their illness is chronic and perceive more consequences of their illness are less likely to adhere to medication treatment. These findings contradict the reports of other researchers (Brewer, Chapman, Brownlee, & Leventhal, 2002; Byrne et al., 2005; Chen et al., 2009; Meyer et al., 1985), who found increased levels of adherence in relation to chronic timeline and serious consequence representations. It is important to note however, that the authors suggest that due to small sample size there was not sufficient power to utilize large multivariate models and control for other predictors of adherence. Moreover, they state further research should examine beliefs about medications, which may be a more proximal predictor of medication adherence and the interaction between beliefs about medications and illness. The current study will address this gap.

Diabetes mellitus is another chronic illness that necessitates multiple lifestyle changes similar to those required in HF such as long-term use of prescribed medications. Griva et al. (2000) conducted a cross sectional investigation of IR and their relationship to treatment adherence (insulin, diet, exercise and blood glucose monitoring) in 64 adolescents and young adults aged 15-25 with insulin dependent diabetes mellitus. Findings revealed that control representations were consistently related to self-reported adherence to all aspects of treatment. On the other hand, poor adherers to diet, exercise,

blood glucose monitoring and insulin believed less strongly that their illness was controllable. In addition, the variable that best accounted for overall adherence after controlling for age and duration of diabetes was the control dimension ($\beta = 4.313$, $t = 6.462$, $p < 0.001$, $R^2 = 0.391$), which accounted for 39% of the variance.

Senior, Marteau, and Weinman (2004) reported similar findings in a cross sectional study of 336 adults with familial hypercholesterolemia (FH) that examined relationships among demographic and clinical factors, IR, and medication adherence. Participants responded to questionnaires that measured self-reported adherence to cholesterol lowering therapy, levels of anxiety and depression, and representations of heart disease. Despite a high mean score of self-reported adherence (4.71, range 1.8 to 5.0, possible range 1.0 - 5.0), there were significant differences in the control dimension between the partially adherent group and the totally adherent group. All participants in the total adherence group ($n=104$) responded “never” to all five items on the Medication Adherence Report Scale (MARS) when compared to participants in the partial adherence group ($n = 180$) who responded other than “never” on at least one item. The total adherence group perceived greater control over their illness (T value = 2.67, $p < 0.01$). In addition, using hierarchical logistic regression, control representations, causal attributes of genetics and cholesterol, and perceived risk of high cholesterol made a significant contribution to the prediction of medication adherence above those of demographic and clinical factors ($\chi^2 (4) = 12.58$, $p < .05$). In summary, individuals in the total adherence group perceived more control over their illness, and IR were important in predicting adherence beyond clinical and demographic factors.

In a similar study, Brewer et al. (2002) examined the relationships among cholesterol control, medication adherence, and IR in 169 hypercholesterolemic patients. The only dimension that predicted adherence in this study was consequences ($\beta(140) = .28, p < .05$). That is, individuals who believed that high cholesterol had serious consequences, such as heart attack and stroke, reported better adherence. For instance, when the consequences scores were divided at the median to form low and high beliefs groups and adherence for each group was examined, participants low in consequence beliefs had adherence of 62% while those with high consequence beliefs were 76% adherent.

Ross, Walker, and MacLeod (2004) conducted a cross sectional study of the role of IR and treatment beliefs to adherence in a sample of 514 persons with HTN. Reported adherence was high, and only 22% of the sample ($n = 112$) was classified as either medium or low adherers. Multivariate analysis indicated that individuals who believed consequences of HTN were not serious had higher levels of adherence [mean difference = 0.18, 95% CI (0.05-0.31), $p = 0.009$]. The authors suggest that this perplexing finding may be due to an interaction of emotional and consequence representations that led to maladaptive coping and was manifested as poor adherence. Personal control, an individual's belief that he or she, personally, has the ability to control the illness and treatment control, one's belief about the efficacy of medical treatment to control or cure the illness (Hagger & Orbell, 2003; Horne, 1997; Moss-Morris et al., 2002) were both examined in this study. A counterintuitive finding was that participants with lower personal control beliefs reported higher levels of adherence [mean difference = 0.28, (0.14-0.42), $p < 0.001$]. The researchers concluded that participants viewed cure and

personal control as two different entities and proposed that even though individuals did not feel they had personal control over their HTN, they still took the medications because they believed that treatment would cure their illness. Additionally, subjects with high treatment control beliefs also reported high levels of adherence [mean difference 0.16, (0.03-0.28), $p = 0.015$]. In multivariate analysis, the IR dimensions that independently predicted adherence were emotional response to illness (OR = 0.65, 95% CI (0.47-0.90), $p = 0.008$) and personal control beliefs (OR = 0.59, 95% CI (0.40-0.89), $p = 0.012$). Interestingly, the sample, in general, believed that HTN is a chronic condition that could be controlled but did not believe it had serious consequences. This is consistent with the theory that individuals may hold different representations than health care professionals. Furthermore, not only are there contradictions in the literature about the role that the control dimension plays in adherence, there appears to be some variation in the way in which the control dimension is analyzed, with some researchers reporting control total score while others report treatment and personal control separately. In addition, there was some suggestion by Senior et al. (2004) and Ross et al. (2004) that subjects view control and cure as two separate dimensions, based on results that seemed counterintuitive as well as contradictory to the theory propositions.

Finally, Chen et al. (2009) investigated the relationship between IR and three types of adherence in 277 Taiwanese individuals with HTN. Findings revealed that treatment control was significantly related to total ($r = 0.20$, $p < 0.001$), increased ($r = 0.17$, $p < 0.01$), decreased ($r = 0.17$, $p < 0.05$) and unintentional ($r = 0.18$, $p < 0.01$) adherence. Personal control was significantly related to total ($r = 0.14$, $p < 0.05$), increased ($r = 0.12$, $p < 0.05$) and unintentional ($r = 0.12$, $p < 0.05$) but not decreased

adherence. Cyclical timeline was significantly related to total ($r = -0.20, p < 0.001$), increased ($r = -0.15, p < 0.05$), decreased ($r = -0.17, p < 0.01$) and unintentional ($r = -0.18, p < 0.01$) adherence. In other words, people who believed more strongly their illness was cyclical, were more likely to be nonadherent, including decreasing frequency and types of medication, adding dosages, taking medications intermittently and deviating from the prescribed timing. Lastly, consequence representations was significantly related to total adherence ($r = -0.12, p < 0.05$), meaning that those who felt there were more serious consequences to their illness were more likely to adhere. In addition, hierarchical regression analysis revealed that individuals who believed that treatment would control their illness were more likely to adhere than those who did not (OR = 1.30, 95% CI (1.04-1.61), $p = 0.017$) and treatment control was a significant predictor of adherence. Of note, illness consequence representations dropped out of the model in regression.

The cause dimension of IR has been correlated with medication adherence in chronic illnesses. However, this dimension has been measured and analyzed in multiple ways. For instance, Byer and Myers (2000) found that external causes was negatively correlated with adherence to preventer inhalers as measured by the number of prescriptions ($r = 0.36, p < 0.05$). In other words, individuals that attributed the cause of asthma to external factors, were more adherent (Myers, personal communication as cited by Jessop and Rutter, 2003). Additionally, external cause was a significant predictor of number of preventer inhaler prescriptions and explained 6.3% of the variance.

On the other hand, contrary findings were reported by Jessop and Rutter (2003). Causes were categorized as internal or external in their study of medication adherence in asthmatics. Results indicated that external causes did predict adherence ($t(227) = -2.04, p$

< 0.05). In other words, individuals that believed the cause of their asthma was external to them (i.e., a germ or virus, pollution, work environment, previous chest illness, anesthesia, chance, other people or poor medical care) were less likely to adhere to their medication.

Likewise, Barnes, Moss-Morris, and Kaufusi (2004) examined the relationship of IR to adherence to self-care regimens, including medications, in 113 patients with diabetes. Findings indicated that nonadherence to medications was related to the belief that diabetes was caused by environmental pollution ($r_s = -0.33, p < 0.01$), God's will ($r_s = -.40, p < 0.001$) and poor medical care in the past ($r_s = -0.29, p < 0.05$).

Senior and colleagues (2004) in their study of adherence to cholesterol lowering medication in 336 patients with familial hypercholesterolemia, found that attributing cause of disease to genes was significantly ($\beta = .28, p < .05$) associated with medication adherence.

In summary, the empirical research reviewed in individuals with a chronic illness, including some with a cardiac diagnosis, demonstrates conflicting findings about the relationship between the dimensions of cure/control, timeline, and consequences to treatment adherence. Eight studies were reviewed that examined relationships between IR dimensions and adherence in individuals with chronic illness. Of these, two studies demonstrated a significant relationship between chronic illness timeline representations and adherence (Byrne et al., 2005; Meyer et al., 1985). In contrast, findings from a third study revealed that a chronic illness timeline representation was associated with nonadherence to treatment (Molloy et al., 2009). A fourth study indicated that a belief that the illness (hypertension) was cyclical was associated with nonadherence to

treatment (Chen et al., 2009). Four studies revealed significant relationships between consequence representations and adherence in samples with a cardiac diagnosis, but the findings across these studies were not consistent. More serious consequence representations were associated with medication adherence in two studies (Brewer et al., 2002; Chen et al., 2009). In contrast, Molloy and colleagues (2009) found that individuals who believed there were more serious illness consequences were less adherent. Similarly, another study found that less serious consequences was associated with higher adherence (Ross et al., 2004). Two of the four studies operationalized control as one dimension and reported that individuals who felt more control over their illness were more adherent (Griva et al., 2000; Senior et al., 2004). Two additional studies measured personal and treatment control dimensions. Findings were mixed with one study reporting lower personal control was associated with higher adherence (Ross et al., 2004) while another reported higher personal control was associated with adherence (Chen et al., 2009). However, both found that higher treatment control was associated with higher adherence (Chen et al., 2009; Ross et al., 2004).

Some of the possible confounders that could explain the inconsistencies include small sample sizes, such as Molloy and colleagues' (2009) study in a similar sample, elderly patients with chronic HF with an *n* of only 58. Four studies reviewed found a relationship between cause and medication adherence. However, results are difficult to compare across studies due to differences in the way cause was operationalized. For instance, some researchers dichotomized into internal and external causes (Byer & Myers, 2000; Jessop & Rutter, 2003) while others analyzed single attributions (Barnes et al., 2004; Senior et al., 2004). Researchers that dichotomized the cause dimension in

samples with the same illness reported contrary findings. In studies analyzing single attributes, different causes were associated with adherence. However, due to the differences in the study samples, such as type of chronic illness, this is not an unusual finding. Five studies reviewed found a relationship between illness identity and adherence. However, results are mixed. Three studies found that more symptoms was associated with better adherence (Byer & Myers, 2000; Meyer et al., 1985; Whitmarsh et al., 2003) while one study reported more symptoms was associated with nonadherence (Chen et al., 2009). In another study, no relationship was found between symptoms and adherence but rather between illness label and adherence (Jessop & Rutter, 2003).

Accordingly, the gap to be addressed in the proposed study is the limited amount of information available in individuals with chronic heart failure; only one study in a CHF population was found, and the findings conflicted with other studies. In addition, that study did not examine the relationship of illness representations to health outcome or the relationship of illness representations through medication adherence to outcomes.

Illness Representations and Illness Outcome

In this section, empirical literature that investigates the relationship between the dimensions of illness representations and illness outcome is presented. The literature review was delimited to studies of populations with a chronic cardiovascular illness. Due to the small number of studies (four) found in this population, studies investigating other chronic illnesses such as asthma and diabetes were included. A total of seven studies met the criteria and will be included in this review.

According to Leventhal et al. (1980) illness representations influence health and illness outcomes. Few researchers have examined the relationship between IR and illness

outcome. Moreover, only a few have been conducted with participants who have heart diseases, none of which were heart failure.

Petrie et al. (1996) investigated the relationship between IR and return to work, cardiac rehabilitation attendance, disability, and sexual dysfunction in a sample of 143 patients, 65 years and younger that had their first myocardial infarction (MI). Return to work within six weeks was predicted by beliefs that their illness timeline was short ($t = -2.52, p = 0.01$) and that consequences were less serious ($t = -2.87, p = 0.005$). Moreover, consequence representations explained variance in multiple dimensions of disability over time including social interaction at six months (12%), recreation at three months (5%) and six months (11%) and home management at three months (8%) and six months (6%). In addition to consequences, cure/control representations explained an additional 4% of the variance in home management disability at three months.

In another study, Lau-Walker, Cowie, and Roughton (2009) investigated the relationship between IR dimensions and health related quality of life (HRQOL) after hospital discharge over a three-year period in 253 individuals with heart disease. Illness representations were measured at discharge and at nine months post discharge while HRQOL was measured at three years post discharge. One-half of the participants had a diagnosis of MI while the other half had unstable angina. Univariate analysis revealed that individuals who believed their condition was controllable at discharge [$\beta = 6.64$, 95% CI (3.34, 9.93), $p < 0.001$] and at nine months [$\beta = 7.84$, 95% CI (5.19, 10.49), $p < 0.001$] reported higher physical HRQOL three years later. This was also true in the multivariate analysis that revealed that stronger cure/control beliefs at baseline [$\beta = 4.07$, 95% CI (1.34, 6.8), $p = 0.004$] and nine months post-discharge [$\beta = 3.69$, 95% CI (1.45,

5.94), $p = 0.001$] predicted higher physical HRQOL at three years. Furthermore, cure/control was also significantly associated with mental HRQOL at baseline [$\beta = 3.64$, 95% CI (0.52, 6.76), $p = 0.023$] and nine months post discharge [$\beta = 4.78$, 95% CI (2.13, 7.42), $p < 0.001$] on univariate analysis but was only significant at time two in multivariate analysis [$\beta = 3.14$, 95% CI (0.67, 5.62), $p = 0.013$]. These findings indicate that individuals who feel that their condition is controllable are more likely to have high levels of physical and mental HRQOL.

Brewer et al. (2002) investigated the relationship of IR to cholesterol control, an illness outcome. These researchers found that consequence ($\beta = 0.23$, $p < .005$), identity ($\beta = -0.16$, $p < .05$) and timeline representations ($\beta = -0.17$, $p < .05$) were significantly related to low-density lipoprotein (LDL) cholesterol levels. That is, participants who believed that high LDL cholesterol increased their risk of having a heart attack or stroke (consequence representations) had better LDL cholesterol control. Regarding timeline, those participants who believed cholesterol levels were stable over time had better LDL control than those who believed levels fluctuated or were more cyclical. For identity, participants who believed that high cholesterol caused symptoms such as fatigue and tiredness, had worse LDL cholesterol.

