ILLNESS REPRESENTATION AND MEDICATION ADHERENCE OF PATIENTS WITH CHRONIC KIDNEY DISEASE

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ABSTRACT

M. Sue McManus

ILLNESS REPRESENTATIONS AND MEDICATION ADHERENCE

OF PATIENTS WITH CHRONIC KIDNEY DISEASE

Chronic kidney disease (CKD) places a high personal and economic burden globally on individuals, families, and society. Although kidney protective medications slow the progression of CKD to end stage kidney disease, adherence to these medications is inadequate. The primary purposes of this study are to: 1) describe the illness and treatment beliefs of CKD patients in stage 3 guided by the Common Sense M model (CSM); and 2) examine the relationship of those beliefs with adherence to renal protective medications, ACE-I. Secondary purposes of this study include determining adherence levels of ACE-I among patients with CKD stage 3; examining relationships between individual and clinical characteristics with patient beliefs and medication adherence with ACE-I; and examining the relationship between the Medication Adherence Report Scale (MARS) and the Medication Possession Ratio (MPR).

Using a descriptive cross-sectional design, a convenience sample of 92 individuals with Stage 3 CKD was obtained from a Midwestern VA medical center. Data were collected through self-administered mailed surveys and medical record reviews. Data analyses were performed using descriptive statistics, correlation, t-tests and ANOVA. Seventeen symptoms experienced were perceived as related to CKD by at least one respondent with most reporting legs/feet swelling (n=31). Top perceived cause of CKD was aging (60%). Revised Illness Perception Questionnaire (IPQ-R) items were scored from 1 to 5 with higher scores indicating perceptions of higher personal and

treatment control of chronic, cyclical illness with serious consequences and negative emotional reactions. In this study, the CKD timeline was perceived as a long-term chronic rather than short-term acute condition (M = 3.8), with minimal cyclical exacerbations (M = 2.7), and moderate severity of consequences (M = 3.1). Respondents perceived having both, but more personal control than treatment control of CKD (M = 3.5 v 3.2). Participants did not perceive CKD as related to a great negative emotional response (M = 2.8). Illness Representations were not found to be significantly correlated with self-reported medication adherence. Medication adherence levels by self-report (M = 4.8 [5 = perfect adherence]) and pharmacy refill records (73% had perfect refill ratio of 1:1) reveal highly adherent levels among this sample.

Janet L. Welch, PhD, RN, FAAN, Chair

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LIST OF ABBREVIATIONS

Abbreviation	Definition
ACE-I	Angiotensin Converting Enzyme Inhibitors
ANG II	Angiotensin II
ANOVA	Analysis of variances analyses
ARB	Angiotensin receptor blockers
CKD	Chronic Kidney Disease
CSM	Common Sense Model
CVI	Index of Content Validity
DM	Diabetes Mellitus
ESRD	End Stage Renal Disease
HTN	Hypertension
IPQ-R	Revised Illness Perception Questionnaire
MARS	Medication
MBM	Medical Belief Model
MPR	Medication Possession Ratio
NHANES	National Health and Nutrition Examination Survey
NKF	National Kidney Foundation
NO	Nitric oxide
PI	Principal Investigator
RAS	Renin-angiotensin system
RENAAL	Reduction in Endpoints in Non-Insulin Dependent Diabetes Mellitus with the Angiotensin II Antagonist Losartan Study
SBM	Stress Belief Model

VAMC	Veterans Administration Medical Center
VISTA	Veteran's Health Information System Technology Architecture

CHAPTER 1

Background

Chronic kidney disease (CKD) has become recognized as a national and international public health problem since it was defined and staged in 2002 (Amaresan & Geetha, 2008). This devastating disease is estimated to affect 16 % or 31 million U.S. citizens (U.S. Renal Data System (USRDS), 2008a). CKD is a progressive disease moving from asymptomatic, early stages with indications of kidney damage (i.e. albumin in the urine) to overt, later stages with indications of whole organ damage and symptoms from failing filtering capacity (i.e. insufficient glomerular filtration rate). The progression of CKD is not an isolated event; it is accompanied by a decreased quality of life, multiple co-morbid conditions, and premature mortality, all of which impose huge personal and economic burdens on patients, families, society, and health care systems worldwide (National Institutes of Health & National Institute of Diabetes and Digestive and Kidney Diseases, 2007; National Kidney Foundation, 2007; Tonelli et al., 2006; USRDS, 2008a). The final stage of CKD, recognized as end stage renal disease (ESRD) requires life-long, life-sustaining treatments which carry even higher human and economic burdens than the earlier stages (U.S. Renal Data System (USRDS), 2008b).

Kidney protective medications such as Angiotensin Converting Enzyme Inhibitors (ACE-I) have been shown to slow progression of CKD through reduction of proteinuria, yet the overall estimated prevalence of CKD is still increasing at an alarming rate (Coresh et al., 2007; de Zeeuw et al., 2006; Kopyt, 2005; USRDS, 2008a). Research indicates that although these medications are increasingly prescribed to those with early stage renal disease (Cooke & Fatodu, 2006; Philipneri et al., 2008; Schmieder, 2005), adherence to

these medications is not adequate and non-adherence may be associated with the continued progression of CKD to ESRD (Bailie et al., 2005; National Kidney Foundation, 2004; Williams, Manias, & Walker, 2008). The renal protective effects of ACE-I medications are dependent on CKD patients' adherence to taking them as prescribed over an extended period of time.

There is an abundance of literature on predictors of medication adherence in chronically ill populations indicating non-adherence rates of approximately 50% (National Counsel on Patient Information and Education, 2007; National Quality Forum, 2005; Peterson, Takiya, & Finley, 2003; World Health Organization, 2003). No empirical evidence is available, at this time that identifies predictors of medication adherence among early stage CKD patients. Given the vast size of the CKD population and heavy burden of the disease progression, it is imperative that studies be designed to examine predictors of medication adherence to ACE-I in patients with pre-ESRD stages of CKD. CKD stage 3 is an ideal stage in which to study renal protective medication adherence because it is most often accompanied by proteinuria and a continuous decline in renal function (Garcia-Donaire, Segura, & Ruilope, 2005). Unless this progression is halted, the patient with stage 3 CKD will either progress through the CKD stages to ESRD (stage 5) requiring dialysis or transplantation to sustain life or die prematurely from cardiovascular events (Coresh etal., 2007; Keith, Nichols, Gullion, Brown, & Smith, 2004).

There is an expanse of medication adherence research available with no consistent reliable and valid empirical support for specific antecedents of long-term medication

adherence. There is growing evidence that medication adherence is affected by patients' beliefs about their illness and treatments (DiMatteo, Haskard, & Williams, 2007; Haynes, Ackloo, Sahota, McDonald, & Yao, 2008; Peterson et al., 2003; Vermeire, Hearnshaw, Van Royen, & Denekens, 2001). Patient beliefs about the nature of their illness and treatment have been shown to be predictive of long-term medication adherence (Horne, Weinman, Barber, Elliott, & Morgan, 2005; National Counsel on Patient Information and Education, 2007; World Health Organization, 2003). Leventhal's self-regulatory common sense model (CSM) (Leventhal, Brissette, & Leventhal, 2003; Leventhal, Diefenbach, & Leventhal, 1992) is an appropriate theoretical framework in which to study the relationship between CKD stage 3 patients' beliefs about their illness and treatment and adherence to renal protective medications, ACE-I. The CSM is a health specific model that examines the cognitive and emotional activities that take place throughout the chronic illness experience. As such, the CSM captures vital health and illness aspects unique to individual experiences and provides beneficial information to healthcare providers. The model may be used to help clinicians develop appropriate interventions by gaining understanding of human efforts to protect health and reduce the threat caused by chronic illness (Leventhal et al., 2003; Leventhal, Leventhal, & Cameron, 2001).

Statement of the Problem

Chronic kidney disease is a progressive disease leading to ESRD or premature death from cardiovascular events. CKD places a high personal and economic burden on individuals, families, and society, as well as national and international healthcare systems. Research indicates less than adequate adherence to medications that have been

shown to slow progression of CKD to ESRD and help prevent cardiovascular events. There are no studies examining predictors of adherence to ACE-I, renal protective medications, in CKD stage 3 patients. Descriptive and correlation studies of medication adherence are needed with this population as a basis for future prospective and interventional studies aimed at slowing the progression of this destructive disease. The findings from this and future research will provide evidence-based guidance to support nurses working with CKD patients. Understanding how patients' perspectives of CKD and its treatment affect their decisions to take their renal protective medications as prescribed will enable nurses to build a more therapeutically effective patient-nurse relationship. Nurses will be better equipped to help CKD patients understand the value of medication adherence when they understand patients' perspectives of their illness and treatments.

Purpose

The primary purposes of this study are to: 1) describe the illness and treatment beliefs of CKD patients in stage 3 guided by the CSM; and 2) examine the relationship of those beliefs with adherence to renal protective medications, ACE-I. Secondary purposes of this study include determining adherence levels of ACE-I among patients with CKD stage 3; examining relationships between individual and clinical characteristics with patient beliefs and medication adherence with ACE-Is; and examining the relationship between the Medication Adherence Report Scale (MARS) and the Medication Possession Ratio (MPR).

Conceptual Model

According to Leventhal's CSM, when individuals are faced with a threat to their health, they build a cognitive and emotional representation (mental model) and this representation determines how they will respond to the health threat (Leventhal et al., 1997; Leventhal et al., 2003). These representations of illness, unique to the individual, are based on the individual's demographics, knowledge, and personal and familial experiences (Petrie & Weinman, 2006). The illness representation leads the patient to reduce the threat of illness or symptoms by guiding their choices of coping strategies (e.g., to take medication, stop smoking, lose weight) directed at reducing the threat (Leventhal et al. 2003).

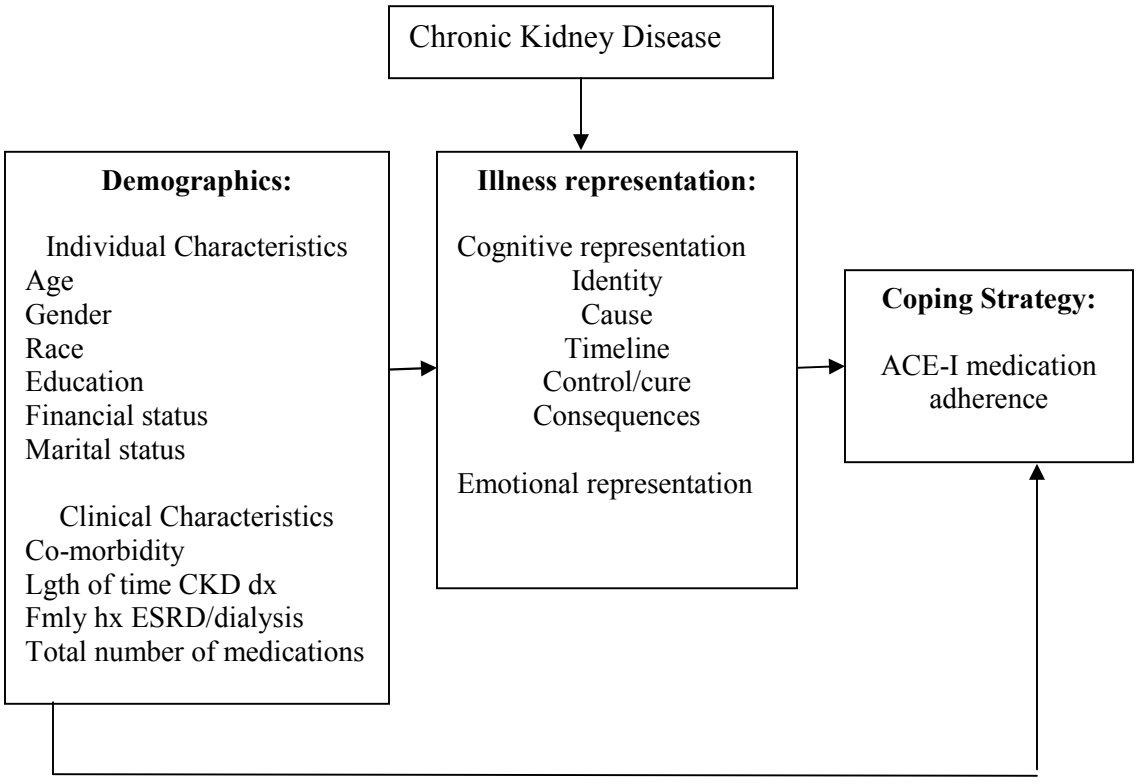


Figure 1. Proposed model based on Leventhal's Common Sense Model

In the proposed model (Figure 1), a diagnosis of CKD stimulates an individual's unique view of himself or herself experiencing kidney disease and its complications. The CKD patient, drawing from personal background, knowledge, life events, experiences and familial experiences, develops a cognitive and emotional illness representation of CKD and its treatments. The person is an active participant using common-sense coping strategies to manage the life changing challenges that CKD presents. Renal protective medication adherence is considered a coping strategy that a CKD patient might choose to take in order to reduce the threat of the disease progression. The patient's decision to take his or her medication as prescribed is affected by his or her illness representation of CKD. Thus, the patient's common-sense illness representations guide his or her adherence decisions (Horne, 1997; Leventhal et al., 2003).

Research Questions

The research questions posed in this study include:

1. What are the illness representations (cognitive representation [identity, cause, timeline, control/cure, consequences] and emotional representation) of patients with CKD stage 3?
2. What are the medication adherence levels of ACE-I among patients in CKD stage 3 as measured by self-report MARS?
3. Does illness representation (cognitive representation [identity, cause, timeline, control/cure, consequences] and emotional representation) of patients with CKD stage 3 predict self-reported adherence to ACE-I as measured with the MARS?
4. What are the relationships among each of the Individual Characteristics (age, gender, race, education, financial status, and living with a partner status) with the

individual Cognitive Representation dimensions (identity, cause, timeline, control/cure, consequences) and self-reported medication adherence with ACE-I?

5. What are the relationships among each of the Individual Characteristics (age, gender, race, education, financial status, and living with a partner status) with the Emotional Representation construct?
6. What are the relationships among each of the clinical characteristics (Co-morbidity, Length of time CKD diagnosis, Family history of ESRD/dialysis and Number of medications) with the individual Cognitive Representation dimensions (identity, cause, timeline, control/cure, consequences) and self-reported medication adherence with ACE-I?
7. What are the relationships among each of the clinical characteristics (Co-morbidity, Length of time CKD diagnosis, Family history of ESRD/dialysis and Number of medications) with the Emotional Representation construct?
8. What is the relationship between the Medication Adherence Report Scale (MARS) and the Medication Possession Ratio (MPR)?

Conceptual Definitions

Illness Representation

In the proposed model, illness representation is the subject's view of the status of his or her CKD created within two domains: cognitive representation and emotional representation.

Cognitive representation. The cognitive representation is composed of five content dimensions: identity, timeline, consequences, cause, and control/cure. Identity is the label assigned to the illness by the patient, often associated with symptoms they

perceive to be related to their illness. Cause is the patient's ideas of disease etiology (i.e. environmental pollution, personal behaviors, genetics). Timeline is the patient's perception of duration and pattern of illness. Control/Cure is the patient's perception of how effective he or she can be in controlling or curing the illness and how well a treatment can control or cure the condition. Consequences are the negative effects or outcomes the patient associates with the illness (Leventhal et al., 1997; Leventhal et al., 1992).

Emotional representation. Emotional representations are internal emotional responses to the mental image of possible dangers imposed by the illness threat, such as depression, fear, anger, or anxiety. Depression is the patient's perspective of feeling depressed (e.g. feeling blue or sad, losing interest) when thinking of their kidney disease. Fear is the patient's expression of feeling afraid when thinking of their illness; fear provoked by the threat of the kidney disease. Anger is the patient's strong sense of displeasure in response to their kidney disease. Anxiety is the patient's expression of uneasiness, worry, or apprehension when thinking of their kidney disease (Barsevick, Whitmer, and Walker, 2001; Leventhal et al., 1997; J. F. Johnson, 1999; Leventhal et al., 2001; Moss-Morris et al., 2002). As opposed to general emotional responses, emotional representations are emotional responses related to the experience of living with kidney disease.

Coping Strategy

Coping strategy (action plan) is the subject's plans and tactics for the control of the illness threat. Coping strategies are created in order to reduce the cognitive and emotional threats posed by the illness (Leventhal et al., 1997; Leventhal et al., 2001;

Leventhal et al., 2003). The current study examines the specific coping strategy of medication adherence, which is conceptually defined as the patient intentionally taking his medication as prescribed.

Summary

CKD is a progressive disease that is a growing global burden to individuals and society as a whole. The cost and complexity of CKD and accompanying co-morbidities, premature mortality, and costly treatments demand attention to methods to prevent progression of this debilitating illness.

There are renal protective medications shown to reduce proteinuria, a predominant cause of kidney disease progression. The most prescribed renal protective medications currently are ACE-I. They are being prescribed for patients with renal involvement, however, evidence indicates that patients may not be adherent in taking these medications as prescribed. There is a vast amount of medication adherence research spanning decades, with agreement that an unacceptably high percentage of non-adherence exists, but little consistency in specific predictors of adherence. Evidence is growing that medication adherence is affected by patients' beliefs about their illness and treatments and these beliefs are predictive factors associated with long-term medication adherence. At this time, there are no studies examining beliefs and perceptions, of patients with CKD stage 3, about their illness and treatments (illness representations), nor their adherence to renal protective medications.

The current study, guided by the CSM addresses this gap by examining illness representations of patients with CKD stage 3 and the relationships between those illness representations and medication adherence with renal protective medications. The

examination of illness representations, of patients with CKD stage 3, and their associations with adherence to ACE-I, is an imperative first step to halting progression of this devastating condition. The findings will help nurses build client-centered participatory partnerships needed to foster adherence with renal protective treatments and will serve as a foundation for future research.

CHAPTER 2

Empirical and Theoretical Literature Review

This chapter includes a review of the literature defining, staging, and examining the progressive course of chronic kidney disease (CKD) and renal protective medications shown to prevent or delay progression. General medication adherence research as well as clinical trials evaluating disease and medication specific adherence behaviors is included in this section. An overview is provided of health behavior and self-regulation theories with emphasis on Leventhal's Common Sense Model (CSM) as a guiding framework for the proposed study (Leventhal, Brissette, & Leventhal, 2003). Individual and clinical characteristics are examined in relationship to the CSM model and medication adherence. The chapter concludes with a summary of research findings from studies examining the illness representations and their relationships with medication adherence behaviors drawn from samples of patients with chronic disease, such as end-stage renal disease, diabetes mellitus, and hypertension. Lastly, how the proposed study will address the gaps found in the existing research is also discussed.