In a more recent study, Hekler and colleagues (2008) investigated the relationships of illness representations, behaviors and hypertension control in a group of African American outpatients. In addition, the researchers hypothesized that commonsense beliefs are associated with blood pressure and statistically mediated by medication adherence. Results demonstrate an association between a medical belief model (hypertension is caused and controlled by factors such as diet, age and weight) and

lower systolic blood pressure that is mediated by lifestyle behaviors, such as exercise and cutting down on salt consumption. Medication adherence was not found to be associated with systolic or diastolic blood pressure. The findings of this study are still significant in that they support the idea of mediation, demonstrating the link between commonsense beliefs and illness outcome through lifestyle behavior changes.

As discussed earlier, Griva et al. (2000) conducted a cross sectional investigation of IR and their relationship to treatment adherence and metabolic control in 64 adolescents and young adults with insulin dependent diabetes mellitus. Results indicated that better metabolic control as measured by lower glycosylated hemoglobin (HgbA1c) levels was significantly related to fewer symptoms ($r = 0.31, p < 0.01$). Additionally, using hierarchical multiple regression, diabetes and generalized self-efficacy expectancies and consequences and identity representations accounted for 46.5% of the variance in HgbA1c.

Another study by Vaughan, Morrison, and Miller (2003) investigated the relationship of IR to outcome, which included illness intrusiveness, activities of daily living, anxiety and depression, and self-esteem in 99 individuals with multiple sclerosis (MS). Findings included that strong illness identity was associated with higher levels of illness intrusiveness ($r = 0.46, p < 0.001$), depression ($r = 0.40, p < 0.001$), anxiety ($r = 0.37, p < 0.001$) and greater impairment in physical functioning ($r = -0.30, p = 0.007$). Moreover, identity was a significant predictor of depression ($\beta = .24, p < 0.05$) and anxiety ($\beta = .22, p < .05$) in multiple regression analysis. To summarize, the perception that an individual was experiencing many symptoms of MS was associated with the

belief that the illness was more intrusive, a greater level of impairment of physical functioning, and higher levels of depression and anxiety.

In a study by Frostholtm and colleagues (2005) the relationship of IR to health care use was explored in 1,785 participants with a chronic illness. These researchers used Leventhal's model and previous research to test the hypothesis that individuals who reported many symptoms, had a chronic timeline, high illness worry and low personal control would have more difficulty coping and therefore, have higher health care use. Findings revealed that high previous health care users were more likely to believe their illness had serious consequences (OR = 1.26, 95% CI (1.1-1.4), $p < 0.001$), would be long lasting (OR = 1.18, 95% CI (1.1-1.3), $p < 0.05$) and have a stronger illness identity (OR = 1.50, 95% CI (1.3-1.8), $p < 0.001$) compared to low previous health care users. When analyzing primary care use during the two year follow-up, the effects of beliefs about serious illness consequences ($\beta = 1.24$, (1.1- 1.4), $p < 0.001$)), stronger illness identity or reporting more symptoms ($\beta = 1.06$, (1.0-1.1), $p < 0.001$) and long timeline ($\beta = 1.20$, (1.1-1.3), $p < 0.001$) on higher health care use were significant, even when previous use was included in the regression model. Health care use was associated with psychosocial ($\beta = 1.13$, (1.0-1.2), $p < 0.05$) and infection/lowered immunity ($\beta = 1.28$, (1.1-1.5), $p < 0.05$) causal attributions when previous use was included in the regression model.

In summary, these findings indicate that beliefs that the illness has serious consequences, is highly symptomatic, and has a chronic timeline are related to previous and future primary care use. Furthermore, this was the only study to report a relationship between cause dimensions and health care utilization, a type of illness outcome. One

methodological weakness of this study was the large number of missing data. Older participants were less likely to complete the study questionnaires, and the researchers noted that this may have been related to the length of the questionnaires used. This underscores the need to limit subject response burden as much as possible in studies with older adults, such as those persons with CHF.

In a study by Scharloo and colleagues (1998), IR, coping, and functioning were investigated in a sample of 249 individuals with rheumatoid arthritis, chronic obstructive pulmonary disease, and psoriasis. The aim of this cross-sectional study was to examine the relationship between IR and general physical, role and social functioning as measured by the Medical Outcomes Study Short Form General Health Survey (MOS), the Daily Activities of Living (DAL) for participants with COPD, the Health Assessment Questionnaire (HAQ) for participants with RA, and the Psoriasis Disability Index (PDI). For individuals with RA, identity and control/cure representations explained three times the variance in general physical functioning (18%) as medical variables such as illness duration and severity. These results were consistent with those reported for the disease specific measure of RA (HAQ) where identity and control/cure explained an additional 35% of variance beyond the 6% explained by medical variables. Moreover, for participants with RA, control/cure representations explained 4% of the variance in general social functioning. For individuals with psoriasis timeline representations accounted for 9% of the variance in general social functioning (MOS) and consequence representations explained the largest variance 17% in disease specific (PDI) physical functioning. Overall, findings indicated that dimensions of IR contributed significantly to the explained variance of all outcomes except for general physical functioning in

participants with COPD and general role functioning in participants with COPD and RA. That is, those who believed that their illness would be long in duration and have severe consequences had worse outcomes on the disease specific measures of physical, role and social functioning.

Finally, Hagger and Orbell (2003) conducted a meta-analysis of 45 empirical studies that examined the relationship between IR and illness outcome. Illness outcomes explored in this analysis included objective outcomes such as glycosylated hemoglobin (HgbA1c) and CD4 counts, as well as self-reported outcomes including physical functioning, depression, anxiety, well-being, life satisfaction, role functioning and vitality. The findings revealed that the dimensions of consequence and timeline representations were related to health and illness outcomes of psychological well-being, role functioning, social functioning vitality, psychological distress, and physical functioning. Control/cure representations were related to psychological well-being, social functioning, vitality, psychological distress, and disease state (i.e. HgbA1c, disease severity and CD4 counts). On the other hand, after correcting for statistical error, there was no variance accounted for by the IR dimensions in the disease state objective measures. In summary, consequence, control/cure and timeline representations were significantly related to multiple illness outcomes in this meta-analysis. However upon closer examination, the illness outcomes predicted by illness representations are self-reported. These findings underscore a need to further examine relationships between IR and objectively measured illness outcomes, such as hospital readmission.

In summary, no empirical research examining the relationships of illness representations to illness outcome and the relationship of illness representations through

medication adherence to illness outcome was located in a sample of individuals with chronic heart failure. Filling this gap will provide knowledge to nursing care providers regarding these relationships that may assist in the identification of individuals that are more likely to experience medication nonadherence and therefore require more monitoring or education. In addition, this knowledge may lead to further investigation of interventions that could improve health outcomes and self-care behaviors potentially decreasing unnecessary and costly hospital readmissions in this population.

Treatment Beliefs and Medication Adherence

In this section, empirical literature that investigates the relationship between treatment beliefs and medication adherence is presented. The literature review was delimited to studies of populations with chronic illnesses requiring medications because only one study in chronic cardiovascular illness was identified. A total of three studies are reported on here.

Few studies have investigated the relationship of treatment beliefs to medication adherence in cardiac populations. Fewer still have investigated the necessity-concern differential (NCD), a cost-benefit assessment of personal beliefs about the necessity of medications to maintain or improve health weighed against concerns regarding the adverse effects of taking the medications (Horne & Weinman, 1999), instead choosing to treat necessity and concerns as two discrete variables.

In an early study, Horne and Weinman (1999) attempted to determine the extent to which medication adherence was influenced by treatment beliefs. A sample of 324 individuals with asthma ($n = 78$), end stage renal disease ($n = 47$), cardiovascular disease (heart failure, angina or hypertension, $n = 116$), and cancer ($n = 83$) participated. Results

revealed that those individuals who had a negative NCD, that is, concerns score higher than necessity score, reported significantly lower adherence (necessity subscale mean = 13.76, concern subscale mean = 15.71; $t = -4.28$; $df = 319$; $p < 0.001$). In fact, regression analysis revealed that the NCD was the strongest predictor and explained 19% of the variance in adherence.

In another study, Aikens et al. (2005) examined demographic, psychiatric and treatment belief predictors of medication adherence in a cross section of 81 individuals who were on maintenance antidepressant therapy. The findings from this study showed that the NCD was the only variable that had a statistically significant and independent association with adherence ($F(2, 70) = 11.77$, $p = .001$) and indicated that in participants whose concerns outweighed need, adherence was lowest.

Similarly, Jónsdóttir and colleagues (2009) conducted a study that examined the relationship between treatment (medication) beliefs and medication adherence in 280 patients with a psychiatric illness. Medication adherence was operationalized as participants' self-report of the percentage of their medication they had taken in the past week and as serum blood concentrations. The differences in mean NCD scores for the fully adherent group ($M = 0.4$), partially adherent ($M = -1.5$), and the nonadherent group ($M = -6.0$) indicated when there were differences between concerns and necessity, adherence decreased. In other words, as individuals concerns outweighed their necessity beliefs, the scores became negative. Hence, when reviewing the mean scores of the groups, as mean scores became more negative representing more concerns, there was more nonadherence. In addition, the difference on NCD scores between the non-adherent group and the partial and fully adherent group was statistically significant ($p < 0.002$).

The researchers concluded that in patients with severe mental disorders such as schizophrenia and bipolar disorder, non-adherent participants believed medication to be less necessary and were more concerned about medications than adherent participants.

To summarize, the studies reviewed here used the NCD to investigate the relationship between treatment beliefs and medication adherence. All three studies found that there is a strong relationship between NCD and medication adherence. Furthermore, in two studies the NCD scores independently predicted nonadherence. However, the relationship to medication adherence and illness outcome remain largely unexplored, particularly in individuals who have chronic HF. Furthermore, many of the studies have been conducted outside of the U.S. in countries where citizens are covered by a national health system, such as Norway. Recently, Cutler and Everett (2010) discussed how the organization of healthcare systems themselves can be a factor in medication adherence. For example, the authors point out the importance of assessing and supporting individual's beliefs but recognize that our current reimbursement structure does not allow for this. Therefore, the findings from studies conducted in countries with different health care systems regarding relationships of treatment beliefs to medication adherence may not be generalizable to persons in the United States.

Treatment Beliefs and Illness Outcome

In this section, empirical literature that investigates the relationship between treatment beliefs and illness outcome is presented. The literature review was delimited to studies of populations with a chronic cardiovascular illness. However, no studies were identified. The search was then broadened to include chronic illnesses. Three studies met this criterion and are included in this section of the literature review.

As noted earlier, few researchers have used the NCD as an antecedent to medication adherence and no studies were identified that examined this variable in relation to illness outcomes. However, there were studies that reported the relationship between the discrete dimensions, necessity and concerns, to both physiological and psychological outcomes. These studies will be reviewed to establish the relationship of each individual dimension of the NCD to outcome.

In a cross-sectional study of 54 individuals with epilepsy, Jones, Butler, Thomas, Peveler, and Prevett (2006) investigated the relationships among IR, medication beliefs, self-reported medication adherence, and seizure control. Participants were classified as poorly controlled if they had one seizure or more per month. Findings revealed that patients with poor epilepsy control had a greater necessity belief than well-controlled participants ($Z = -2.31, p = 0.02$). In addition, though not statistically significant, which could be due to small sample size, poorly controlled individuals also reported more concerns about their medications ($Z = -1.82, p = 0.07$). Interestingly, even though poor control was related to non-adherence in this study, poor control was not associated with a lower belief median score. Therefore, even though those that were poorly controlled believed in the necessity of the medication, they were still non-adherent and this may be related to the fact that their concerns about the medications outweighed their necessity beliefs, leading to nonadherence. If the authors had measured the necessity-concern differential, this would have provided more information about this possibility. Additionally, these findings may reflect the asymptomatic nature of epilepsy which fits with the propositions of the CSM where symptoms, especially those viewed as a threat, are likely to produce action.

Aikens and Piette (2009) studied 803 diabetic patients' medication use, medication beliefs, and illness outcomes including HgbA1c, systolic (SBP) and diastolic blood pressure (DBP). Systolic blood pressure ($\beta = 0.16, p < 0.005$) and diastolic blood pressure ($\beta = 0.12, p < 0.01$) were significantly associated with medication concerns, though anti-hyperglycemic medication concern was not an independent predictor of HgbA1c ($\beta = 0.08, p = 0.034$).

Finally, in a recent study of 615 adults with Type II diabetes, Paddison (2010) explored the relationships among beliefs about medications, physical and psychological well-being, and metabolic glucose control (HgbA1c). Greater concerns about diabetes medication was significantly related to higher HgbA1c ($r = 0.25, p = 0.001$), higher diabetes related distress ($r = 0.57, p = 0.001$) and poorer self-reported mental health ($r = -0.34, p = 0.001$). However, as Paddison (2010) and others (Frostholm et al., 2005; Scharloo et al., 1998) point out, it is possible that these relationships may be mediated by medication adherence.

Medication Adherence as a Mediator

In this section, empirical literature that investigates the mediating relationship of medication adherence is presented. The literature review was delimited to studies of populations with a chronic illness investigating medication adherence as a mediator due to the small number of studies (three) located with only two in heart failure. However, the studies in heart failure were not investigating illness and treatment representations but do provide insight into medication adherence as a mediator in the population of interest for this proposed study. Therefore, four studies will be included in this review.

In dissertation research, Paddison (2006) conducted a cross sectional survey with medical database review with 615 subjects that were diagnosed with type II diabetes mellitus to determine relationships between psychological variables, that included illness and treatment representations and illness outcome. Testing of the theorized relationship of coping procedures as a mediator found that medication adherence did mediate the relationship between treatment representations, specifically, medication concerns and glycosylated hemoglobin (HgbA1C) levels. In other words, the significance of the relationship between medication concern and HgbA1C levels ($\beta = .19, p < .001$) was significantly reduced ($\beta = .13, p < .001$) when treatment adherence was controlled for.

Wu and colleagues (2010) conducted a prospective, longitudinal study of 135 patients with HF to examine the role of medication adherence as a mediator between ethnicity and event free survival (emergency room visits for decompensated HF, hospital readmission for HF or cardiac events, and mortality) to determine disparities. Findings included no difference in mortality, but a statistically significant difference in hospitalization between African American and Caucasian patients. Based on the principles of mediation, the significance of ethnicity ($p < .026$) as a predictor of event free survival was nullified, or insignificant when medication adherence was added to the regression model ($p < 0.061$). Similarly, in a report of secondary data analysis of the same study above, Wu and colleagues (2012) found that medication adherence was a mediator between marital status and outcome free survival. Based on the principles of mediation, the significance of marital status ($p < .017$) as a predictor of event free survival was nullified, or insignificant when medication adherence was added to the regression model ($p < 0.08$). While these findings were not examining illness or

treatment representations, the role of medication adherence as a mediator was supported. Additionally the authors suggest that attitudes toward taking medications may explain this relationship, providing non-empirical support for the currently proposed study.

In summary, empirical evidence supports some of the theoretical relationships being tested in this study. However, some of the theorized relationships have no empirical support. For instance, there were no studies that tested the theorized relationship between the NCD and illness outcome. In addition, there were no studies that examined the theorized associations of IR and treatment beliefs to hospital readmission as an outcome, and none that tested medication adherence as a mediator of these relationships, as theorized by the CSM. Therefore, the purpose of this study is to investigate the relationships among illness representations, treatment beliefs, medication nonadherence, and hospital readmission in elderly individuals with chronic heart failure.

Hypotheses

The following hypotheses will be investigated in older adults with chronic HF:

1. Perception of illness timeline as chronic is related to medication adherence.
2. Perception of serious illness consequences is directly related to medication adherence.
3. Perception of illness control is directly related to medication adherence.
4. Perception of illness symptoms is directly related to medication adherence.
5. The necessity-concern differential is directly related to medication adherence.
6. Perception of a chronic illness timeline is positively related to hospital readmission.

7. Perception of serious illness consequences is positively related to hospital readmission.
8. Perception of illness control is inversely related to hospital readmission.
9. Perception of illness symptoms is directly related to hospital readmission.
10. The necessity-concern differential is inversely related to hospital readmission.
11. When medication adherence is controlled for, the magnitude and significance of the relationship between illness timeline and hospital readmission will diminish.
12. When medication adherence is controlled for, the magnitude and significance of the relationship between illness consequences and hospital readmission will diminish.
13. When medication adherence is controlled for, the magnitude and significance of the relationship between illness control and hospital readmission will diminish.
14. When medication adherence is controlled for, the magnitude and significance of the relationship between illness identity and hospital readmission will diminish.
15. When medication adherence is controlled for, the magnitude and significance of the relationship between the necessity-control differential difference between beliefs about the necessity and concerns of medications and hospital readmission will diminish.

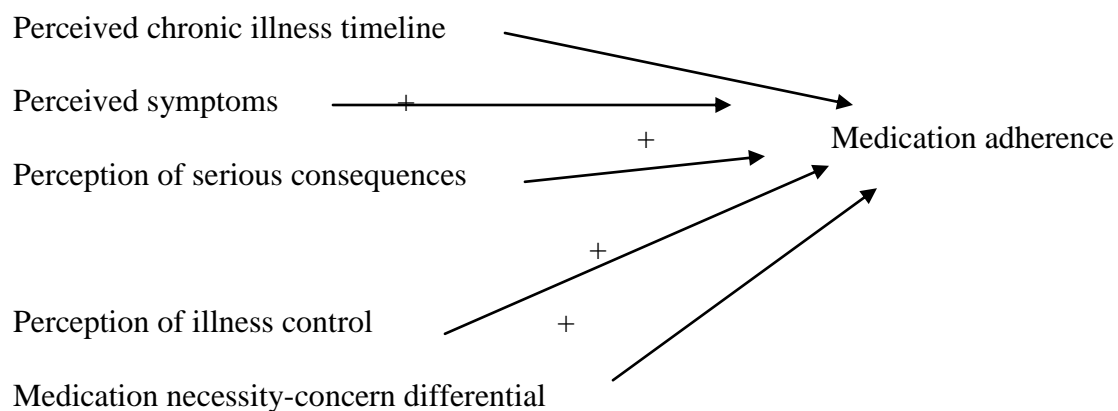


Figure 1. Correlates of medication adherence.

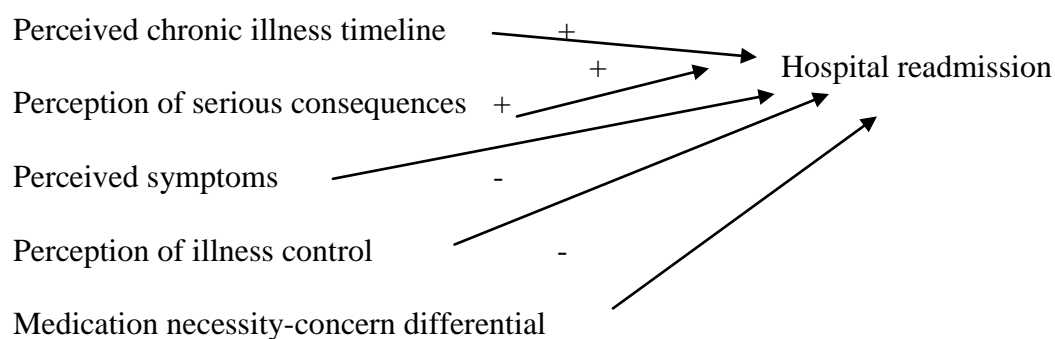


Figure 2. Correlates of hospital readmission.

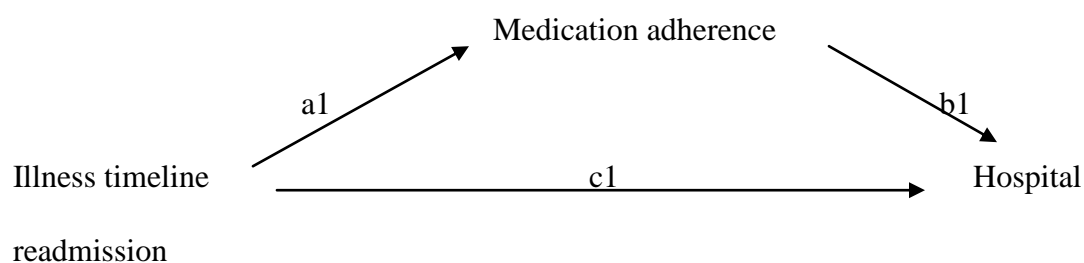


Figure 3. Mediation Model A.

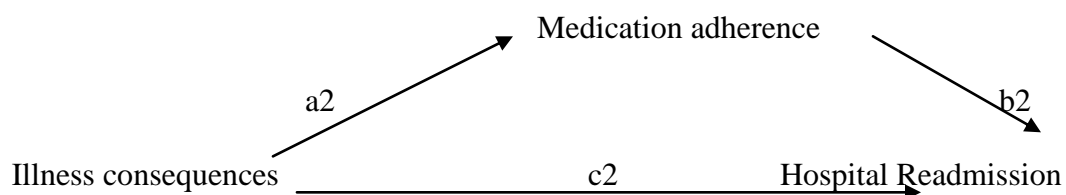


Figure 4. Mediation Model B.

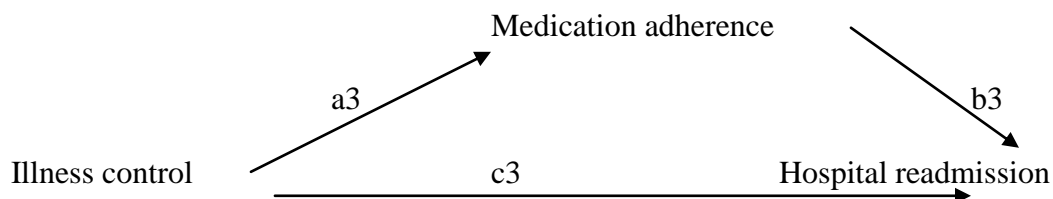


Figure 5. Mediation Model C.

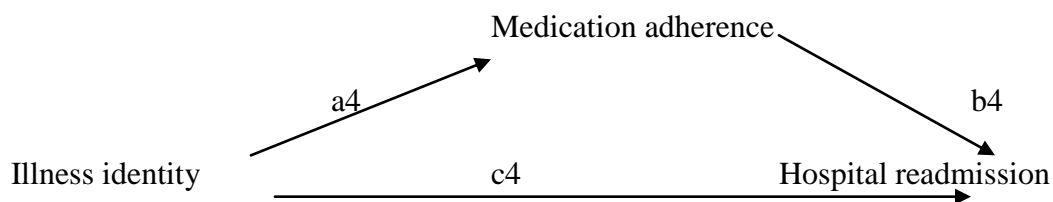


Figure 6. Mediation Model D.

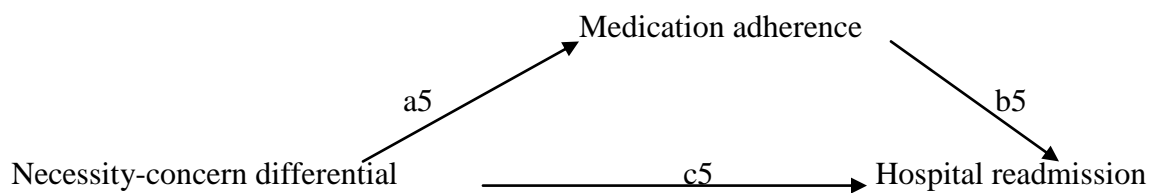


Figure 7. Mediation Model E.

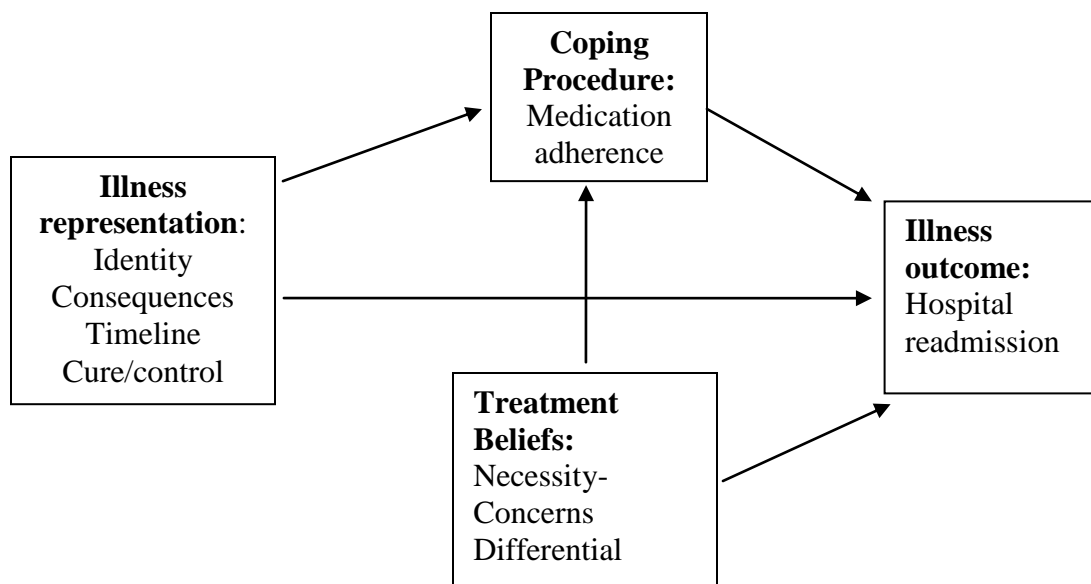


Figure 8. Theoretical Model.

CHAPTER 3. METHODS

This chapter will describe the research design for this study. The research setting, sampling methods and sample, instruments, and the procedures for data collection and analysis are described. This study used a longitudinal, descriptive, correlational research design to investigate the relationships among illness representations, treatment beliefs, medication adherence and hospital readmission in older adults with chronic HF.

Research Setting

Subjects were recruited from a teaching, level two trauma regional medical center licensed for 769 beds that is part of a health network. According to data for fiscal year October 1, 2010 through September 30, 2011 from the hospital system, over 1000 patients were treated and discharged with an ICD-9 code (428.0–428.4) of heart failure.

Participants were on one of several units in the hospital including medical-surgical, cardiac telemetry, and cardiac care. All patients who met the inclusion criteria during the recruitment period were invited to participate in the study upon their discharge from the hospital. Inclusion criteria include: age 55 or older, primary medical diagnosis of heart failure, read, write and understand English, have access to a telephone and are independent in medication taking. Exclusion criteria include living in a nursing home or other facility that assists in medication administration, and/or have a cognitive impairment. Cognitive impairment is defined as decline in at least one of the following areas: short-term memory, attention, orientation, judgment and problem-solving skills, and visual-spatial skills (Chang, Burke, & Glass, 2010).

Sampling Methods

A convenience sampling strategy was used to select study participants. Potential subjects who met inclusion criteria and were ready for discharge were identified by unit charge nurses, discharge coordinators or unit staff nurses. Research assistants provided a flyer to potential participants identified by unit staff that briefly described the study. They were also provided a verbal explanation of the study purpose and extent of contact required, questions about participation were answered, and interest in study participation determined. Those patients who expressed an interest in participation were screened using the Short Blessed Test (SBT), a six item tool to determine cognitive impairment. The SBT has demonstrated 95% sensitivity and specificity of 65% as well as optimal overlap with the Mini Mental Status Exam (Katzman et al., 1983) but allows for rapid assessment of cognitive dysfunction. Patients were asked to respond to items that elicit their ability to state the current year and month, the time of day, to count backwards from twenty to one, to recite the months of the year backwards, and to repeat a phrase to assess memory. Total SBT scores are calculated. A score of zero to eight indicates normal to mild cognitive impairment (Katzman et al., 1983). Individuals scoring eight or less were presented with an information sheet that provided the elements of informed consent. Participants provided their contact information to include name, mailing address, telephone number and best time to conduct the telephone survey within one week of discharge.

Based on the theoretical and empirical literature, a moderate effect size ($r = .30$, $d = .50$) is anticipated for this study (Byrne et al., 2005; Griva et al., 2000; Horne & Weinman, 1999; Jessop & Rutter, 2003; Jónsdóttir et al., 2009). Given six independent

variables, a moderate effect size, and an alpha level of 0.05, a minimum sample of 97 subjects will be required to achieve a power of .80 for multiple regression analysis (Cohen, 1992). A power analysis for correlation using Pearson product moment correlation coefficient r , a moderate effect size, and an alpha level of 0.05, a minimum sample size of 85 will be required to achieve a power of .80 (Cohen, 1992). Therefore, sample size determination is based on a minimum sample of 97, the larger sample size of the two power analyses. Based on the range of reported telephone survey response rates of 52%-94% (Barriball, Christian, While, & Bergen, 1996; Wilson & Roe, 1998; Worth & Tierney, 1993) and reported attrition in longitudinal studies with samples of elderly heart failure patients that ranged from 10%–19% (Harrison et al., 2002; Kostis, Rosen, Cosgrove, Shindler, & Wilson, 1994; Park, Malone, Suresh, Bliss, & Rosen, 2008; Yu, Lee, & Woo, 2007) a minimum sample size of 166 subjects will be recruited to achieve sufficient power for statistical analyses.