Chronic Kidney Disease

To describe CKD, one must start from the end – end stage renal disease (ESRD), also known as kidney failure (National Kidney Foundation, 2003). The definition of ESRD is an administrative term derived from the conditions set by the Medicare ESRD Program (HR-1 bill) responsible for coverage of dialysis and transplantation expenses for ESRD patients. Payment for ESRD health services requires a glomerular filtration rate (GFR) of less than 15 mL/min/1.73m^2, with exceptions made before that point for

patients at increased risk of mortality and morbidity (Hoffart, 1995). In the time since passage of HR-1 bill by the U.S. Congress in 1972 which made treatment for ESRD reimbursable under the Medicare program regardless of age, millions of lives have been extended (U.S. Renal Data System (USRDS), 2006). However as of 2004, the annual cost of the ESRD program soared to nearly 19 billion Medicare dollars, 1.1 billion Health Maintenance Organizations (HMO) dollars, 9 billion non-Medicare dollars, and 390 million Employee Group Health Plan dollars (USRDS, 2006). Chronic kidney disease and ESRD patients constitute a small proportion of the Medicare population (6.6 and 1.2 percent, respectively) yet consume a large portion of the entire Medicare budget (19.4 and 6.4 percent, respectively) (U.S. Renal Data System (USRD), 2007). The high burden CKD places on the American population and economy make it an important public health issue requiring a major public health initiative and redirection of the national focus from ESRD to CKD (NKF, 2002; Schoolwerth, et al., 2006; USRDS, 2006).

Little attention was paid to earlier stages of CKD until 2002 when the National Kidney Foundation (NKF) published the Chronic Kidney Disease Guidelines to define and classify stages of the disease (NKF, 2002). CKD is defined as meeting at least one of two criteria: structural or functional kidney damage for at least three months and/or glomerular filtration rate (GFR) less than 60 mL/min/1.73m^2 for at least three months. Structural or functional kidney damage is determined by abnormalities in blood or urine tests or imaging studies. A GFR of less than 60 mL/min/1.73m^2 represents a loss of at least one half of normal adult kidney functioning. A CKD classification system was established using five stages to describe the degree of kidney damage. The stages of CKD are determined by the level of GFR with the lower stages representing higher GFR

levels (less kidney damage) and the higher stages representing lower GFR levels (more kidney damage). Level 5 is classified as ESRD which requires dialysis or transplantation to sustain life (NKF, 2002; USRDS, 2006). When this classification system was applied to the most recent National Health and Nutrition Examination Survey (NHANES) 1988-1994 and 1999-2006 data, an estimated 31 million American citizens fell into one of the five CKD stages (USRDS, 2008). This is an ominous sign of an impending surge on the health care system and Medicare budget.

Stage 3 CKD has been chosen for this study for two reasons. First, of the five stages of CKD, there are more Americans (2.5 million) estimated to have stage 3 CKD (Coresh et al., 2007; USRDS, 2008). Second, stage 3 is a critical stage to examine since it is most often accompanied by proteinuria (a marker for progression to kidney failure), complications of organ dysfunction and a continuous decline in renal function leading to diagnosis and patient awareness of renal disease (Garcia-Donaire, Segura, & Ruilope, 2005; NKF, 2004). Research is needed to examine ways to interrupt the progression of CKD. Unless the progression of kidney disease is halted, this large number of patients with stage 3 CKD will either progress to kidney failure, requiring dialysis or transplantation to sustain life, or die prematurely from cardiovascular events (Coresh et al., 2007; Go, Chertow, Fan, McCulloch, & Hsu, 2004; Keith, Nichols, Gullion, Brown, & Smith, 2004).

The clinical factor that has repeatedly emerged as a major link to progression of CKD to ESRD and increased risk of cardiovascular disease leading to premature death, is proteinuria. Proteinuria is most often associated with elevated blood pressure levels and inadequate glycemic control among patients with diabetes (Coresh et al., 2007; de Zeeuw

et al., 2004b; Keith et al., 2004; Lakkis & Weir, 2004; Praga et al., 1995). It is now recognized that proteinuria is not only a marker of kidney damage, but also has toxic effects on the kidney contributing to the progression of renal disease (Remuzzi, Benigni, & Remuzzi, 2006; Schieppati & Remuzzi, 2003). The degree of proteinuria has been shown to be an independent factor contributing to the rate of functional decline, the need for dialysis and transplantation, as well as renal and all-cause mortality, irrespective of the primary etiology of the renal disease (Campbell, Ruggenenti, & Remuzzi, 2002; Keane, 2000; Velde et al., 2009; Wolf, Butzmann, & Wenzel, 2003). Angiotensin II (ANG II), part of the renin-angiotensin system (RAS), has been shown to increase proteinuria by altering glomerular capillary permselectivity leading to podocyte injury, glomerulosclerosis, and interstitial fibrosis (Abbate et al., 2002; Kshirsagar, Joy, Hogan, Falk, & Colindres, 2000; Yoshioka, Rennke, Salant, Deen, & Ichikawa, 1987). In addition, studies have shown that ANG II contributes to an inflammatory process that contributes to chronic renal injury (Keane, 2000; Schieppati & Remuzzi, 2003).

The classical known systemic hemodynamic effects of ANG II, to maintain extracellular volume and blood pressure to compensate for volume depletion, have been expanded in recent years suggesting local tissue generation of ANG II through a RAS in several organ tissues including the kidney tubular cells. Micropuncture animal studies indicate the local tissue RAS may function independently from the systemic RAS. Two main ANG II receptors, AT_1 and AT_2 are implicated in the locally activated RAS. AT_1 receptors are associated with ANG II functions such as vasoconstriction, release of aldosterone, tubular transport, pro-inflammatory, pro-fibrogenic activities and growth stimulation effects. Activities associated with AT_2 receptors are thought to antagonize

AT_1 receptor effects by reduction of blood pressure through release of nitric oxide (NO) and bradykinin release, inhibition of proliferation inducing differentiation, and may even mediate apoptosis in some cells (Abbate et al., 2002; Bader et al., 2001; Wolf et al., 2003).

The intracellular involvement of ANG II in podocyte foot process effacement and cytoskeleton reorganization leading to increased proteinuria was the focus of several recent animal studies (Macconi et al., 2006; Ronco, 2007; Sever et al., 2007). The common denominator in all of these studies was that ANG II plays a major role in proteinuria which is a marker of and contributor to kidney damage and progression to renal failure.

There are renal protective medications shown to interfere with the RAS and to reduce proteinuria in CKD patients, including diabetic, non-diabetic and hypertensive patients (de Zeeuw et al., 2006; Hovind, Tarnow, Rossing, Carstensen, & Parving, 2004; Kopyt, 2005; Matsuda, Hayashi, & Saruta, 2003). Currently the most effective antiproteinuric agents are angiotensin-converting enzyme inhibitors (ACE-I) and angiotensin receptor blockers (ARB), which inhibit and block the damaging effects of ANG II, thereby preventing or delaying progression of renal dysfunction (de Zeeuw et al., 2004a, 2004b; Remuzzi, Ruggenenti, & Perico, 2002; Ronco, 2007).

The Reduction in Endpoints in Non-Insulin Dependent Diabetes Mellitus with the Angiotensin II Antagonist Losartan Study (RENAAL), a multinational randomized, double-blind study of 1,513 participants with diabetic nephropathy, compared the effects of an ARB (Losartan) and placebo on renal and cardiovascular outcomes (Brenner et al., 2001). The ARB resulted in a significant 35% reduction in proteinuria ($p = .001$) and

reduced incidence of ESRD (28% risk reduction, p = .002). In a secondary analysis, data from the RENAAL study were analyzed by de Zeeuw et al. (2004a, 2004b) to examine albuminuria as a marker of renal disease and as a monitor of the renoprotective efficacy of an ARB in diabetic nephropathy. High albuminuria levels at baseline were associated with a higher risk for progression to ESRD. There was significant reduction in albuminuria by the ARB with related renal protection short and long term.

Two smaller studies found significant renal protective benefits of ACE-Is and ARBs. Praga et al. (1995) studied the influence of weight loss and ACE-I treatment in 17 obese patients with proteinuria. Both weight loss and ACE-I use without weight loss were associated with a significant decrease in proteinuria and stable renal function (Praga et al., 1995). In a study by Matsuda et al. (2003), monotherapy using ACE-I and ARB treatment groups in 52 hypertensive patients with proteinuria revealed a significant reduction in proteinuria in both groups, however there was a time difference in onset of effects. The ACE-I reduction occurred at 12 weeks while the ARB reduction became significant at 48 weeks (Matsuda et al., 2003). A summary of reviews and meta-analysis examining the relationship between ACE-I, ARB monotherapy or combination therapy in 21 studies with 18,418 diabetic and non-diabetic hypertensive subjects found significant antiproteinuric effects independent of the blood pressure lowering effects (Bakris, Ferdinand, Douglas, & Sowers, 2002; Hunsicker, 2004; Kopyt, 2005). These renal protective effects were found in monotherapy and combination therapy. Cardiovascular function improvement also was found independent of blood pressure effects. These studies attest to the antiproteinuric affect of ACE-I and ARB medications.

Prescribing patterns of renal protective medications are increasing, especially with diabetic renal disease patients (78.6%) and hypertensive patients with renal involvement (85%) (Cooke & Fatodu, 2006; Schmieder, 2005). However, medication adherence is less than adequate among the general chronic disease population and across medications, with an average estimated rate of 50% (Balkrishnan, 2005; Gossec, Tubach, Dougados, & Ravaud, 2007; Svarstad, Chewning, Sleath, & Claesson, 1999; Williams, Rodin, Ryan, Grolnick, & Deci, 1998). Some studies have shown that adherence to blood pressure medications and more specifically, ACE-I and ARBs is higher than average at 60.4% (Cooke & Fatodu, 2006) and 77% (Pladevall et al., 2004). If applied to CKD patients, this would indicate that approximately 23 to 39.6 % of the estimated 2.5 million patients with stage 3 CKD (Coresh et al., 2007; USRDS, 2008) are not taking renal protective medications as prescribed to slow progression of their renal disease.