Instruments

Brief Illness Perception Questionnaire

In this study, illness representation dimensions of identity, timeline, control/cure and consequences will be operationalized as a score on the respective item or items on the Brief Illness Perception Questionnaire (B-IPQ; Broadbent et al., 2006), a nine-item self report measure that has been administered successfully over the telephone (Petrie, Perry, Broadbent, & Weinman, 2012). The tool is designed to assess cognitive and emotional illness representations. The B-IPQ uses a single-item approach to measure each CSM dimension. Eight of the nine items are scored on 10-point visual analog scales with adjective pairs anchoring the lower and upper ends. For instance, the item

measuring personal control states “How much control do you feel you have over your illness?” Participants are asked to respond to this item on a scale of zero to ten with a zero rating that corresponds to “absolutely no control” and a rating of ten that corresponds to “an extreme amount of control.” For the item measuring timeline, “How long do you think your illness will continue?” responses range from zero rating that corresponds to “a very short time” to a rating of 10 that corresponds to “forever.” Each item is scored separately. According to Broadbent and colleagues (2006), the scale allows for easy interpretation of scores since increase in item scores represent linear increases in the dimension measured. For example, higher scores on the timeline dimension indicate individuals believe that their illness will last a long time. Lower scores indicate a belief that the illness will last a short time. The same is true for the personal control item. Higher scores indicate that individuals feel as if they have more personal control over their illness where lower scores indicate no to limited control. For the treatment control item, higher scores indicate that an individual believes that their treatment is extremely helpful in controlling the illness while lower scores indicate a belief that it is not at all helpful. The B-IPQ is designed to be adapted for specific illnesses by substituting the word “illness” on the generic scale with a specific diagnosis (e.g. heart failure). The B-IPQ can be completed in only a few minutes by most patients, including those who are very ill (Petrie, Jago, & Devcich, 2007).

Psychometric evaluation of the B-IPQ was conducted in a group representing six illness groups, myocardial infarction ($n = 103$), renal disease ($n = 132$), type 2 diabetes ($n = 119$), asthma ($n = 309$), minor illness (allergies, colds, headaches; $n = 166$) and a group with chest pain undergoing diagnostic testing ($n = 62$; Broadbent et al., 2006). Test-retest

reliability, concurrent validity, discriminant validity, and predictive validity were evaluated.

Concurrent validity was determined by asking participants with renal disease, diabetes and asthma to complete the B-IPQ and the Illness Perception Questionnaire (IPQ-R). Moderate to good correlations (timeline, $r = 0.53, p < 0.001$; consequences, $r = 0.62, p < 0.001$; personal control, $r = 0.33, p < 0.001$; treatment control, $r = 0.32, p < 0.001$) on the CSM dimensions are reported between the B-IPQ and the IPQ-R with the exception of the personal and treatment control dimensions, which were comparatively low. Therefore, further validity testing of the personal and treatment control dimensions was conducted.

According to social cognitive theory, perceived control is measured as self-efficacy (Broadbent et al., 2006). Hence, the personal control item of the B-IPQ was tested against the self-efficacy measures of the Knowledge, Attitude, and Self-Efficacy Asthma Questionnaire and the Multidimensional Diabetes Questionnaire. The Brief IPQ personal control item was significantly correlated with diabetes self-efficacy ($r = .61, p < 0.001$) and with asthma self-efficacy ($r = .47, p < 0.001$; Broadbent et al., 2006). Further validation of the control dimensions were assessed by correlating the B-IPQ with HgbA1c for metabolic control, the Jones Asthma Morbidity Index and the Beliefs about Medicines Questionnaire. Results demonstrate that after controlling for length of illness, personal control correlated with a lower HgbA1c or better metabolic control ($r = -0.30, p < 0.01$) and higher treatment control beliefs were associated with poorer metabolic control ($r = .21, p < 0.05$). Personal control ($r = -0.18, p < 0.01$) and treatment control (r

= -0.13, $p < 0.05$) were inversely related to asthma morbidity as measured by the B-IPQ (Broadbent et al., 2006).

Predictive validity was evaluated in participants with MI to determine if the B-IPQ predicted key outcomes such as cardiac rehabilitation attendance, return to work, cardiac anxiety and quality of life. Slower return to work was associated with higher concern ($r = 0.43$, $p = 0.03$) and higher treatment control beliefs ($r = 0.44$, $p = 0.03$). B-IPQ consequences dimension predicted cardiac anxiety ($r = 0.33$, $p < 0.05$), vitality ($r = -0.52$, $p < 0.001$) and mental health ($r = -0.58$, $p < 0.001$). Broadbent and colleagues (2006) concluded that the B-IPQ demonstrated good predictive validity in this sample with consequences, identity, concern, understanding and emotional dimensions measured at discharged to be consistently related to mental and physical functioning at 3 months follow-up.

Broadbent and colleagues (2006) state they tested discriminant validity by determining if the B-IPQ could distinguish between different illnesses, diabetes, asthma, colds, MI patients and patients with chest pain waiting for exercise stress testing. However, it does appear this more accurately describes known-groups validity. One-way ANOVA with Scheffe post-hoc tests revealed differences between the illness groups that were in line with expectations based on variations in illness presentation, chronicity, impact on patient's lives and disease management. For instance, mean and standard deviation scores for timeline were as follows: diabetes 9.2(1.9), asthma 8.8(2.2), colds 5.4(3.1), MI 7.2(3.1), and chest pain without diagnosis 4.5(3.0).

Internal consistency reliability of the B-IPQ is not reported since there is no total, summed score and single items are used to measure each dimension. However, the B-

IPQ has been used in samples with heart failure (Reynolds, Broadbent, Ellis, Gamble, & Petrie, 2007), myocardial infarction (Broadbent, Ellis, Thomas, Gamble, & Petrie, 2009), individuals with liver transplants (O'Carroll, McGregor, Swanson, Masterton & Hayes, 2006) and in a sample of rural southern women whom human papillomavirus knowledge, vaccine acceptability and beliefs were being investigated (Cates, Brewer, Fazekas, Mitchell, & Smith, 2009).

Test-retest reliability was established in the renal sample with the first administration given at an outpatient clinic appointment. Half of the sample received retest questionnaires at three weeks post-visit and to the remainder at six weeks post-visit. Pearson correlations ranged from $r = 0.42$, $p < 0.01$ for the personal control item at six weeks to a high of $r = 0.75$, $p < 0.001$, on the identity item at six weeks.

In summary, the reliability and validity of the B-IPQ has been established in samples of individuals with various chronic cardiac illnesses including heart failure. In addition, the tool has been used in inpatient and outpatient settings. Therefore the B-IPQ is considered to be valid and reliable for use in elderly outpatients with heart failure.

Beliefs about Medicines Questionnaire

Treatment beliefs will be operationalized as a score on the Beliefs about Medicines Questionnaire (BMQ; Horne et al., 1999) which was developed to assess commonly held beliefs about medicines. The questionnaire consists of 18 items and has two areas of focus, specific and general beliefs. The specific beliefs are beliefs about particular medications that an individual is prescribed. General beliefs are those beliefs about medications in general. There are four BMQ subscales related to necessity and concern beliefs including (a) Specific-Necessity, which measures beliefs about the

necessity of medications prescribed for the patient; (b) Specific-Concerns that reflects concerns about medications prescribed; (c) General-Harm which reflects views about the nature of medications; and (d) General-Overuse assesses what individuals believe about how medications are used by doctors. This instrument has been administered successfully over the telephone (LaPointe et al., 2011). For this study, only the data obtained from the specific-necessity and specific-concerns subscales will be analyzed.

BMQ items are rated on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Persons with chronic illness including heart failure have completed the BMQ (George & Shalansky, 2006).

Internal consistency reliability as measured by Cronbach's alpha for Specific-Necessity and Specific-Concerns subscales, respectively, has been reported in samples with heart failure (0.67, 0.81; George & Shalansky, 2006); schizophrenia and bipolar disorder (0.90, 0.76; Jónsdóttir et al., 2009); and diabetes (0.68 to 0.81; Aikens & Piette, 2009; Llewellyn, Miners, Lee, Harrington, & Weinman, 2003). Confirmatory factor analysis revealed replication of the factor structure in both the specific and general scales in chronic illness samples including persons with asthma, diabetes, kidney failure, cardiac disease, general medical problems, and psychiatric illness (Horne et al., 1999).

Test-retest reliability was evaluated in the asthmatic sample with the initial questionnaire completed at a clinic visit and the retest sent two weeks later via mail. A total of 31, a 40% response rate returned the retest questionnaire. Cronbach's alpha for Specific-Necessity 0.77, and Specific-Concerns 0.76 (Horne et al., 1999) are above the acceptable limit of .70 (Polit & Beck, 2012).

A priori hypothesis testing was used by Horne et al. (1999) to determine the criterion-related validity of the BMQ. Correlations between timeline and identity items from the Illness Perception Questionnaire (Weinman et al., 1996) and items from the Reported Adherence to Medication Scale (Horne et al., 1999) were assessed. Results indicate that as expected there were positive correlations between specific-necessity and timeline ($\rho = 0.49, n = 77, p < 0.001$) and identity ($\rho = 0.24, n = 76, p < 0.05$) scores. Correlations between the BMQ scales and reported adherence were also as expected with specific-necessity beliefs correlating with higher reported adherence ($\rho = 0.19, n = 210, p < 0.01$). The correlation between the BMQ and specific-concerns beliefs were in the predicted direction ($\rho = -0.28, n = 210, p < 0.001$). Results provide evidence of criterion related validity.

Discriminant validity was assessed by conducting one-way ANOVAs with a priori linear contrasts and post-hoc Tukey's tests where mean scores on the BMQ subscales were compared across illness groups and treatments (Horne et al., 1999). It was predicted that the effects of the medications on symptoms is particularly important. Therefore, persons with diabetes who do not take their medications can become severely ill, for instance hyperglycemia, and experience more symptoms effects of not adhering compared to persons with asthmatics who use their medications for symptom relief. Moreover people with diabetes and asthma have very tangible symptoms when non-adherent to medications versus the participants with mental health problems where the link between medication and relief of psychiatric problems is vaguer. Findings were as predicted on the Specific Necessity and Concerns subscales. The diabetic group had significantly higher specific-necessity score than all other groups. The asthmatic sample

had significantly higher scores than the psychiatric patients as predicted. In addition, the asthmatic and psychiatric samples had significantly higher specific-concerns scores.

These findings indicate that the BMQ is able to discriminate medication beliefs accurately across chronic illness samples.

Medication Adherence Report Scale

There are many methods for measuring adherence, but no consensus or gold standard is identified in the literature. In fact, there are advantages and disadvantages to all methods. For instance, with serum drug levels, individual metabolism and drug-drug or drug-food interactions can affect the data. Electronic monitoring caps are expensive and only monitor when a medication cap is removed, not that the medication was taken. Self-report may be influenced by problems with recall, cognitive function or the desire of participants to give socially acceptable responses. However, self-report has been shown to correlate with pill count (Haynes et al., 1980) and electronic medication caps (Walsh, Mandalia, & Gazzard, 2002). In a study using a single self-report item, results indicate that it was associated with adverse cardiovascular outcomes (Gehi, Ali, Na, & Wooley, 2007). Therefore, a self-report measure will be used in this study.

The medication adherence report scale (MARS) is a five-item self-report scale originally created to assist in the psychometric evaluation of the BMQ (Horne et al., 1999) and address the lack of a self-report scale that specifically addresses medication nonadherence and an individual's adjustment or alteration of dosing schedules.

Respondents are asked to rate items on a five-point Likert scale that is scored with 1 = very often and 5 = never. Higher scores indicate greater reported adherence. Examples of statements include "I take less than instructed" and "I sometimes forget to take my

medicines.” The MARS-5 has been administered successfully over the telephone (Phillips, Leventhal, & Leventhal, 2012) to assess medication adherence.

Internal consistency reliability of the MARS-5 has been reported in a sample of 324 pharmacy customers (0.73; Mardby et al., 2007), individuals taking inhaled corticosteroids (0.81; Menckeburg et al., 2008), women with breast cancer taking tamoxifen, (0.68; Grunfeld, Hunter, Sikka, & Mittal, 2005), and patients with essential hypertension taking antihypertensive drugs (0.77; Theunissen, de Ridder, Bensing, & Rutten, 2003).

Ohm and Aaronson (2006) reported the test-retest reliability on the MARS. The instrument was administered at the beginning of the study and again at the end, four weeks later. Pre- and post-study MARS scores were highly correlated ($r = .74$) suggesting good stability over time. Additionally Ohm and Aaronson examined construct validity by assessing the extent to which Advair® inhaler administered dose count correlated with MARS scores and found a moderate correlation ($r = 0.53$) between the two measures, supporting construct validity of the instrument .

Hospital Readmission

Hospital readmission is defined as the first unplanned hospital admission for heart failure or exacerbation of heart failure within 30 days after hospital discharge for heart failure (Schwarz & Elman, 2003). Hospital readmission was measured by calling participants 30 days after hospital discharge and asking if they had an unplanned admission to the hospital within the past 30 days (yes/no). For those participants who responded yes to the question, indicating a hospital readmission occurred, their medical record was reviewed to identify the primary admitting diagnosis. Only those participants

with a primary admitting diagnosis of heart failure, or with an International Classification of Diseases, Ninth Revision (ICD-9) code of 428.0 through 428.4 were considered positive on the dependent variable of hospital readmission.

Demographic Questionnaire

A Demographic Questionnaire was used to collect the following demographic information from study participants: age, gender, race, number of prescription medications taken daily, marital status, level of education and years since diagnosis with CHF.

Procedure for Data Collection

At the designated time selected by participants or within one week of hospital discharge, telephone contact with all potential participants who expressed an interest in the study and provided their contact information was made. At that time, either the survey was administered, a voice mail message left or an appointment made for another time, as some individuals did not feel up to completing the 30 minute phone call at that time. During the call, the PI or research assistant highlighted the points of informed consent from the information sheet provided at initial contact and included: (a) a statement that the study involves research; (b) an explanation of the purpose of the study; (c) an explanation that there will be no direct benefits and no anticipated risks to participation; (d) an assurance of confidentiality, anonymity; and (e) an assurance of the participant's right to choose not to participate or to terminate participation at any time. Additionally, elements of the Health Insurance Portability and Accountability Act Privacy Rule for release of protected health information, in this study access to their medical records to determine diagnosis if readmitted, was included as part of the consent.

When possible, telephone surveys were scheduled with the research assistant that made initial in-person contact to improve response rates (Worth & Tierney, 1993).

Research assistants were trained by the PI on all study procedures including (a) subject recruitment, (b) Short Blessed Test, a cognitive status screening and scoring; (c) telephone survey administration and electronic data entry; and (d) anticipated common participant questions and appropriate responses. At the beginning of the telephone call, participants were asked to use the response cards they were given at the time of initial contact. Each response card contained the item responses scales for each of the questionnaires that participants used as visual prompts for item response choices. During the interview, the PI or research assistant asked the participant to move to the next response card as appropriate. Using a prepared script, the PI or research assistants then administered the instruments and entered participant responses to survey items into an electronic survey software platform Select Survey©. Each survey was assigned a unique subject identifier code to facilitate tracking and data collection on the dependent variable. Participants were mailed a twenty-dollar gift card at the completion of the telephone survey and asked to return a postage paid postcard indicating they had received the gift card.

To collect data on the dependent variable, a phone call was made to participants 30 days after their index hospitalization to determine if they had an unplanned readmission to the hospital within that 30 day period. For participants that reported readmission, the PI reviewed their hospital medical records for the admitting diagnosis and reason for readmission.

Data Analysis

A statistical database was created by the PI using the Statistical Package for the Social Sciences (SPSS) version 18.0 for Windows (SPSS, 2010). Prior to data analysis, data was reviewed for inconsistencies, wild entries, and outliers. Frequency tables, histograms, scatterplots, and skewness and kurtosis statistics were examined to assess distribution of study variables for normality. For variable scores that are not normally distributed, data transformation will be utilized to meet normality assumptions of the statistical tests. Descriptive statistics, that is means, standard deviations, and response frequencies, will be analyzed to describe characteristics of the sample. A code book which includes copies of the original data set and the cleaned data set, copies of the basic descriptive, correlations and regression analyses, syntax and output, and PI notes will be created to document the analysis file.

To test hypotheses one through ten, correlational analysis will be conducted using Pearson Product Moment Correlation and chi square test for nominal level variables. A two-tailed test of significance set at .05 level will be used. The correlation matrix will be examined to determine if there are any demographic variables that are significantly correlated with the dependent variable and that need to be controlled in subsequent analyses. In addition, the correlation matrix will be examined to determine if illness representation, treatment belief and medication adherence variables are significantly related to hospital readmission.

To test hypotheses 11–17, Baron and Kenny's (1986) three-step regression analysis procedure will be used. According to Baron and Kenny (1986), a mediating variable is a variable that accounts for the relationship between the predictor and

outcome. A variable functions as a mediator when variations in the independent variable significantly account for variations in the mediator (path a), variations in mediating variable significantly account for variations in the dependent variable (path b) and when paths a and b are controlled, a previously significant relationship between the independent and dependent variables becomes insignificant. In the first step, the mediating variable (medication adherence) is regressed on the independent variable (necessity-concern differential) the dependent variable (hospital readmission) is regressed on the independent variable (necessity-concern differential) and third, the dependent variable is regressed on mediating (medication adherence) and independent variables (necessity-concern differential). In the event that significant relationships among study variables exist, a series of regressions will be conducted to test the mediation model. To test hypothesis 13, the first regression equation will test the relationship between necessity-concern differential and medication adherence. The second regression will test the relationship between necessity-concern differential and hospital readmission. Necessity-concern differential and medication adherence scores will be entered into the regression simultaneously in the third regression. In this regression, complete or partial mediation will be determined. Complete mediation occurs if, after controlling for the effects of mediating variable on the dependent variable, the effect of the independent variable and the dependent variable becomes zero, or in partial mediation the effect of the independent variable on the dependent variable diminishes and the intervening variable remains significant (Baron & Kenny, 1986). This procedure will be repeated for testing the other mediation models with the dimension of illness representations (identity, control, timeline, consequences) as the independent variables.

Human Subjects Protection

This study was submitted to the Institutional Review Boards (IRB) of Rutgers, The State University of New Jersey, University of North Carolina, Wilmington, and the recruitment hospital for an expedited review to ensure that the rights of human subjects are protected prior to data collection. There is no more than minimal risk to subjects participating in this research where the magnitude of harm or discomfort anticipated are not greater, in and of themselves, than those ordinarily encountered in daily life. Survey questionnaires were administered over the telephone. Instructions given reiterated the purpose of the study. In the instructions, participants were reminded that participation in the study involves minimal risk, is confidential, and voluntary. Subjects identified as being non-adherent during data collection were advised to review and discuss their medication treatment plan with their health care provider, but confidentiality was maintained.

The investigator maintained a computer list of participants' names, addresses, telephone numbers and code numbers. The computer files were password protected, and only the PI and research assistants had access to the password. Data collected from this study was entered into SPSS and only code numbers were used to identify each subject's response. Computer files were backed up onto a password protected thumb drive and the drive was maintained in a locked cabinet in a locked office. Only the investigator has access to the cabinet.

Data collected from this study that are published or presented will be reported only as aggregate data and participants will not be identified by name. Computer files

will be deleted and the thumb drive will be destroyed after completion of the research study and the three year mandatory IRB data maintenance period.

CHAPTER 4. DATA ANALYSIS

The purpose of this study was to examine the relationships among illness representations, treatment beliefs, medication adherence, and 30-day hospital readmission in elderly individuals with chronic HF. A convenience sample of 96 subjects aged 55 and older, diagnosed with heart failure and discharged from the hospital to home participated in the study. The following instruments were used: (a) Demographic questionnaire developed by the PI for this study to collect data on participants such as age, gender, race, marital status, education level, income level, years diagnosed with heart failure, number of medications daily, and history of other comorbidities; (b) dimensions of illness representation were measured by the respective item on the Brief Illness Perception Questionnaire (BIPQ; Broadbent et al., 2006); (c) specific treatment beliefs were measured using the Beliefs about Medications Questionnaire (BMQ; Horne et al., 1999); (d) medication adherence was measured using the Medication Adherence Report Scale (MARS; Horne et al., 1999); and (e) hospital readmission was measured by asking participants if they had an unplanned hospital readmission (yes/no) during the 30 day follow up phone call. Analyses of these data are presented in this chapter.

Demographics of Study Sample

A description of the sample demographics is presented in Table 1. In summary, the majority of participants were retired (48%), married (54%), white (73%), and males (60%), with the majority having a high school education or less (52%). The mean age of the sample was 67.77 years ($SD = 8.62$) and respondents were taking an average of nine prescription medications per day ($M = 9.09$, $SD = 4.08$, range = 3–23). Approximately 25% of the sample reported having their diagnosis of heart failure for a year or less.

Table 1

Study Sample Demographic Characteristics

Variable	<i>n</i>	%
Gender		
Male	57	59.4
Female	39	40.6
Race		
Black/African American	25	26
White	70	72.9
Native American	1	1
Marital Status		
Married	52	54.2
Divorced	11	11.5
Separated	7	7.3
Widowed	20	20.8
Never married	6	6.3
Work Status		
Retired	46	47.9
Unable to work	28	29.2
Disabled	6	6.3
Working	13	13.5
Unemployed	2	2.1
Never worked	1	1.0
Education level		
Less than high school graduate	14	14.6
High school graduate	36	37.5
Some college education	7	7.3
College graduate	35	36.5
Graduate school	4	4.2
Income level		
Less than \$25,000/year	49	51
Between \$25,000 and \$50,000/year	24	25
Between \$50,000 and \$75,000/year	10	10.4
Between \$75,000 and \$100,000/year	3	3.1
More than \$100,000/year	4	4.2
Declined to answer	6	6.3

Description of the Study Variables

Descriptive statistics (means, standard deviations, range) for study variables are presented in Table 2. The mean score for illness consequences ($M = 7.28$) was high indicating that subjects felt their illness severely affected their life. On average, subjects felt their HF would last a long time ($M = 7.57$), reflecting a perception consistent with a chronic timeline. For personal control, the mean score ($M = 5.41$) reflected that subjects did not feel strongly about their personal control over their illness, either positively or negatively. That is, they did not feel they had a lot of control, but they did feel they had some control. However, perceptions of treatment control on average were very high ($M = 8.46$) meaning that individuals felt the treatment of their illness was very helpful. Mean score on perceptions of illness identity ($M = 6.17$), which reflects illness symptoms, suggested that subjects, on average, experienced several symptoms that were perceived to be associated with their CHF and moderate in severity. This sample reported high adherence to their medications ($M = 21.94$) and they felt the necessity of their treatment outweighed the concerns they had about it ($M = 4.09$).

Table 2

Descriptive Statistics of the Study Variables

Variable	<i>M</i>	<i>SD</i>	Range
BIPQ consequences	7.28	2.53	0–10
BIPQ timeline	7.57	3.15	0–10
BIPQ personal control	5.41	2.92	0–10
BIPQ treatment control	8.46	1.84	2–10
BIPQ identity	6.17	2.78	0–10
MARS	21.94	2.86	9–25
NCD differential	4.09	4.89	-9 – 16

Internal consistency reliability coefficients and confidence intervals for the BMQ necessity and concerns subscales and the MARS are listed in Table 3. According to Polit and Beck (2012), a coefficient alpha of .70 or above is an acceptable level of reliability when making group level comparisons. Additionally, Iacobucci and Duhachek (2003) recommend reporting confidence intervals for coefficient alpha so that readers may “assess the size of the reliability index” (p. 484). The BIPQ uses single items to measure each dimension of illness representation and therefore reliability is not calculated.

Table 3

Alpha Coefficients for Study Instruments

	BMQ necessity sub-scale	BMQ Concerns sub-scale	MARS
Cronbach’s alpha coefficient	.76	.71	.73
95% Confidence interval	.67-.83	.61-.79	.63-.80

The data for this study were managed through the design and implementation of a data management plan (Polit & Beck, 2012). The first phase of the plan involved selecting the survey platform to record survey data obtained during telephone calls. SelectSurvey© was utilized. All questions in the survey had to be answered to move forward in the survey, therefore there was no missing data. As subjects were recruited, they were assigned a random subject code number that was used to match their data on initial and follow up phone calls. At study completion, data was downloaded from SelectSurvey© into SPSS. Data on the dependent variable had to be manually entered to match subjects, using their subject code number, on their responses.

The data were then coded as needed, verified, and cleaned, as recommended by Polit and Beck (2012). Data cleaning and verification involved inspecting the data for outliers and other irregularities. Outliers were identified by reviewing scatterplots. One outlier was identified in the “years with HF diagnosis” variable but was verified as this subject had a congenital defect identified at a young age. Other outliers were noted in the total MARS score. Analyses were conducted with and without the outliers to determine if there were any significant differences in the results. No differences were noted and these data points were included. A codebook was created of the data. The codebook included the data set, both original and recoded set, and the computer copies of all statistical analyses, syntax, and output information.

Data quality was assessed by evaluating the study variables for extreme skewness, variability, as well as for ceiling and floor effects (Polit & Beck, 2012). Frequency tables and histograms for all study variables were assessed for normal distribution using visual shape of the distribution, skewness and kurtosis values (see Table 4). Fisher’s skewness coefficient (measure of skewness/standard error of skewness) results in a z statistic that indicates the seriousness of the skew. Z statistic values that fall between +1.96 and -1.96 suggest that the distribution is not significantly different than a normal distribution (Pett, 1997). For non-normally distributed data, as is the case for these variables in this study, data transformation should be considered. However, Tabachnick and Fidell (2006) state that data transformation is not universally recommended as transformed data may be more difficult to interpret. The degree of skewness for non-normally distributed data in this study was considered mild, and data were not transformed (Tabachnick & Fidell, 2006).

Table 4

Distribution of Scores for Study Variables

	BIPQ consequence	BIPQ timeline	BIPQ personal control	BIPQ treatment control	BIPQ identity	NCD	MARS
Skewness	-.86	-1.00	-.66	-1.28	-.62	-.26	-1.56
St. Error Skewness	.24	.24	.24	.24	.24	.24	.24
Kurtosis	.23	-.24	-.41	1.15	-.62	-.27	3.79
St. Error Kurtosis	.48	.48	.48	.48	.48	.48	.48
Z-score	3.49	4.07	2.69	5.20	2.52	1.07	6.34

Results of Hypothesis Testing

The correlation matrix of the study variables is presented in Table 5. The first four hypotheses were developed based on the theoretical proposition that a person's representation of an illness guides the selection and execution of strategies (e.g., medication adherence) to manage the problem.

Table 5

Correlation Coefficients between Study Variables

Variables	1	2	3	4	5	6	7	8
1. Hospital Readmission	—							
2. Illness consequences	.11	—						
3. Illness timeline	.06	.25 [*]	—					
4. Personal control	-.03	-.14	.04	—				

Table 5

(Cont.)

Variables	1	2	3	4	5	6	7	8
5. Treatment control	-.26*	-.03	.05	.11	—			
6. Illness identity	.06	.60**	.19	-.18	-.06	—		
7. NCD	.02	.06	-.002	-.12	.16	.10	—	
8. Medication adherence	-.02	-.07	.05	-.05	.04	.02	.15	—

* indicates $p \leq .05$ (2-tailed); ** indicates $p \leq .01$ (2-tailed)**Hypotheses 1–4**

Pearson product-moment correlation coefficients were computed to examine the hypothesized relationships between illness representations (identity, timeline, personal control, treatment control, consequence) and medication adherence. The findings indicate that illness identity ($r = .02$, $p = .81$), timeline ($r = .05$, $p = .61$), personal control ($r = -.05$, $p = .62$), treatment control ($r = .04$, $p = .66$), and consequence ($r = -.03$, $p = .73$) representations were not significantly related to medication adherence, when operationalized as a continuous variable, using a two-tailed test of significance in elderly individuals with HF using a two-tailed test of significance. To further examine the theorized relationships among illness representations and medication adherence, scores for adherence were dichotomized since the distribution of these scores was skewed towards adherence. In the literature, adherence has been operationalized either as the score on a particular instrument or by categorizing individuals into groups, such as high or low adherers (Horne et al., 2004), or as adherent or non-adherent based on score criteria. Therefore, hypothesis testing was also carried out with the medication adherence

variable dichotomized into two categories, adherent, those with a MARS score of 21-25 or non-adherent, those with a MARS score of 9–20. Pearson product-moment correlation coefficients were computed to analyze the relationships between the illness representation dimensions scores, and the MARS dichotomized variable. The findings indicate that the personal control representations are inversely related to medication adherence using a two-tailed ($r = -.20, p = .05$) test of significance in elderly individuals with HF, indicating that the belief that one has little to no personal control over their illness is significantly related to medication adherence. Identity ($r = .03, p = .71$), timeline ($r = .01, p = .92$), treatment control ($r = .03, p = .73$), and consequence ($r = .01, p = .85$) representation dimensions were not significantly related to medication adherence or non-adherence. Therefore, only Hypothesis 3, that is, control representation is significantly related to medication adherence, was partially supported.