Medication Adherence

Although there is a lack of literature on the medication adherence practices of early stage chronic kidney disease patients, there are studies that indicate a less than desirable medication adherence pattern among people with diabetes and hypertension, which comprise the majority of CKD patients (Carter, 2006; NKF, 2004; Shenolikar, Balkrishnan, Camacho, Whitmire, & Anderson, 2006; USRDS, 2006). The concept of medication adherence is complex; adherence problems are common where self-administration of long term medication is required, such as those prescribed for chronic illnesses; and many patient-related factors are involved in patient adherence to long-term medications.

Patient-related factors involved in non-adherence to medication are often divided into two categories: unintentional and intentional. Unintentional factors related to medication non-adherence include forgetfulness, being unable to understand instructions (e.g. low health literacy, language barriers, etc), and unable to follow instructions for taking medications (e.g. costs of medications, lack of transportation to pharmacy, unable to physically open medication container, etc). Intentional factors related to medication non-adherence include patients' beliefs and attitudes about the nature and severity of their illness (duration and course of illness, etc.); about the value and effectiveness of the medications; associated social concerns and stigmas attached to medications; fear of side effects, dependency, self-injections; and lack of self-efficacy and positive motivations to make medication adherence behavior changes (Horne, Weinman, Barber, Elliott, & Morgan, 2005; National Counsel on Patient Information and Education, 2007; World Health Organization, 2003).

Horne et al. (2005) proposes that unintentional factors affecting medication adherence stem from limitations in patient capacity and resources that prevent them from following the treatment plan they decided upon. Examples provided include memory and dexterity limitations, problems obtaining prescriptions, and competing work, family or social demands. He also describes intentional factors affecting medication adherence as those stemming from "beliefs, attitudes, and expectations that influence patients' motivation to begin and persist with the treatment regimen" (p. 14). The World Health Organization (2003) does not divide factors affecting patients' adherence to medication into unintentional and intentional, but do support the same antecedents described by

Horne by stating that "patient-related factors represent the resources, knowledge, attitudes, beliefs, perceptions and expectations of the patient" (p. 30).

Systematic reviews and meta-analyses of medication adherence research conclude there is support for general, but no consistent reliable and valid empirical support for specific factors predicting long-term medication adherence or nonadherence (DiMatteo, Haskard, & Williams, 2007; Haynes, Ackloo, Sahota, McDonald, & Yao, 2008; Peterson, Takiya, & Finley, 2003; Vermeire, Hearnshaw, Van Royen, & Denekens, 2001). Some of the general factors cited include: a) medication-related factors such as complexity of the prescribed medication regimen; b) prescriber-related factors such as clinicians' skill in basic adherence management principles, trust of provider-patient relationship, and quality of communication with patient; c) pharmacy-related factors such as access to community-based pharmacists and formal pharmacy care programs tailoring education and counseling to patient needs; and d) system- and government-related factors such as lack of consensus and interrelation of various healthcare clinician roles, interpretation of federal and state laws, and funding for adherence research (Horne et.al, 2005; National Counsel on Patient Information and Education, 2007; National Quality Forum, 2005; World Health Organization, 2003).

Patient-related factors are most often the focus in literature regarding adherence to medication. Vermeire and colleagues (2001) reported that medication adherence was affected by patients' beliefs about medications. Adherence is also affected by patients', as well as family and friends' knowledge, ideas, and experiences with medications (Vermeire et al., 2001). Although Haynes et al. (2005) agrees there is little consistency in findings regarding medication adherence antecedents, he also recognizes limited

education, lack of understanding of medication instructions, and forgetfulness as contributing factors of medication non-adherence (Haynes et al., 2005).

In a meta-analysis of intervention studies designed to improve medication adherence, the inability to achieve positive results has been attributed to the multitude of variables affecting a patient's decision to take a medication. The patient's "deeply ingrained values and beliefs" regarding illness and medications are sometimes powerful barriers to medication adherence (Peterson et al., 2003, p. 662). DiMatteo et al. (2007) stated that despite more than 60 years of patient adherence research, findings are still conflicting and answers remain elusive. However, in a meta-analysis examining patient adherence in relation to health beliefs and disease severity, a significantly positive correlation was found between patients' beliefs about their illness severity and treatment adherence. An interesting finding in this meta-analysis was that for patients with a less serious illness, poorer health was a predictor of adherence, whereas for a more serious illness, poorer health was a predictor of non-adherence (DiMatteo et al., 2007). There is consensus among these reviews and meta-analyses that intentional factors related to medication adherence include patients' beliefs and attitudes about the nature and severity of their illness.

Results of individual studies of medication adherence support the findings of national and international work groups, meta-analyses and systematic reviews, that adherence to medications is problematic where self-administration is required. This has been found true regardless of disease type and severity, accessibility to resources, age, and gender (George, Kong, Thoman, & Stewart, 2005; Hedenrud, Jonsson, & Linde,

2008; Roe, Motheral, Teitelbaum, & Rich, 2000; Thier et al., 2008; World Health Organization, 2003).

Studies acknowledge that patients make their own decisions regarding how they manage their medications. These decisions are often seen as a rational choice based on their beliefs and understanding, taking into account physical, economic, psychological, and social considerations (George et al., 2005; Hedenrud et al., 2008; Kidd & Altman, 2000; N. H. Miller, 1997). In medication adherence research with chronic obstructive pulmonary disease patients, George et al. (2005), found that patients' beliefs, experiences, and behaviors regarding disease and treatment were stronger predictors of adherence to medications than sociodemographic and clinical factors. A large retrospective analysis of a national insurer's claims data reveals that knowledge and access to medication are important predictive factors in medication adherence. They also found medication non-adherence is evident in those covered by commercial insurance, Medicaid and Medicare, as well as those without any form of insurance coverage – adherence issues cut across socioeconomic status and level of insurance coverage (Thier et al., 2008). Shalansky and Levy (2002) also found no difference between adherent and non-adherent patients based on whether or not they had insurance coverage. These individual studies supported previous findings of studies that examined over 200 factors in relation to medication adherence; characteristics like age, gender, education, occupation, financial status, race, and ethnic background have not been consistently associated with adherence. In contrast, illness-related cognition, patient perceptions of illness and beliefs about treatment have shown consistently strong relationships with

adherence (Haynes, McKibbon, & Kanani, 1996; Wetzels et al., 2006; World Health Organization, 2003).

Renal protective medication treatments require a patient-medical team partnership, but success depends a great deal on the patient's ability to successfully self manage his or her illness (Lorig, 2001; J. F. Miller, 2000). Current clinical interventions are not working with a large portion of the CKD population (Coresh et al., 2007; National Institutes of Health & National Institute of Diabetes and Digestive and Kidney Diseases, 2007; USRDS, 2006). To examine why CKD patients are not adherent with renal protective medications, the literature suggests that researchers and healthcare providers need to go to the patients themselves to look at individual human perspectives that might lead to promoting behavior change in a context unique to patients diagnosed with CKD. What are CKD patients' perceptions, beliefs, and emotional responses to his or her disease process and prescribed treatments and do they predict medication adherence behavior? Knowing this may lead to more successful interventions to improve adherence to medications and curb the burden of kidney disease progression in this unique group of patients.

Theoretical Framework

There has been a growing body of research guided by health behavior theories and models over the past two decades (Cameron & Leventhal, 2003a; Glanz, Rimer, & Lewis, 2002). Some of the most prominent health-related behavioral theories and models cited in the literature are the Health Belief Model (Rosenstock, Strecher, & Becker, 1988), Social Cognitive Theory (Bandura, 1989), and the Transtheoretical Model (Prochaska, DiClemente, & Norcross, 1992). Each of the above models have been

examined and tested by researchers and have developed over time as valid and reliable theoretical frameworks for health behavior research (Glanz et al., 2002). However, Noar and Zimmerman point out in their critique of health behavior theories, initiation of behavior change is the focus in most of the current theories, and there is a lack of theoretical models that also address maintenance of behavior change as a separate process (Noar & Zimmerman, 2005). The focus of studies on behaviors to promote health has left a gap with a need for theoretical frameworks with emphasis on behaviors to adapt to and manage chronic illness over the long-term. The theory of self-regulation fills this gap in health-related behavior research (Cameron & Leventhal, 2003b; Vohs & Baumeister, 2004).

The complexity of studying CKD patients' health beliefs and medication adherence behaviors requires a theoretical framework that addresses the dynamic nature of living with and managing a chronic illness and its complex treatments. According to self-regulation theory, health behavior in the context of chronic illness is a dynamic process requiring feedback, motivation, and goal pursuit to initiate and maintain optimal outcomes (Cameron & Leventhal, 2003b). The theory proposes that illness threatens all aspects of an individual's personal and social self, requiring short- and long-term self-regulation of critical aspects of living, including emotional and physical states (Cameron & Leventhal, 2003b; Vohs & Baumeister, 2004). According to Leventhal's self-regulation CSM, when individuals are faced with threats to their health, they build cognitive and emotional representations (mental models) and these representations determine how they will respond to the threat (Leventhal et al., 1997; Leventhal et al., 2003). These representations of illness, unique to the individual, are influenced by the

individual's demographics, knowledge, and personal and familial experiences (Petrie & Weinman, 2006). The illness representations lead the patient to reduce the threat of illness or symptoms by guiding their choices of coping strategies (e.g., to take medication, stop smoking, lose weight) directed at reducing the threat. The patient then analyzes the outcomes of his coping strategies. If the patient deems them satisfactory, he or she is motivated to continue the strategies, if less than satisfactory a feedback loop is redirected back to representations and coping strategies (Leventhal et al., 2003).

The content of a person's "problem-solving system" (Leventhal et al., 2001, p 20) is composed of both cognitive and emotional representations of the health threat. Health threats are processed as two interacting, but independent dimensions. The cognitive dimension processes information for controlling the danger of the health threat while the emotional dimension processes information for controlling the emotional responses triggered by the health threat. The dual dimensions of the problem-solving system became evident in Leventhal's early work that revealed the emotional response to disease threat messages triggered fear, anxiety, depression and anger, attitude change and sometimes influenced behavior. The emotional response was temporary, facilitated disease prevention behavior, inhibited illness detection behavior, and did not lead to health protective changes required for long term behavior change. This indicated that there was something else, besides the emotional response in play to drive health behavior change for the long term. He found health protective actions for the longer term were taken when participants were exposed to health threat messages combined with action plans requiring a cognitive response. Therefore, a cognitive response, in addition to an

emotional response, was needed to recognize the health threat and move plans into action for the long term (Leventhal et al., 2001).

Emotional distress in the face of illness threats is not static – it varies between persons and within the same person over time. Illness specific rather than general emotional responses predict health behavior responses. The cognitive-emotional representation links are complex and dynamic. Health threats ignite bi-directional movement between cognition and emotional representations. The emotional response and ability to regulate the response will affect the cognitive response. On the other hand, emotional reactions depend greatly on the cognitive meaning a person assigns to them. In effect, "…the affective tail is wagged by the cognitive dog" (Leventhal et al., 2001, p 25; Leventhal, Weinman, Leventhal, & Phillips, 2008).

The cognitive-emotional link is described in work by Millar and Millar (1993; 1996) in their experimental studies examining the relationship between health attitudes and health behavior. Health attitudes are described as being composed of both cognition and affect components. Positive health behaviors are described as being composed of disease detection and health promotion behaviors. Millar and Millar found that disease detection behaviors were significantly associated with the affective component of health attitudes ($p = .002$), and health promotion behaviors were significantly associated with cognitive components of health attitudes ($p = .001$). Overall, however, significantly more cognitive than affective responses were used to describe participants' reactions to both detection and health promotion behaviors. These findings are in line with Leventhal's theory of cognitive-emotional representations driving health behavior actions.

The CSM has remained constant in its focus of the individual's self-regulating belief system of illness representation, coping and appraisal across cultures, disciplines and illnesses (Hagger & Orbell, 2003). In a meta-analysis of 45 empirical studies derived from psychology that were guided by the CSM and encompassed 23 illnesses (including diabetes mellitus and hypertension) and conditions, Hagger and Orbell (2003) examined the convergence and discriminant validity of the CSM model. They also examined the relationship between the CSM variables of illness representation, coping behaviors and illness outcomes across the studies. Most of the studies were cross-sectional designs followed by prospective or mixed cross-sectional and longitudinal study designs. A variety of measures were used across the studies to examine illness representations, coping behaviors and outcomes. The measures used in this meta-analysis showed a collective congruence in measuring and scoring the illness representation dimensions of cause, consequences, cure/control, identity and timeline. Using the average corrected intercorrelation matrix, the CSM illness representation dimensions of consequences, control/cure, identity, and timeline were shown to follow a logical pattern across studies, thus supporting construct validity across illness types. Perceived controllability of the illness was significantly associated with both general and specific problem-focused coping strategies ($r_c = 0.27$, $p < .05$ and $r_c = 0.12$, $p < .05$) such as diabetes management behavior and treatment adherence as well as cognitive reappraisal ($r_c = .20$, $p < .05$). The Hagger and Orbell meta-analysis also supported evidence for "theoretically predictable relations" (p. 141) of a major CSM tenet that a causal relationship exists between illness cognitions and outcomes that are mediated by coping behaviors. In the meta-analysis, a stronger, more significant relationship between illness representations and outcomes was

revealed than between illness representations and coping behaviors. This suggests that the relationship between illness representation and outcomes is mediated by coping behaviors. A limitation given as an explanation of the low-to-moderate correlation between illness representation and coping behaviors is the generality of the coping measures in this meta-analysis drawn from psychological research. A recommendation for future research was to use more objective, specific problem-focused coping measures, such as treatment and medication adherence (Hagger & Orbell, 2003).

Illness Representation

A search was conducted to examine empirical literature guided by the CSM examining illness representations of patients with chronic illness and in the relationships with problem-focused coping strategies. The search revealed 26 studies guided by self-regulation theory or CSM drawn from populations of patients with chronic illness. However, the search exposed a paucity of research guided by self-regulation theory or CSM examining the relationship between illness representation and objective, specific problem-focused coping strategies such as medication adherence. More importantly, there were no CSM-guided studies of CKD patients in earlier stages of the disease process, before end-stage renal disease and dialysis. There were a limited number of studies of dialysis patients and these will be discussed. However, since the focus of the current study is the examination of the illness representation of CKD patients and the relationship of illness representation with renal protective medication adherence in CKD patients before end-stage renal disease; and since the two major causes of CKD are diabetes mellitus and hypertension (NKF, 2002 ; USRDS, 2006), the literature review is drawn mainly from CKD proxy chronic illness populations of diabetes mellitus and

hypertension. The illness representation of these chronic illness groups are examined with a special emphasis placed on CSM-guided studies as they relate illness representation to the specific problem-focused coping of medication adherence.

End stage renal disease. There were four CSM-guided studies conducted with the end-stage renal disease patient population, with only one addressing medication adherence. Two quantitative cross-sectional studies examined illness representation in relationship to quality of life (Covic, Seica, Gusbeth-Tatomir, Gavrilovici, & Goldsmith, 2004; Fowler & Baas, 2006). One qualitative study using narrative methodology in face-to-face interviews used the CSM, termed the theory of representations in this study, to examine the lived experience of hemodialysis patients and how they reinterpret living with illness by identifying their own beliefs about symptoms, causes, consequences and ability to control their treatment (Velez & Ramasco, 2006). The fourth study, a prospective cross-sectional study of 73 hemodialysis patients, examined the utility of CSM to predict specific problem-focused coping strategies of diet, fluid regimen and medication adherence (O'Connor, Jardine, & Millar, 2008). Indirect physiological measures were used for diet (serum potassium levels), fluid intake (mean and standard deviation of interdialytic weight gain), and medication adherence (serum phosphate levels). Serum potassium levels of greater than or equal to 5.5 mEq/l indicated nonadherence to diet, and an interdialytic weight gain of greater than or equal to 2 kg indicated nonadherence to fluid restrictions in this study. Oral phosphate-binding medications are prescribed to dialysis patients to manage serum phosphate levels. Serum phosphate levels greater than or equal to 1.8mmol/l were an indirect measure of medication nonadherence in this study. The results indicated that 70% (M = 2.4, S.D.

0.87, range 0.8 - 5.31) of patients were non-adherent to fluid restrictions, 55% (M = 1.8, S.D. 0.49, range 0.85 - 2.91) were nonadherent to medication, and 16% (M = 4.7, S.D. 0.75, range 0.24 - 1.78) were nonadherent to diet. Illness representations, as measured by the mean Revised Illness Perception Questionnaire (IPQ-R) scores, suggested that the strongest beliefs of these dialysis participants were about the timeline (M = 25.81, S.D. = 4.35) and the consequences (M = 23.19, S.D. = 4.39) of their illness. This implies that the participants perceived their illness to be chronic (rather than acute) and to have severe negative effects on their physical, economic, and social life. A relative strong personal cure/control belief (M = 18.16, S.D. = 5.26), as well as coherence belief (M = 18.73, S.D. = 4.99), indicated a belief in the self-efficacy of their own actions, and understanding of their illness to manage the disease process. Participants had a less strong belief in their treatment control/cure ability (M = 14.05, S.D. = 3.97). Most of the participants perceived that they experienced emotional distress as a result of their illness (M = 17.25, S.D. = 5.74). Hierarchical regression analysis showed that as a block of variables, illness representation was a predictor of fluid adherence only, ($p = .04$). While of individual illness representation variables predicted diet and medication adherence coping strategies, ($p < .05$) specifically, emotional representations predicted diet adherence ($\beta = .443$, $p = .01$) and medication adherence ($\beta = .362$, $p = .048$) and timeline predicted medication adherence ($\beta = -.324$, $p = .024$).

These findings indicated that the perception of emotional distress from their illness predicted diet and medication nonadherent behavior and the perception of their illness being chronic rather than acute predicted medication nonadherence. An interesting finding is that the participants' emotional representation of ESRD predicted

medication and diet adherence over and above general psychological distress as measured by the Hospital Anxiety and Depression Scale (HADs). This finding is supported in an immunosuppressant medication adherence study of renal transplant patients where emotional distress about the transplant was significantly related to medication nonadherence, while general emotional distress as measured by SF36 scale was not significantly related to medication adherence behavior (Butler et al., 2004). O'Connor et al. (2008) posit that medication adherence prediction may be based on illness-specific rather than general emotional responses.

The lack of CSM-guided ESRD studies examining the ability of illness representations to predict treatment adherence as a coping strategy is apparent in this review of literature. The O'Connor et al. (2008) study did support the ability of illness representation to predict the coping behaviors of diet and medication adherence, was a prospective designed study, and reported an adequately powered sample size for appropriate analysis. Stronger support for the prediction ability of the illness representation of the participants may have been gained with the use of self-report, pill counts, or refill records as measures of adherence in addition to the proxy physiological measures. Treatment control beliefs were not significant predictors of treatment adherence, including medication adherence in this study. It is postulated that a measure more specific to the type of treatment being studied rather than treatments in general would add to the validity of the study of treatment adherence and illness representation (Horne & Weinman, 2002; O'Connor et al., 2008).