Hypothesis 5

Hypothesis 5 was developed based on Horne and Weinman's (1999) proposition that "adherence decisions are influenced by an interaction of personal beliefs about the *necessity* of the treatment for maintaining or improving health and *concerns* about the potential adverse effects of adhering to it" (p. 19). A Pearson product-moment correlation coefficient was computed to examine the hypothesized relationship between necessity-concern differential (NCD) and medication adherence. The findings indicate that NCD was not related to medication adherence using a two-tailed test of significance ($r = .15, p = .12$). However, NCD was significantly related to medication adherence when dichotomized into low vs. high adherence using a two-tailed ($r = .22, p = .02$) test of significance. In other words, when medication necessity beliefs were stronger than

medication concerns, subjects were highly adherent to their medications. Therefore, hypothesis five was supported.

Hypotheses 6–9

Hypotheses 6–9 were developed based on the premise of the CSM that illness representations influence health outcomes (Leventhal et al., 2001). A Pearson product-moment correlation coefficient was computed to examine the hypothesized relationship between illness representations (identity, timeline, personal control, treatment control, consequence) and 30-day hospital readmission for HF. The findings indicate that illness identity ($r = .06, p = .54$), timeline ($r = .06, p = .52$), personal control ($r = -.03, p = .77$), and consequence ($r = .11, p = .26$) representation were not significantly related to 30-day hospital readmission in elderly individuals with HF using a two-tailed test of significance. However, treatment control ($r = -.26, p = .01$) was significantly related to 30-day hospital readmission in elderly individuals with HF using two-tailed tests of significance. This finding indicates that individuals who did not believe their treatment was effective in controlling their HF were readmitted within 30 days of hospital discharge. Therefore, Hypothesis 6, 7, and 9 were not supported, and Hypothesis 8 was partially supported.

Hypothesis 10

Hypothesis 10 was developed based on Horne's (1997) proposition that treatment beliefs influence self-regulative behaviors that, in turn, influence health outcomes. A Pearson product-moment correlation coefficient was computed to examine the hypothesized relationship between the NCD and 30-day hospital readmission for HF. The findings indicate that NCD was not related to 30-day hospital readmission for HF in

elderly individuals with HF using a two-tailed ($r = .06$, $p = .54$) test of significance.

Therefore, hypothesis ten was not supported.

Hypotheses 11–15

Hypotheses 11–15 were developed based on the theoretical propositions that coping procedures mediate the relationships between illness representations and treatment beliefs and illness outcome. An assumption of Baron and Kenny's (1986) method of testing for mediation requires that both independent and mediating variables are correlated with the outcome or dependent variable. Therefore, these hypotheses could not be tested because this assumption was not met. However, because no significant correlations were found where theory and empirical literature suggested there would be, other types of variables that may have affected these relationships, such as moderating or suppressing variables were investigated.

In summary most hypotheses were not supported. Hypothesis 5 was supported, and hypotheses 3 and 8 were partially supported. Hypotheses 11, 12, 13, 14, and 15 could not be tested because assumptions for regression analysis were not met, that is, the bivariate relationship between the mediator, medication adherence, and 30-day hospitalization, the dependent variable, were not significant.

Ancillary Findings

Additional analyses were conducted to (a) examine the independent effects of personal control representations and NCD on medication adherence; (b) examine the relationship between study variables (illness representations, treatment beliefs, medication adherence) and all-cause readmission; (c) examine the relationship between

demographic variables and study variables; and (d) test the effects of moderators on the theorized relationships that might explain negative main findings in this study.

Independent effects of personal control and NCD on medication adherence.

To test the independent effects of personal control representations and NCD on medication adherence/nonadherence (dichotomized variable), logistic regression analysis was conducted. When personal control and NCD variables were entered into the regression model simultaneously, NCD remained a significant predictor of medication adherence while personal control dropped out of the model and was not a significant predictor (see Table 6). The odds ratio indicates that the likelihood of medication adherence is nearly 1.7 times greater in individuals whose medication necessity beliefs outweigh their medication concern beliefs compared to individuals whose medication concern beliefs outweigh their medication necessity beliefs. The test of model coefficients indicated that the model was significant ($\chi^2 = 8.457, p = .015$). The goodness of fit statistic using the Hosmer-Lemeshow statistic indicated that the model was a good fit for the data ($\chi^2 = 8.644, df = 8, p = .373$). The overall accuracy of the model to predict patients being adherent to their medications was 75%.

Table 6

Odds of Personal Control and NCD Predicting Medication Adherence

Predictor	B	SE	P	Exp(B)	Wald
Personal control	-.49	.28	.07	.60	3.15
NCD	.51	.25	.04	1.67	4.14

Relationships among illness representations, treatment beliefs, medication adherence, and all-cause readmission. The CSM stipulates that illness representations, treatment beliefs, and coping procedures (medication adherence) influence health outcomes. The empirical literature reveals that readmission for any reason (i.e., all-cause readmission) is also an important and costly health outcome for individuals with HF. Therefore, additional analyses were carried out to investigate the relationships between the dimensions of illness representations, NCD, medication adherence and 30-day all-cause readmission. Pearson product moment correlations indicated that treatment control was inversely related to all-cause readmission in elderly individuals with HF using a two-tailed test of significance ($r = -.28, p = .005$).

Relationships between demographic factors and study variables. According to the CSM, self-regulation of illness is nested within a larger context that includes personal, social, and cultural factors that can influence both treatment beliefs and procedures for coping, that is, illness management behaviors (Leventhal et al., 1997). Thus, demographic characteristics can be considered important personal factors that may influence how one represents their illness, self-manages it, and experiences health outcomes. Accordingly, correlation coefficients were examined between demographic variables and the study variables. A comorbidity index was calculated based on the self-reported number of comorbid conditions such as depression, anxiety, diabetes mellitus, and hypertension. The comorbidity index score reflects the total number of comorbid conditions the subject reported as having presently or having a history of the condition. For example, a subject who reported a history of heart trouble, hypertension, and anxiety would have a comorbid index score of 3. Therefore a higher score reflects more

comorbid conditions. Findings revealed that several demographic characteristics were significantly related to particular dimensions of illness representations. Specifically, education level was inversely related to illness consequences ($r = -.21, p = .03$), number of years with the diagnosis of HF was directly related to timeline ($r = .27, p = .006$), receiving home health visits was inversely related to personal control ($r = -.23, p = .02$), and income level was inversely related to illness identity ($r = -.25, p = .01$). Moreover, the comorbidity index was directly related to all-cause readmission ($r = .22, p = .02$). To determine if any specific comorbid conditions alone were related to medication adherence or hospital readmission, additional correlations were performed. None of the comorbid conditions were significantly related to medication adherence/nonadherence when operationalized as a dichotomous variable. However, depression ($r = -.20, p = .05$) and anxiety ($r = -.21, p = .03$) were both inversely related to medication adherence as a continuous variable. In other words, those with current depression or anxiety or a history of depression or anxiety was associated with lower levels of adherence to medications. Findings also indicated that anemia ($r = .27, p = .007$), and high cholesterol ($r = .20, p = .04$) were directly related to 30-day hospital readmission for HF. Anemia was also significantly related to 30-day all cause readmission ($r = .25, p = .01$). In addition, lung disease, such as chronic obstructive pulmonary disease, was also directly related to 30-day all cause readmission ($r = .25, p = .01$). These findings suggest several demographic factors may have moderated expected significant relationships between illness representations and medication adherence or between illness representations and 30-day hospital readmission. Therefore, tests of moderation were undertaken.

Tests of Moderation

According to Baron and Kenny (1986), moderating variables help explain the circumstances that cause a weak or ambiguous correlation between two variables that were expected to have a strong relationship. In addition, Baron and Kenny indicate that moderators do not have to be correlated with independent or dependent variables in order to test for moderation. The interaction term represents a combined relationship between two independent variables which explains the additional variance in the dependent variable that is not explained by either variable alone. A moderating effect is present if the interaction term explains a statistically significant amount of the variance in the dependent/outcome variable (Bennett, 2000). Therefore, a series of 2-step hierarchical multiple regression analyses were conducted to examine any moderating effects of demographic variables on the relationships between the five illness representation dimensions (identity, timeline, personal control, treatment control, consequence) and medication adherence.

Moderating effects of demographic factors on the relationship between illness representations and medication adherence. Interaction terms were computed between demographic variables significantly related to illness representation variables (age, gender, number of years with diagnosis of HF, education level, home health visits, income, comorbidity index) and each of the five illness representation variables examined for hypothesis testing. A series of 2-step hierarchical linear regression analyses were conducted with the demographic moderator and illness representation entered in the first step, and the interaction term entered in the second step. The only interaction that was a significant predictor of medication adherence in elderly individuals with HF was illness

identity x number of years with HF diagnosis ($\beta = -.59, p = .01$). That is, number of years with HF diagnosis moderated the relationship between illness identity and medication adherence, and only the combined effects or interaction between illness identity (i.e., perception of multiple CHF-associated symptoms) and number of years with heart failure, were significantly and independently related to medication adherence (see Table 6).

Table 7

Moderating Effects of Years with CHF on Relationship between Illness Identity and Medication Adherence

Predictor Variables	Cumulative R^2	R^2 Change	Significance of Change
Illness Identity and Number of Years with HF Diagnosis	.001	.001	.96
Illness Identity x Number of Years with HF Diagnosis	.06	.06	.01

Moderating effects of demographic factors on the relationship between illness representations and 30-day hospital readmission. To determine if any demographic variables moderated the relationships between illness representation and 30-day hospital readmission, a series of binary logistic regressions were conducted. Scores for the dimensions of illness representations and demographic variables were standardized using Z-scores. Findings indicated a significant interaction between personal control and depression as a comorbid condition on probability of 30-day hospital readmission for HF (see Table 8). The coefficient on the interaction term personal control

x depression has a Wald statistic equal to 4.18 which is significant at the .05 level (95% confidence level). The odds ratio for the interaction indicates that persons who felt that they had personal control over this illness and were not depressed or did not have a history of depression were less likely to be readmitted within 30 days of discharge compared to persons who believed they had little personal control over their illness and were depressed or had a history of depression. The test of model coefficients indicated that the model was not significant ($\chi^2 = 5.29, p = .15$; see Table 9). The goodness of fit statistic using the Hosmer-Lemeshow statistic indicated that the model was a good fit for the data ($\chi^2 = 6.02, df = 7, p = .53$; see Table 9). The overall accuracy of the model to predict patients being readmitted within 30 days for HF was 92%.

Table 8

Moderating Effects of Depression on the Relationship between Personal Control and 30-Day Hospital Readmission

Predictor	<i>B</i>	<i>SE</i>	<i>p</i>	Exp(<i>B</i>)	Wald
Constant	-2.65	.53	.00	.07	24.20
Personal control	.66	.60	.26	1.94	1.22
Depression	-.05	1.03	.95	.94	.002
Personal control x Depression	-1.82	.89	.04	.16	4.18

DV: 30-Day Hospital Readmission for HF

Illness representation moderators of the relationship between other illness representations and 30-day hospital readmission. Finally, the CSM indicates that identity is the core dimension, or starting point of the development of an illness representation (Leventhal et al., 2003) and labeling the illness becomes the catalyst around which all the other dimensions are developed (Moss-Morris & Wrapson, 2003). Therefore, to determine if dimensions of illness representations were acting as

moderators on other dimensions in the relationship with the outcome variables of medication adherence and 30-day hospital readmission, additional linear and binary logistic regressions were conducted. Scores for the dimensions of illness representations were standardized using Z-scores. Interaction terms were computed between the illness representation dimensions in the main analysis of this study (identity, consequences, personal control, treatment control and timeline) and those that were measured, but not part of the main analyses in this study (illness concern, illness coherence and emotional representations). Results indicate a significant interaction between illness consequences and emotional representation on probability of 30-day hospital readmission for HF (see Table 9). These findings suggest that when elderly persons with HF have a high level of illness consequences and also feel that their HF strongly affects them emotionally, the odds of 30-day hospital readmission is 2.5 times higher compared to persons who have low levels of illness consequences. The coefficient on the interaction term illness consequences x emotional representation has a Wald statistic equal to 4.37 which is significant at the .05 level (95% confidence level). The test of model coefficients show that the model approached significance ($\chi^2 = 6.92, p = .07$; see Table 9). The goodness of fit statistic using the Hosmer-Lemeshow statistic suggests that the model was a good fit for the data ($\chi^2 = 8.52, df = 8, p = .38$; see Table 9). The overall accuracy of the model to predict patients being readmitted within 30 days for HF was 92%. No other dimensions of illness representations were found to moderate this relationship.

Table 9

Moderating Effects of Emotional Representations on the Relationship between Illness Consequences and 30-Day Hospital Readmission

Predictor	<i>B</i>	<i>SE</i>	<i>p</i>	Exp(<i>B</i>)	Wald
Constant	-3.17	.63	.00	.04	25.12
Illness consequences	1.02	.69	.14	2.79	2.16
Emotional representation	-.17	.56	.75	.83	.09
Illness consequences x Emotional representation	.92	.44	.03	2.52	4.37

Illness representation moderators of relationship between other illness representations and medication adherence. Results using linear regression to test the relationships between the interaction terms of illness representation dimensions and the continuous variable of medication adherence indicate that the only interaction that was a significant predictor of medication adherence in elderly individuals with HF was illness identity x illness concern ($\beta = -.74$, $p = .04$; see Table 10). That is, illness concern moderated the relationship between illness identity and medication adherence, and only the combined effects or interaction between illness identity and illness concern, were significantly and independently related to medication adherence. This interaction indicates that, when persons with HF have a high level of illness concern and also believe that their HF is associated with multiple symptoms, they are more adherent to their medications.