Diabetes Mellitus. There were 16 CSM or similar self-regulation model guided studies identified that focused on the diabetes mellitus (DM) patient population. All of

the studies contributed to the growing body of evidence indicating that illness representation is an important factor in the study of chronic illness health behavior across multiple patient populations and illnesses. Among studies that used the CSM in the diabetic population, few examined the relationship between illness representations and the objective, specific problem-focused coping strategy of medication adherence. Of the 16 studies, 6 examined illness representation in DM patients focusing on family interactions, physiological complications, psychological outcomes and emotional-focused coping strategies (Edgar & Skinner, 2003; Eiser, Riazi, Eiser, Hammersley, & Tooke, 2001; Keogh et al., 2007; Paschalides et al., 2004; Scollan-Koliopoulos, O'Connell, & Walker, 2005; Searle et al., 2008). One study examined predictors of illness representation as opposed to the ability of illness representation to predict coping strategies or outcomes (Lawson, Bundy, & Harvey, 2007). Nine of the 16 studies examined illness representation in DM patients as it related to health behaviors and specific, problem-focused coping strategies. The specific, problem-focused coping strategy most often studied was dietary behaviors. None of the DM studies focused on medication adherence alone, but seven of the problem-focused studies included medication adherence, two of which dropped medication adherence from the model before final analysis. Glascow, Hampson, Strycker, and Ruggiero (1997) excluded medication use secondary to extremely high compliance reporting resulting in heavy skewing. Heterogeneity of medication regimens was the reason given for Hampson, Glasgow, and Foster (1995) excluding medication use, citing that some participants were on insulin injections, others taking pills and some on both or neither. Only 5 of the 16 DM studies included medication adherence in the final analysis (Barnes, Moss-Morris, &

Kaufusi, 2004; Griva, Myers, & Newman, 2000; Kart, Kinney, Subedi, Basnyat, & Vadakkan, 2007; Scollan-Koliopoulosm O'Connell, & Walker, 2007; Searle et al., 2007).

Scollan-Kiliopoulos et al. (2005) used the Theory of Illness Representation and the Family-systems-illness-disability Model to examine the multigenerational legacy of Type 2 diabetes in a review of the literature from 1984-2004. The implications from the findings in this review are that having a family history of diabetes has an affect on the health behavior of the next generation of family members with diabetes. Each individual diabetes patient has his or her own illness representation, but this study indicates that the individual's representations are shaped by multigenerational legacies – the illness representation of diabetes exemplified by family members who have experienced living with the disease. Another study of illness representations among DM patients and family members was submitted in the form of a proposal of a randomized controlled trial of a family-based intervention as part of an ongoing study of patient and family members' illness perceptions (Keogh et al., 2007). Studies examining multigenerational legacies of DM are relevant to kidney disease, also a multigenerational legacy disease which may influence the CKD patient's illness representation and health behavior coping strategies (National Institutes of Health & National Institute of Diabetes and Digestive and Kidney Diseases, 2002; NKF, 2004; USRDS, 2008).

Searle et al. (2008) examined three matched groups of DM patients' self-reported illness beliefs in relation to DM complications in a cross-sectional study. General findings that DM was perceived as a chronic illness having moderately severe consequences that could be controlled were similar across the three groups of patients - those without complications, those with retinopathy, and those with active ulceration.

Significant specific beliefs were found in the ulceration group who perceived a more cyclical timeline ($p = .001$), higher personal control ($p = .01$), poorer treatment control ($p = .006$) and had poorer perceived understanding (coherence) of DM than the other two groups (Searle et al., 2008). These findings suggest that patients may share general illness perceptions within a common chronic illness, while having more specific illness beliefs according to co-morbidities. Since DM is a co-morbidity of a high percentage of CKD patients, 46.4% of patients 65 years and older and 37.8% ages 20 - 64 years, (USRDS, 2008) the specific illness perceptions of patients experiencing complications of DM are relevant to this study.

Psychological outcomes and emotional-focused coping strategies were examined in relation to illness representation in three cross-sectional questionnaire survey studies (Edgar & Skinner, 2003; Eiser et al., 2001; Paschalides et al., 2004). Positive and negative well-being and quality of life dimensions were examined in relation to DM patients' illness beliefs. Significant findings were found across the three studies in three illness representation dimensions: identity (i.e. labeling of symptoms), consequences (i.e. degree of disruption caused by DM) and in control (i.e. belief in personal efficacy or treatment to control DM and complications). More perceived symptoms and consequences were related to higher levels of depression, anxiety and poorer physical and mental functioning. Greater perceived effectiveness of personal or treatment control of DM was associated with greater sense of well-being ($p < .001$), self-efficacy ($p = .006$), mental functioning ($p < .001$), and less pessimistic expectations ($p < .001$). One finding of particular relevance to the current CKD study of illness representation relationships to the problem-focused coping strategy of medication adherence is that emotion-focused

coping strategies examined in Edgar and Skinner (2003) did not appear to be robust mediators between illness representation and outcomes of emotional well-being, thus supporting the value of examining illness representation in relationship to problem-focused coping strategies.

An interesting study by Lawson et al. (2007), phase one of a longitudinal prospective study, examined factors that influence individuals' personal models of illness. Along with demographics and clinical factors as predictors of patients' personal models of illness, how the health threat was communicated to the patient and personality traits were also examined as predictors. Patient's perceptions of how diabetes was explained to them were the strongest overall predictors of personal models of DM in this study. When health messages were communicated in a more threatening way, participants perceived more severe consequences and greater emotional responses associated with DM. These findings are important since these two dimensions of illness representation, consequences and emotional response, have been shown to be related to medication adherence in some studies (Barnes et al., 2004; O'Connor et al., 2008; Scollan-Koliopoulos et al., 2005).

Nine studies examined illness representation of DM patients in relation to more specific problem-focused coping self-management strategies such as diet, physical activity, glucose monitoring, foot care, seeking care, and medication adherence (Barnes et al., 2004; Glasgow et al., 1997; Griva et al., 2000; Hampson et al., 1995; Hampson, Glasgow, & Strycker, 2000; Kart et al., 2007; Lawson, Bundy, Lyne, & Harvey, 2004; Scollan-Koliopoulos et al., 2007; Searle, Norman, Thompson, & Vedhara, 2007). With the exception of Lawson et al. (2004), all studies included self-management of diet in

combination with one or more other self-management coping strategies. Lawson et al. examined the association between illness representation and level of care seeking of DM patients. This cross-sectional study of 52 DM patients seeking regular follow-up care and 32 patients who were not seeking regular care found no illness representation dimensions significantly associated with regular care seekers, although perceptions of control almost reached significance in this group ($p = .07$). Four illness representation dimensions reached statistical significant levels with the group that did not seek regular care: identity (reported more symptoms $p = .02$); timeline chronic (more pessimistic timeline $p = .03$); consequences (reported more serious consequences, $p = .02$); and control (less perceived control of DM, $p = 0.05$).

Of the eight remaining problem-focused DM studies that included dietary self-management, one (Hampson et al., 2000) also included physical activity and two (Glasgow et al., 1997; Hampson et al., 1995) included physical activity, glucose monitoring and medication adherence. However, as previously described, medication adherence was dropped from the model in both studies. The five remaining DM studies examined illness representation associations with dietary self-management and medication adherence (Barnes et al., 2004; Griva et al., 2000; Kart et al., 2007; Scollan-Koliopoulos et al., 2007; Searle et al., 2007) along with physical activity, glucose monitoring, and/or foot care which were also included in some. The illness representation dimensions found to be associated with problem-focused coping strategies among the DM participants in these five studies were: timeline (acute/chronic) positive correlation, ($p = < .05$ to $.05$), timeline (cyclical), mixed positive and negative

correlations ($p = .001$ to $< .05$), consequences, all negative correlations ($p = .001$ to $< .05$), control, mixed positive and negative correlations ($p = .007$ to $.065$).

Searle et al. (2007) examined 164 patient-partner dyads' illness representation and relationship to diet, exercise and medication adherence in a non-randomized prospective study of illness representation. Patients' beliefs about the timeline of their condition being long-term (chronic) and their perception of having personal control over their disease were positively and significantly related to dietary ($p < .01$) and physical activity self-management coping strategies ($p < .01$). Moreover, partners' illness representations in these dimensions were positively correlated and partially mediated the relationships between patients' illness representation and their self-management of diet and physical exercise. High levels of medication adherence were self-reported by participants (range 6 - 30; $M = 28.3$, S.D. = 5) and no meditational relationships were found suggesting that the self-management behavior of medication adherence is beyond the partners' influence.

Barnes et al. (2004) compared 43 Tongan and 39 European patients' DM self-management behaviors in a cross-sectional correlation study. Glycosylated hemoglobin levels revealed significantly poorer DM control of Tongan patients. There was also a significant difference in illness representation between Tongan and European DM patients. Tongan patients were more likely to report perceptions of DM as cyclical, uncontrollable, and caused by external factors. Poor adherence to diet was significantly associated with cyclical timeline ($p < .05$) and perceived cause of DM from poor medical care in the past ($p < .01$). Poor adherence to medications was significantly associated with perceptions of a cyclical nature of DM ($r_s = -.27$, $p < .05$), more severe consequences

($r_s = -.28$, $p < .05$), and external causes of DM such as God's will ($r_s = -.40$, $p < .001$), environmental pollution ($r_s = -.33$, $p < .01$), and poor medical care ($r_s = -.29$, $p < .05$).

A cross sectional correlation study by Griva et al. (2000) examined the respective and combined role of illness representation and self-efficacy in insulin treatment adherence and metabolic control, in 64 DM Type 1 adolescents and young adults. Significant correlations were found between several illness representation dimensions and self-efficacy in this study. Self-efficacy beliefs were associated with greater perceived control ($p < .01$), fewer diabetes-associated symptoms ($p < .01$) and the perception of less serious consequences ($p < .001$). Perceived control ($t (62) = 2.79$, $p = .007$) was the only significant difference found between patients reporting good and poor insulin adherence with higher perceptions of control was related to better adherence with prescribed insulin regimen.