Table 10

Moderating Effects of Illness Concern on the Relationship between Illness Identity and Medication Adherence

Predictor Variables	Cumulative R^2	R^2 Change	Significance of Change
Illness Identity and Illness concern	.03	.03	.16
Illness Identity x Illness concern	.07	.04	.04

DV: Medication Adherence

CHAPTER 5. DISCUSSION OF THE FINDINGS

The purpose of this study was to examine the relationships among dimensions of illness representations, treatment beliefs, medication adherence, and 30-day hospital readmission in elderly individuals with chronic HF. The findings in this chapter are discussed in the context of theoretical propositions derived from the Common Sense Model of Self-Regulation (Leventhal et al., 1980) and the Necessity-Concern Framework (Horne, 1997).

In a brief review, Leventhal and colleagues (1980) proposed that illness representations influence self-regulative behaviors, that is, coping procedures, which in turn influence health outcomes. According to both theoretical and empirical literature, treatment adherence, a self-regulative procedure, is a function of both illness representations (Leventhal et al., 1992; Meyer et al., 1985; Petrie et al., 1996) and treatment beliefs (Horne & Weinman, 1999, 2002). The specific dimensions of illness representations that were investigated and the direction of the relationships was based upon review of the empirical literature in samples with chronic illness with a particular focus on cardiovascular disease when studies were available.

Illness Representations and Medication Adherence

Of the five illness representations examined (timeline, consequences, personal control, treatment control, identity), only one (personal control) was significantly related to medication adherence in bivariate analysis. One explanation for the insignificant bivariate correlations was a lack of variability in medication adherence scores in the study sample. Only 25 subjects had a total adherence score on the MARS of 20 or less which represents non-adherence. This finding of skewed data on self-reported adherence

measures is consistent with the literature. Socially desirable responses and fear of admitting non-adherence to health care provider instructions are cited as common reasons for high self-reported adherence scores in research (Piette, Heisler, & Wagner, 2004; Wu, Moser, Chung, & Lennie, 2008). In addition, another potential methodological factor that may have affected subject response to items on the MARS was the broad or general nature of the questions on this instrument. The MARS does not assess a specific medication (e.g., furosemide or digoxin) or class of medications (e.g., beta-blocker or diuretic). This may have made it more difficult for individuals to answer the questions as they may always take their digoxin, but because of urinary concerns, don't always take their diuretic as prescribed.

Hypothesis one tested the CSM theoretical proposition that one's perception that CHF is a chronic illness is positively related to medication adherence; that is, a person who believes that CHF will last a long time will be adherent to their medication regimen. This hypothesis was not supported. Despite lack of variability in medication adherence scores, these findings are consistent with some studies as the literature was contradictory on this relationship. In other words, some researchers found that chronic illness timeline was associated with medication adherence (Byrne et al., 2005; Chen et al., 2009; Meyer et al., 1985) while others reported no correlation between chronic timeline and adherence (Brewer et al., 2002; Ross et al., 2004) or that an acute timeline was associated with medication adherence, measured by serum drug levels, in individuals with heart failure (Molloy et al., 2009). A possible explanation for the contradictory findings could be the difference in the use of subjective and objective measures of medication adherence. Future research including both subjective and objective measures as well as a measure of

social desirability may be considered. Another explanation offered by Ross and colleagues (2004) who also found no relationship between chronic timeline and medication adherence is that subjects were not newly diagnosed and, having had the illness for a long time, may not be as diligent in medication taking. In addition to lack of variability in adherence scores, the mean score for illness timeline in this sample was 7.57, meaning this sample largely endorsed CHF as a chronic illness, again indicating little variability on this measure as well. Chen and colleagues reported a mean of 18.71, out of a total score of 25 when using the IPQ-R, which has 5 items measuring the timeline dimension. Byrne and colleagues (2005) reported a mean score of 22.51 out of a total 30 when utilizing the IPQ, which has 6 items to measure the timeline dimension. These results reveal the potential for more variability in illness timeline scores when assessed with multiple items. In the current study, illness timeline was measured with a single item and this may potentially explain the differences in findings when compared to the literature.

Hypothesis 2 tested the theorized relationship that an individual's perception of CHF as a serious illness with many negative consequences is significantly related to their level of medication adherence. This hypothesis was also not supported and this finding adds to an inconsistent body of literature where results have ranged from supporting (Brewer et al., 2002) to not supporting this relationship (Byrne et al., 2005). Moreover, past research has also revealed a rather unexpected finding, that serious consequences are related to non-adherence (Horne & Weinman, 2002; Molloy et al., 2009). Some have suggested that other dimensions of illness representations, such as the emotional representation, may interact with the consequence dimension that in turn may alter the

individual's coping and therefore behaviors (Ross et al., 2004). However, ancillary analyses in this study revealed no significant interactive effects between other dimensions of illness representations, including emotional representations, and illness consequences on medication adherence. A possible explanation for this negative finding may be related to the concept of consequences itself. Illness consequences was theoretically defined in this study as the imagined or anticipated repercussions of the health threat; how the illness will affect the person's life including the physical, psychological, social and economic domains (Leventhal et al., 2003, 2010). Essentially the consequences are viewed as something that will happen in the future secondary to the disease. In fact it is reported that over half of people with HF die within five years of diagnosis (Go et al., 2013). However, in this study sample, the mean number of years the individuals had the diagnosis was high, 7.75 years. Therefore, many of these subjects have likely suffered the consequences of living with HF for this long period of time and this has not only shaped their illness representations, but their illness management behaviors. Hence, they adhere to their medication regimen because of their *actual* experiences with consequences of the illness, rather than to try and prevent future sequelae. Finally, another potential explanation for the negative findings related to this relationship was little variability on the measure of consequences in this sample. Replication of this study in elders with CHF is warranted.

Hypothesis 3 indicated that a person's belief that personal or treatment control over their CHF is directly related to medication adherence. The hypothesis was partially supported, as findings revealed a significant inverse relationship with personal control, but not treatment control. That is, individuals who had strongly held beliefs that they did

not have a lot of personal control over their illness were adherent to their medication. This counterintuitive finding was also reported by Ross et al. (2004). They explained that non-adherence and high personal control may reflect internal locus of control beliefs and it is more difficult for this type of person to accept recommended treatment regimens. It is also possible that individuals did not view their medication taking as a behavior or strategy that they personally control, but rather that something outside of them, the medication, is what is controlling their illness. Alternatively, Moss-Morris and Wrapson (2003) suggest that beliefs about cure/control reflect an individual's causal beliefs. That is, a person's causal attributions of the illness may shape their beliefs about whether it can be controlled or cured. For example, if an individual feels that illness is caused by altered immunity, they are likely to use medicines or alternative measures that boost the immune system, not something that might further compromise it, such as glucocorticoids. In this study, the cause dimension was not analyzed and may moderate these relationships, as several other dimensions of illness representations did. A recommendation for further analysis would be an analysis of any interactive effects between cause and control representations which may help to explicate their relationship with medication adherence in elderly individuals with CHF.

Hypothesis 4 indicated that one's belief that CHF is associated with multiple symptoms, that is, illness identity, is directly related to medication adherence. This hypothesis was also not supported in the current study. While this finding is consistent with results in other studies (Byrne et al., 2005; Chen et al., 2009; Jessop & Rutter, 2003), the negative findings in the studies cited were explained by the researchers as little variability on the "low end" of illness identity. That is, participants in their studies

identified little to no illness-related symptoms. However, the mean score for illness identity representations was 6.18 in this study, indicating that elders experienced a moderate number of CHF-related symptoms. A plausible explanation for the negative relationship between illness identity and medication adherence in this study may be the particularly salient “if-then” questions that Leventhal and colleagues (2003) theorize that individuals use to create their self-regulation system. For example, this questioning is part of the process individuals undertake to decide whether a symptom is because of an illness or just aging. It is possible that in this sample of participants, who were elderly, that they did not identify symptoms as a possible exacerbation of their HF, but rather just part of getting older. For instance, an older adult may interpret the symptom of fatigue in the following way, “If I feel tired because I am old, then I don’t need this medicine because it is not my heart causing me to feel tired.” In addition, participants in this study reported multiple comorbidities, and they may not have identified particular symptoms, such as difficulty breathing, as a result of their HF, but rather felt it is because of another comorbid condition such as COPD. Leventhal and colleagues (2010) note that individuals with more than one physical illness may attribute symptoms incorrectly. Therefore, the medication regimen for managing shortness of breath due to COPD differs from that of HF, which may in turn affect their adherence. In fact, this phenomenon was identified by Horowitz, Rein, and Leventhal (2004) in a qualitative study of patients with HF. They found that few patients used medication to treat symptoms of shortness of breath and swollen legs because they did not identify these symptoms as coming from their heart condition. Lastly, ancillary tests for moderation conducted in this study revealed a potential moderator that may have blunted the anticipated significant effect of

illness identity on medication adherence. Number of years with CHF moderated the expected significant relationship between illness identity representations and medication adherence and may explain the negative bivariate relationship. The role of number of years of heart failure as a moderator suggests that an elder's belief that their illness has multiple symptoms is significantly associated with medication adherence only *when* the elder has had heart failure for a long period of time. This finding is also consistent with the CSM premise that illness representations are a product of the individual's understanding, skills, and years of experience with an illness (Leventhal et al., 2001). Individuals that have had HF for a long period of time, such as those in this sample (mean number of years with HF = 7.75) have likely received years of education and counseling from the medical establishment, improving knowledge and skills in disease management (Leventhal et al., 2001; Linne, Liedholm, & Israelsson, 1999).

Necessity-Concerns Differential and Medication Adherence

Hypothesis 5 indicated that the necessity-concern differential (NCD) is directly related to medication adherence. That is, persons with beliefs about medication necessity that outweighed their medication concerns were more adherent to their medication regimen. The mean score for the necessity-concerns differential in this study indicated that, in general, participants' beliefs about the necessity for their medications far outweighed the concerns they had about the medication. This hypothesis was supported in this study. Additionally, in multivariate analysis when personal control and NCD were entered into the model, NCD was the only predictor that remained significant. These findings are consistent with the literature (Aikens et al., 2005; Horne & Weinman, 1999;

Jónsdóttir et al., 2009) and indicate the importance that medication beliefs have for adherence in this population.

Illness Representations and 30-Day Hospital Readmission

Of the five illness representations examined in this study, only one, treatment control, was significantly related to 30-day hospital readmission in bivariate analysis. Similar to medication adherence scores, the level of 30-day readmission for participants in this sample was quite low. Thirteen subjects (13.5%) were readmitted within 30-days and of those, only eight (8.3%) were readmitted for an exacerbation of their HF. Thus, there was little variability in the sample on this variable, which may explain, in part, the negative bivariate relationships. Factors extraneous to the study may have also led to low variability in hospital readmission in the study sample. The timing of the study coincided with the implementation of the Affordable Care Act's Hospital Readmissions Reduction Program. This program, effective October 1, 2012, requires that the Centers for Medicare and Medicaid Services (CMS) reduce payments to hospitals with excess readmissions (CMS, 2013). The hospital recruitment site had programs in place to prevent readmission, including a CHF telephonic case management program, follow up phone calls by unit staff and screening of every individual with a HF diagnosis for discharge needs. During the time recruitment was conducted, the hospital also opened its own home health agency, with concurrent education of the case managers on available resources and encouraging this new agency as an option for eligible patients. Additionally, one of the local hospice agencies began a palliative care program specifically for patients with HF, which is one of the American Heart Association's "Get with the Guidelines" recommendations. A goal of the program is to prevent unnecessary

emergency room visits and hospitalizations (Lower Cape Fear Hospice & LifeCareCenter, 2008).

Hypothesis 6 indicated one's illness timeline beliefs are positively related to hospital readmission; that is, the belief that CHF is a chronic illness is directly related to 30-day hospital readmission. This hypothesis was not supported. Limited literature examining the relationships between illness representations and illness outcome was available and none examined hospital readmission. Findings from the current study are consistent with those that examined other objective illness or behavioral outcomes such as returning to work or length of hospitalization (Kaptein et al., 2003). Hekler and colleagues (2008) found there was no relationship between illness timeline and blood pressure control in bivariate correlation. Similarly, Griva et al. (2000) found no correlation between timeline and glycosylated hemoglobin levels in a sample of adolescents with diabetes. On the other hand, Frostholm and colleagues (2005) did find significant correlations between timeline representations and health care utilization; however they noted there was a lot of missing data and, that older participants were less likely to complete the questionnaires. In fact, the age cutoff for study participation was age 65, and the mean age of the sample was 38.8 years, much younger than the present study. Therefore, current study findings are similar to those in the literature investigating the illness timeline representations and objective health outcomes.

Hypothesis seven indicated that illness consequence representations are positively related to 30-day hospital readmission; that is, one's beliefs that CHF has serious consequences, is related to medication adherence. This hypothesis was not supported. However, an ancillary test revealed a potential moderator of this relationship and may

provide an explanation for the negative finding. According to Baron and Kenny (1986) moderators are intervening variables that influence the relationship between an independent and dependent variable, in this case consequence beliefs and 30-day hospital readmission. Bennett (2000) states that “moderators explain the circumstances that cause a weak or ambiguous association between two variables that were expected to have a strong relationship” (p. 415). Moderator testing focuses on “when” the relationship between independent and dependent variables occurs. In this instance, emotional responses to CHF blunted the expected effect of consequence representations on 30-day hospital readmission. In other words, the relationship between consequences and 30-day hospital admission occurred in the sample *only* for participants who had high scores on emotional representation items. Moderation testing revealed that the interaction between negative emotional responses (i.e., person is emotionally affected by CHF) and a belief that CHF has serious consequences was significantly and independently related to 30-day hospital readmission. The role of negative emotional reactions as a moderator suggests that an elder’s belief that CHF is associated with serious consequences is significantly associated with 30-day readmission *when* the elder also is extremely emotionally affected by the illness. Additionally, these findings are congruent with some of the studies reviewed (Griva et al., 2000; Hekler et al., 2008; Vaughan et al., 2003) but not with others (Brewer et al., 2002; Frostholm et al., 2005; Petrie et al., 1996). A possible reason for the equivocal findings may lie in the particular health condition of the study sample. For instance, in studies that did not find a relationship between illness consequence representations and illness outcome, the diseases were diabetes mellitus, hypertension, multiple sclerosis and HF, all chronic health conditions that are insidious and exert a

negative impact on people over time. However, those studies that did find a significant relationship between illness consequence representations and health outcome included persons with hypercholesterolemia, myocardial infarction and those seeking care at a primary care practice for a complaint. These individuals may perceive these diseases as having very acute consequences that have an impact on them immediately or one that has severe long-term consequences such as an MI or stroke in the persons with hypercholesterolemia which may in turn lead to a more timely response by individuals. Another possible explanation is that in individuals with a chronic illness that requires ongoing treatment such as diabetes and HF, they had already experienced consequences, affecting their perceptions about the illness and how to respond or prevent them.

Hypothesis 8 indicated that one's beliefs about illness control, (i.e., personal control and treatment control) are inversely related to hospital readmission. This hypothesis was partially supported. Treatment control was significantly and inversely related to 30-day hospital readmission, indicating that individuals who did not believe their treatment was effective in controlling their illness also had higher levels of readmission. These findings are consistent with others. For example, Halimi and colleagues (2007) examined control of asthma and its relationship to hospital admission. Hospital admission was significantly related to external control beliefs as well as an increased risk of non-adherence. External control beliefs, such as treatment control, were significantly related to hospital readmission in this study. These findings underscore the importance of one's belief that their treatment is working. Bivariate analysis also revealed that personal control was not related to 30-day hospital readmission. However, an ancillary test indicated a potential moderator of this relationship. Moderation testing

revealed that the interaction between depression as a comorbid condition and personal control was significantly and independently related to 30-day hospital readmission. The role of depression as a moderator suggests that an elder's belief that he or she has little personal control over their CHF is significantly associated with 30-day readmission *when* the elder has a diagnosis of depression. In this sample, approximately 31% of participants reported a history of or current diagnosis of depression, a level similar to findings from a meta-analysis that reported an estimated prevalence of clinically significant depression in patients with HF at 21.5% (Rutledge, Reis, Linke, Greenberg, & Mills, 2006).

Hypothesis 9 indicates that a person's belief about symptoms that are associated with an illness is directly related to 30-day hospital readmission. This hypothesis was not supported in bivariate analysis and it contradicts the findings of others (Brewer et al., 2002; Frosthalm et al., 2005; Griva et al., 2000; Vaughan et al., 2003). However, an ancillary test revealed a potential moderator that may explain the insignificant relationship in this study. Moderation testing revealed that the interaction between illness concern and illness identity was significantly and independently related to 30-day hospital readmission in multivariate analyses. Illness concern is an item on the BIPQ that measures one's emotional response to an illness and taps the CSM emotional representation dimension. The role of illness concern as a moderator suggests that an elder's belief that he or she has multiple symptoms associated with their CHF is significantly associated with 30-day readmission *when* the elder also has a high level of concern about their illness. This finding also emphasizes the complexity of relationships among illness beliefs, emotional responses, and health outcomes in persons with CHF,

and it underscores the need for further examinations and rigorous exploration of these complex relationships.

Necessity-Concerns Differential and 30-Day Hospital Readmission

Hypothesis 10 indicated that one's beliefs about the necessity of medications outweighs their concerns about medications (i.e., necessity-concerns differential) and is inversely related to hospital readmission. This hypothesis was not supported. These findings are similar to findings of others (Aikens & Piette, 2009; Jones et al., 2006). It is difficult to make comparisons as so few researchers have used the necessity-concerns differential to measure treatment beliefs. Despite this difference in measurement, Aiken and Piette reported that neither anti-hyperglycemic medication necessity nor concerns was associated with the illness outcome of glycosylated hemoglobin. This was true in the current study as well, neither the individual subscales nor the necessity-concerns differential were related to 30-day hospital readmission. Jones and colleagues (2006) reported similar findings where patients with poorly controlled epilepsy reported more concerns about medications, but it was not a statistically significant finding. A possible explanation for the lack of findings in the current study may be that individuals have worked with their health care providers to tailor their medication regimens over time. This sample overall had HF for many years, so that concerns about safety and side effects have been addressed with a change in medication. Therefore, the concerns had been eliminated over time.

Adequacy of the CSM for Explaining Medication Adherence and Hospital Readmission in Older Adults with CHF

There was limited support of many of the hypotheses tested in this study. However, according to Leventhal and researchers (2010) this is to be expected because “social-biological systems are complex; the enormous number of possible interactions among their many parts pose a challenge to theoretical ingenuity and methodological skills” (p. 58). Findings from this study revealed the complexity of the self-regulation system. Self-regulation is not a linear process. It occurs within a sociocultural context, and illness representation dimensions interact with personal, social, environmental, and cultural factors in their effects on illness self-management and health outcomes. Relatively little work has been done in examining these interactions in explaining self-regulation behaviors and health outcomes, and more research is sorely needed in this area.

CHAPTER 6. SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary

This study was designed to gain knowledge about elderly individual's beliefs about their chronic HF, its treatment, medication taking and 30-day hospital readmission for HF exacerbation. This study examined theoretically derived relationships among four dimensions of illness representations (identity, timeline, cure/control and consequences), the difference between specific necessity and concern treatment beliefs, coping procedures used to manage the illness threat (medication adherence) and illness outcome (30-day hospital readmission). The relationships originated from theoretical propositions in the Common Sense Model of Self-Regulation (Leventhal et al., 1980) and the Necessity-Concern Framework (Horne, 1997).

The following hypotheses were tested:

1. Perception of illness timeline as chronic is related to medication adherence.
2. Perception of serious illness consequences is directly related to medication adherence.
3. Perception of illness control is directly related to medication adherence.
4. Perception of illness symptoms is directly related to medication adherence.
5. The necessity-concern differential is directly related to medication adherence.
6. Perception of a chronic illness timeline is positively related to hospital readmission.
7. Perception of serious illness consequences is positively related to hospital readmission.

8. Perception of illness control is inversely related to hospital readmission.
9. Perception of illness symptoms is directly related to hospital readmission.
10. The necessity-concern differential is inversely related to hospital readmission.
11. When medication adherence is controlled for, the magnitude and significance of the relationship between illness timeline and hospital readmission will diminish.
12. When medication adherence is controlled for, the magnitude and significance of the relationship between illness consequences and hospital readmission will diminish.
13. When medication adherence is controlled for, the magnitude and significance of the relationship between illness control and hospital readmission will diminish.
14. When medication adherence is controlled for, the magnitude and significance of the relationship between illness identity and hospital readmission will diminish.
15. When medication adherence is controlled for, the magnitude and significance of the relationship between the necessity-control differential difference between beliefs about the necessity and concerns of medications and hospital readmission will diminish.

The study sample consisted of 96 older adults that were being discharged to home from one of three medical-surgical or cardiac telemetry units at a regional medical center in southeastern North Carolina. Subjects were included if they met the inclusion criteria; were age 55 or older, had a primary or secondary diagnosis of heart failure, were able to

read, write and understand English, had access to a telephone and were independent in medication taking. Individuals were excluded if they lived in a nursing home or other facility that assists in medication administration, spoke a language other than English and/or had a cognitive impairment. The sample was 59% male and 41% female. Ages ranged from 55 to 86. Seventy-three percent of the sample was Caucasian, 26% Black or African American, and 1% Native American. Of the 96 participants, eight were readmitted within 30 days for HF exacerbation, an incidence of 8.3%.

Data were collected on the independent variables using self-report scales administered during a telephone call to subjects within a week of discharge from the hospital. The following instruments were used: illness representation dimensions were measured using the nine-item Brief Illness Perception Questionnaire (Broadbent et al., 2006); the necessity-concerns differential was used to operationalize treatment beliefs and was measured using the BMQ (Horne et al., 1999) specific subscales; medication adherence was measured using the medication adherence report scale (MARS), a five-item scale originally created to assist in the psychometric evaluation of the BMQ (Horne et al., 1999). A Demographic Questionnaire developed for the study was used to collect the following demographic information from study participants: age, gender, race, number of prescription medications taken daily, marital status, level of education and years since diagnosis with CHF. Data on the dependent variable, hospital readmission was measured during a follow up phone call to participants 30 days after hospital discharge using a yes/no question asking if they had an unplanned admission to the hospital within the past 30 days. If participants responded yes to the question, indicating

that a hospital readmission occurred, their medical record was reviewed to identify the primary admitting diagnosis.

Hypotheses 1 through 10 were tested using Pearson product-moment correlation coefficients and regression analysis. Variables found to be significantly correlated with medication adherence when dichotomized, personal control and necessity-concern differential, were subjected to logistic regression analysis. Results indicated that the likelihood of medication adherence is 1.5 times greater in individuals whose medication necessity beliefs outweigh their medication concern beliefs than individuals whose medication concern beliefs outweigh their medication necessity beliefs in this sample of older adults with chronic HF. Hypotheses 11–15 were not tested because assumptions of the test of mediation were not met.

In summary, few of the dimensions of illness representations and treatment beliefs were found to be significantly related to either medication adherence or 30-day hospital readmission in bivariate correlation in this sample. However, in follow up analyses, many of these relationships were moderated by other dimensions of illness representations and demographic variables.

Limitations

One limitation of the study includes its cross sectional design. The design did not allow for assessment of changes in variables over time and therefore, no cause and effect could be determined. Multiple factors decrease the generalizability of the study findings and include: (a) One recruitment site; (b) Older adults were the focus of the study and findings cannot be generalized to any other age group; (c) Non-English speaking individuals were not included in the study due to constraints of study staff and

instruments; and (d) Participation was voluntary and therefore could be a source of bias, due to differences between those that volunteered and those that did not.

Conclusions and Implications for Nursing

Conclusions that can be drawn from this study of 96 older adults with chronic HF are:

1. Perceived lack of personal control over HF and the belief that medication necessity outweighs medication concerns was significantly related to medication adherence.
2. The belief that an individual's treatment is not controlling their HF was significantly related to 30-day hospital readmission.
3. Moderators, in particular those characterizing the emotional representation of the CSM interacted with the cognitive dimensions of illness representation to affect the relationships with medication adherence and hospital readmission.

Adherence to therapeutic treatment regimens is a necessary behavior in the management of chronic illness. Since medication adherence is a potentially modifiable behavior, and one that nursing can intervene upon, understanding the factors that affect adherence is critical in developing strategies that effectively increase adherence and thereby prevent negative outcomes such as hospital readmission. According to theory, that is, the CSM of Self-Regulation and the Necessity Concerns Framework, there are two potentially modifiable antecedents to medication adherence; an individual's beliefs about his or her illness and beliefs about its treatment. These factors are theorized to influence medication adherence that, in turn, influences illness outcomes.

In the current study, personal control and treatment necessity outweighing treatment concern were two factors related to medication adherence. Nurses can use this information to help identify individuals who may be at risk of being non-adherent. For instance, the Brief IPQ and the BMQ specific subscales could easily be incorporated into an admission assessment, review of health history or medication reconciliation process already in place to assess the individual's beliefs. Identifying individuals who may be at risk for non-adherence is one of the first steps in addressing this problem. More importantly, this research identifies individuals with high personal control as being non-adherent, which is the opposite of what one would expect. In practice, nurses encourage personal control and self-care in illness management but in some elderly individuals with heart failure, encouraging personal control may have negative consequences such as medication non-adherence. While discouraging personal control in this population seems counterintuitive, findings from this study suggest that personal control in some elders with CHF may be a marker for medication non-adherence. Clearly, further exploration regarding the meaning of personal control in this population is necessary.

Findings from this study also confirm that there are additional individual personal factors to consider when we are intervening to improve adherence or prevent hospital readmission. Personal health history, such as current or past comorbid conditions, was an important antecedent to or moderator of illness outcomes in this study. The findings from this research indicate that nurses in both acute and community-based settings such as homecare should carefully assess the health history of elders with CHF and target strategies to improve medication adherence in those individuals with particular current or past health conditions such as depression or anxiety.

Finally, the findings related to treatment beliefs in this study have important implications for nursing practice. When individuals in this study believed that their treatment was not effective in controlling their HF, they were readmitted within 30 days for HF. Additionally, participants were more adherent when they believed that medication necessity outweighed the concerns they had about their medicines. It is possible that individuals hold misconceptions about their treatment or medications or they may have unmet expectations related to their treatment. Nurses are in a perfect position to assess treatment beliefs on an individual basis, correct any misconceptions and/or collaborate with other members of the health care team, such as physicians and pharmacists, to either help patients better understand their treatments or determine another course of treatment.

Recommendations

Based on the findings from the current study, directions for future research include:

1. Replication with multiple sites to increase generalizability of findings.
2. Use of objective measures of medication adherence to validate reliability of self-report measures and eliminate error due to problems with memory and recall.
3. Measurement of all dimensions of illness representations and investigate both the cognitive and emotional pathways.
4. Interventional studies aimed at changing treatment beliefs to improve medication adherence and changing treatment control beliefs to assess effect on hospital readmission is warranted.

5. Qualitative exploration of personal control and its meaning in relationship to medication adherence in HF is necessary to better understand the unexpected findings in this study.
6. Exploring the relationships among anxiety, depression, illness representations, treatment beliefs and medication adherence are necessary and should be sure to differentiate whether the anxiety and depression are a current or past problem.
7. Research that attempts to explain the interaction between illness representation dimensions and personal, social, environmental, and cultural factors and how these interactions effect illness self-management and health outcomes is needed.

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CURRICULUM VITAE

- 1973 Born July 13, Pompton Plains, New Jersey
- 1991 Graduated Lakeland Regional High School, Wanaque, New Jersey
- 1995 Graduated, Bloomsburg University, Bloomsburg PA, BS in Nursing
- 2004 Graduated, Rutgers, The State University of NJ, Newark, MS in Nursing
- 2006 Post-Master's Certificate in Nursing Education, Indiana University School of Nursing

Principal Positions/Occupations

- 1995–2001 Staff Nurse, Englewood Hospital and Medical Center Englewood, NJ
- 1999–2003 Substitute School Nurse, Butler School District, Butler, NJ
- 2001–2003 Nurse Educator Staff Development, Englewood Hospital and Medical Center, Englewood, NJ
- 2003–2003 Adjunct clinical faculty: Ramapo College, UMDNJ, Englewood Hospital and Medical Center Joint BSN Program, Englewood, NJ
- 2003–2004 Adjunct clinical faculty: Horry Georgetown Technical College, Conway, SC
- 2004–Present Lecturer: University of North Carolina Wilmington, Wilmington, NC
- 2007–Present Staff Nurse, J. Arthur Doshier Memorial Hospital, Southport, NC