The Lay explanatory model was used as a guiding framework for a cross sectional correlation study of 300 Type 2 DM patients in the kingdom of Nepal (Kart et al., 2007). The purposes of this study were to examine symptoms that patients identified with DM, and examine the relationship between lay explanations and self-management of DM. Self-management activities included diet, exercise, glucose testing, foot care, stress management, taking medications, taking complementary and alternative medicine (CAM), and stress management. Lay explanations included patients' perception of causes of DM, timeline (acuity/chronicity), timeline (cycle), consequences, personal control, treatment control, and emotional representation of DM. There was a high degree of internal reliability (Cronbach's alpha of 0.83) in the symptoms response of participants. The most frequently reported symptoms believed to be associated with DM

included fatigue (82.6%), weight loss (80%), and loss of strength (74.5%). Participants who believed that alcohol consumption and smoking was a cause of their diabetes were less likely to adhere to a healthful diet ($\beta = -0.170$), but more likely to report greater medication adherence ($\beta = 0.172$). A significant negative relationship was found between a belief in psychological causes (poor mental attitude, family concerns, overwork, and/or negative emotional state) of diabetes and reported medication use ($\beta = -0.172$, $p < .05$). A negative relationship was also reported between treatment control and medication use ($\beta = -0.346$, $p < .05$). More confidence in DM treatment was associated with poorer medication adherence ($\beta = -.346$, $p < .05$), but better adherence to self-management activities such as, exercise ($\beta = .184$, $p < .05$) , CAM ($\beta = .314$, $p < .05$), and stress management ($\beta = .309$, $p < .05$). Stronger beliefs in the cyclicality of DM was related to more consistent medication usage ($\beta = 0.147$, $p < .05$) and healthful diet ($\beta = 0.169$, $p < .05$).

A cross sectional study drawn from a convenience sample of 123 adults with DM Type 2 and a family history of diabetes, examined participants recollections of family members' DM controllability and social consequences in relation to their own health beliefs and behaviors (Scollan-Koliopoulos et al., 2007). A statistically significant positive relationship was found between recollections of the participant about family members' controllability beliefs ($p = .03$) and perceived social consequences ($p = .01$) and the participants own beliefs. More perceived social consequences of DM were associated with insulin regimen non-adherence ($P = 0.005$). More perceived social consequences ($p = .01$) and controllability ($p = .01$) of DM were negatively associated with adherence to

pill regimens. There were no statistically significant relationships between consequences or controllability and diet, exercise, or glucose monitoring.

In summary, the literature review of the illness representation of DM patients supports the CSM as a guiding framework for examining coping strategies and outcomes in individuals living with chronic illness. Every illness representation dimension was correlated with some aspect of managing life with Type 1 and Type 2 DM among adolescents and adults, across various cultures, and as complications changed the dynamics of living with DM. Multigenerational legacies of living with DM as well as patient-partner dyads' illness representations were also found capable of predicting self-management coping strategies of DM patients.

Many of the findings were relevant to the proposed study of the illness representation of CKD patients. The findings that the illness representations of individuals with DM are shaped by multigenerational legacies may prove to be important in CKD, an illness that shares the multigenerational legacy phenomenon. This finding gives support to adding a family history of kidney disease to the clinical characteristics in the proposed model. The findings that patients may share general illness perceptions within a common chronic illness, but have different specific illness beliefs according to co-morbidities also lends support to adding co-morbidity to the model. Another interesting finding to consider is that the patient's perception of how diabetes was explained to them was a strong predictor of their illness representation of DM, which therefore, according to the CSM, would affect the patient's health behavior choices such as medication adherence.

Also noted in this review of CSM in the diabetic population, is the paucity of studies examining the relationship between illness representations and the specific problem-focused coping strategy of medication adherence. Only 5 of 16 DM studies (Barnes et al., 2004; Griva et al., 2000; Kart et al., 2007; Scollan-Koliopoulos et al., 2007; Searle et al., 2007), included medication adherence in the final analysis and in none of the studies was medication adherence the predominant coping strategy examined. All five studies were non-randomized. Four of the five studies were cross sectional in design, while one was a prospective repeated measures design. Sample sizes ranged from 82 to 300 patients with Type 2 DM and 64 patients with Type 1 DM. There were variations among the studies of DM medication regimens examined with some studies limited to insulin injections, some to oral medications, and still others with both or just described as diabetes medications. Having such variation in the few DM studies incorporating illness representation and medication adherence makes it difficult to draw consistent conclusions on which to build more long-term studies to examine medication adherence in individuals managing life with chronic illness. The exclusive use of self-report medication adherence questionnaires was another limitation of these studies resulting in unusually high adherence rates that sometimes skewed the results to the extent that medication adherence was excluded from the model. Use of other medication adherence measurement tools, such as pill counts or pharmacy refill records in addition to self-report, would add support to the predictability of illness representation in relation to medication adherence.

Hypertension. Six studies that used the CSM or similar self-regulation model were conducted with participants from the hypertension (HTN) patient population

(Blumhagen, 1980; dela Cruz & Galang, 2008; Godoy-Izquierdo, López-Chicheri, López-Torrecillas, Vélez, & Godoy, 2007; Hekler et al., 2008; Meyer, Leventhal, & Gutmann, 1985; Ross, Walker, & MacLeod, 2004). Rich information was captured about illness perceptions of patients with HTN, however congruent with the ESRD and DM studies, a minority of the HTN studies examined the relationship between illness representation and medication adherence.

Two of the six studies were qualitative studies using Kleinman's explanatory model of illness, an anthropological model similar to CSM, but focused more on cultural perceptions, as a guiding framework (Blumhagen, 1980; dela Cruz & Galang, 2008). Blumhagen (1980) used an exploratory descriptive design to explore illness beliefs of 103 people recruited from an urban Veterans Administration Medical Center HTN clinic. In this study, two belief models emerged - the Popular Model and the Professional Model. The Popular Model was held by 72% of the participants who believed they had 'Hyper-Tension' described as "excessive tenseness" from social stress that led to physical illness (p. 197). The remaining 28% of the participants subscribed to the Professional Model described as a continuing pressure built up in the systemic circulation. More than half (68%) felt there was agreement between the Popular Model and the Professional Model and 32% stated that they knew the difference, but rejected the Professional Model as one that was generally true, but did not pertain to them personally. Blumhagen stressed the importance of clinicians' understanding of the role of language when caring for patients with high blood pressure. He states, "Plain folk say 'Hyper-Tension': the experts say hypertension, and each thinks the other is talking about the same thing" when in reality, they may be talking about very different illnesses (p. 224). Relationships between illness

beliefs and illness behaviors were not addressed in this study, but the authors did cite this as suitable for future studies.

Dela Cruz and Galang (2008) examined illness beliefs and practices of hypertensive Filipino Americans using the explanatory model, exploring CSM dimensions of cause, identity, consequences and treatment. This qualitative study used focus groups segregated by gender, 10 men and 17 women. The illness beliefs of this sample corresponded to the biomedical model. Men reported higher insurance costs and doctors fees, and sexual-related side effects of medications as reasons for not adhering to medication regimens. Women reported forgetfulness and family pressures for not adhering to healthy lifestyle changes and medication regimens. This study was aimed at the participant's culture, family, and work issues as causes for health behavior choices rather than the association with particular illness beliefs.

A cross sectional study by Godoy-Izquierdo et al. (2007) sought to establish the contents of lay illness models of influenza, cancer, and HTN as well as depression and schizophrenia, based on the CSM (Godoy-Izquierdo et al., 2007). The illness representation of healthy participants and those suffering with these diseases, as well as participants who have and have not coexisted with people suffering with these diseases, were examined and compared (N = 348). Similar profiles were found across physical and mental disease, and the illness representations of healthy and ill participants were generally in line with the medical model in this study. However, the cases that were not in line with the medical model, had beliefs very divergent from the accepted medical knowledge. Of the participants in this study with physical illness, influenza, cancer, or HTN, the hypertensive participants' belief were clearly far from accepted medical

knowledge. A significant difference was found in the illness representation of those participants who experienced disease, either personally or through relatives, and those who have not ($p < 0.05$). Those participants who have experienced or co-existed with someone experiencing the disease perceived their condition as significantly less chronic and serious, with a lower impact on day-to-day life and well-being, having more controllability and curability, and more preventable, stable, and cyclical than participants who have not experienced or co-existed with someone experiencing the disease.

A cross sectional study of 102 African American hypertensive patients examined their lay models of HTN and the relationships of those models to medication adherence, life-style behaviors (diet, exercise, weight loss and getting regular check-ups), stress-reducing behaviors (including prayer), and blood pressure control (Hekler et al., 2008). An interview was developed specifically for this study and administered in hour long sessions by trained African American interviewers. Rather than soliciting participant's beliefs about HTN in general, a 19-item instrument was used to assess participants' beliefs about their own blood pressure. Using principal component analysis with varimax rotation, two main factors (eiganvalues of 3 and 2) were extracted as representing participants' beliefs of cause and control dimensions. Factor 1, drawn from the cause/control dimensions, endorsed the Medical Belief Model (MBM) with causal beliefs such as family history and age that could be controlled by medications and diet (Cronbach $\alpha = 0.64$). Factor 2, drawn from cause/control dimensions, endorsed the Stress Belief Model (SBM) with causal beliefs related to stress that could be controlled by stress reduction (Cronbach $\alpha = 0.63$). Other illness representation dimensions included in the final analysis along with MBM, SMB and demographic variables were

identity (eigenvalue = 1.9) and consequences (eigenvalue = 2.2). Medication adherence was determined by self-report of whether the participants took their medications every time within the past two weeks. Medication adherence was dichotomized as adherent and nonadherent after evaluation of the data indicated a bimodal distribution of 50% self-report of adherent and 50% non-adherent. Correlation analyses were conducted to examine relationships among beliefs, behaviors, and blood pressure. Medication adherence was not statistically significantly correlated with illness representation dimensions (identity, timeline, consequences, cause, and control), demographic variables (education, marital status, gender), or biomedical variables (body mass index and number of years with diagnosis) in this analysis. Multiple regression analyses indicated only one variable significantly predicted medication adherence, that being age (OR = 1.07, CI 1.01 - 1.13, $p < 0.05$). Older age was associated with greater medication adherence ($t = -2.4$, $df = 100$, $p < 0.05$), endorsement of the Stress Belief Model ($r = - 0.22$, $df = 100$, $p < 0.05$), and consequences ($r = - 0.22$, $df = 100$, $p < 0.05$).

A longitudinal exploratory study was conducted with 230 randomly selected individuals presenting to a primary care, renal, or HTN clinic for screening or treatment (Meyer et al., 1985). The participants were entered into one of four groups depending on their HTN status and clinic history: (1) normotensive group (n = 50) consisted of patients in a primary care clinic for non-blood pressure reasons; (2) newly treated group (n = 65) were hypertensive patients attending a clinic for the first visit for treatment of their elevated blood pressure; (3) continuing treatment group (n = 50) were receiving treatment for at least three months to 15 years; and (4) re-entry group (n = 65) were patients who had dropped out and had returned to a clinic for treatment of their HTN. The purpose of

this study was to investigate whether people develop illness representations about HTN and evaluate the impact of their illness representations on medication adherence and remaining in treatment. Adherence to medications was examined in the continuing treatment group, as it was felt this was most appropriate since they have remained in treatment and were less likely to drop out of treatment. Remaining in treatment was examined in the newly treated and re-entry groups as these groups are making decisions about the necessity of treatment. Findings indicated that people do construct illness representations of hypertension and there are strong similarities to prior experiences with illness by the patient or a family member. All four groups believed symptoms of HTN were present and one could monitor blood pressure elevations by these symptoms. An interesting side note indicating that patients are aware of the medical knowledge that HTN is asymptomatic was that a majority (63%) of the continuing treatment group specifically asked that their beliefs about blood pressure symptoms not be communicated to their provider. In general, the groups believed that HTN was of limited duration and related to a variety of causes such as work and family stressors and diet. Examining the illness representations by groups of non-hypertensive, newly treated, continuous, and re-entry hypertensive patients illustrated that their illness representations evolved over time, in some cases to a closer match with the medical model. In the continuing treatment group, 92% of the participants identified symptoms of HTN and 37% of these believed treatment affected their symptoms. Of the 37% who believed treatment affected symptoms, 70% reported taking their medications as prescribed, and of these, 53% had good blood pressure control. Of those patients who believed treatment affected their symptoms, but did not take their medication as prescribed, 29% treated their HTN as an

acute illness, and took their medication only when symptoms were present. This study demonstrated that identity of symptoms and timeline beliefs predicted medication adherence in a group of hypertensive patients who were receiving treatment for their hypertension on a continuous basis.

Only one of the six hypertensive studies focused specifically on the examination of illness representations and medication adherence (Ross et al., 2004). This cross sectional study of 514 hypertensive patients recruited from secondary clinics in the United Kingdom found high self-reported medication compliance rates (78%). In general, this sample of hypertensive patients' scores of their illness representation beliefs (possible range 1-5) indicated a high perception of the chronicity of their disease (M = 3.55, S.D. 0.44), but also that it changes over time (M = 3.21, S.D. 0.79). The scores also indicated they did not perceive their illness causing great emotional distress with a generally low emotional response (M = 2.56, S.D. 0.74) however, outliers scored very high. Day-to-day disruption of life (consequences) caused by hypertension was moderately scored (M = 2.63, S.D. 0.63). Both control dimensions, treatment (M = 3.53, S.D. 0.60) and personal (M = 3.49, S.D. 0.66), were scored high indicating that the participants believed in both personal and treatment efficacy in controlling hypertension. Participants who held high personal control beliefs were less likely to be adherent with their medications as opposed to those who believe their treatment could control their blood pressure, who were more apt to be adherent with their medications. Analysis of multiple logistic regression showed statistically significant relationships between medication adherence and emotional response (OR 0.65, CI 0.47 - 0.90, $p < .001$) and personal control (OR 0.59, CI 0.40 - 0.89, $p = .012$). Age was the only demographic

variable that predicted medication adherence (OR 4.82, CI 2.85 - 815), $p < .001$). The authors pointed out that illness representation may have mediated the relationship between age and medication adherence since age was related to both illness representation dimensions and medication adherence.

Information gleaned from the six studies that were guided by the CSM or similar self-regulation models and focused on patients with HTN provide useful insight for the proposed CKD study. These six studies included 1324 participants drawn from various community and healthcare settings. Two of the study designs were qualitative, three were cross sectional, and one was a longitudinal exploratory study with randomly selected participants. Three of the studies were drawn from culturally diverse groups, including Filipinos, and African Americans. These studies found that HTN patients subscribe to two general belief models of HTN, stress-related models and biomedical-related models which, in turn, predict their choice of coping strategies (Blumhagen, 1980; dela Cruz & Galang, 2008; Hekler et al., 2008). Those who identified the stress-related model described using stress reduction behaviors, including prayer, to reduce the symptoms of HTN. Those who identified the biomedical-related model reported behaviors such as dietary compliance and taking medications as strategies to help reduce the symptoms of HTN. According to medical knowledge, HTN is an asymptomatic condition, as is the early stages of CKD (Blumhagen, 1980; Meyer et al., 1985; Stevens & Levey, 2009; Stewart et al., 2007) so the findings that patients identify symptoms of HTN that can be controlled by medically prescribed treatments is an important finding for the current CKD study. Meyer et al. (1985) revealed the dynamic nature of illness representations of HTN and that the longer patients were in treatment for HTN, the more

consistent their beliefs were with the biomedical model. If these findings hold true for CKD patients, the relationship between illness representations and medication adherence may be affected by the length of time the patient has been treated for CKD. Five illness representation dimensions of HTN were significantly related to medication adherence: identity, timeline (chronic/acute), personal control, treatment control and emotional response.

Individual and Clinical Characteristics

A review of the literature regarding the model of CKD patients' illness representations in relation to their medication adherence behavior with renal protective medications reveals conflicting findings. There is a lack of consensus of relationships among illness representation, medication adherence, demographics and clinical characteristics in research drawing from the chronic illness population. The lack of research examining these variables in CKD patients is evident and the current study adds to the scientific knowledge base required for further study of this important population and efforts to slow the progression of CKD.

Age. The relationship of age to illness representation dimensions and medication adherence varied across studies. Among the studies examining illness representation of chronic disease patients and adherence, age was significantly related to four illness representation dimensions: identity, consequences, emotion, and control/cure (Lawson et al., 2007; Ross, 2004; Heckler, 2008; Glasgow, 1997). In general, older participants identified fewer symptoms related to their illness, reported less severe consequences and emotional distress, and higher treatment control beliefs than younger participants. Age was not related to any illness representation dimensions in the study by Griva et al.

(2000). Three studies did not examine the relationship between age and illness representations (Kart, 2007; Searle, 2007, Meyer, 1985). Ross et al. (2004) was the only study to examine the relationship of age with both illness representation and medication adherence. Age was significantly related to both illness representation (emotion, consequence, and control/cure) and medication adherence, thus raising the possibility that the relationship between age and medication adherence may be mediated by illness representation. Most of the studies reviewed, specific to medication adherence among chronic disease patients, revealed a significant positive relationship between age and medication adherence (Ross, 2004; Heckler, 2008; Bame, 1993; Caro, Salas, Speckman, Raggio, & Jackson, 1999; Caro, Speckman, Salas, Raggio, & Jackson, 1999; Shrank et al., 2006). However, in a longitudinal study by Caro and Speckman et al. (1999) the medication adherence gap between the ages closed at 4.5 years into the study with both young and old becoming less adherent. In a meta analysis of 596 adherence studies, of which 238 were medication adherence specific, DiMatteo (2004) reported significant relationships between age and adherence, but whether the relationship was positive or negative depended on the measurement tool. A negative relationship was found with self-report measures of adherence with older participants reporting less adherence, but a positive relationship was found with older participants being more adherent when measures other than self-report were used. As with illness representation studies, there were some medication adherence studies of chronic disease patients that found no significant relationships, such as among DM patients (Griva et al., 2000), hemodialysis patients (Curtin, Svarstad, & Keller, 1999), and COPD patients (George et al., 2005).

Gender. The relationships among gender, illness representations and medication adherence varied across studies. Among the studies examining illness representation of chronic disease patients and adherence, gender was significantly related to three illness representation dimensions: cause, consequences, and control/cure (Glasgow et al., 1997; Heckler et al., 2008; Lawson et al., 2007; Ross et al., 2004). In general, male participants exhibited stronger beliefs that their illness was caused by risk factors (i.e. smoking, dietary indiscretion, alcohol consumption) ($p < .001$) and reported more severe consequences resulting from their illness than females ($p < .05$). Males scored higher on personal control beliefs than females ($p < .01$), whereas females reported higher treatment control beliefs ($p = .0000$). Four studies did not examine the relationships between gender and illness representation (Griva et al., 2000; Kart et al., 2007; Searle et al., 2007, Meyer et al., 1985). Ross et al. (2004) was the only study to examine the relationship of gender to both illness representation and medication adherence finding a significant relationship to both, thus raising the possibility that the relationship between gender and medication adherence may be mediated by illness representation. The literature specific to medication adherence was varied with two studies finding females more adherent (Ross et al., 2004; Caro, Speckman et al., 1999), two studies finding males more adherent (Shrank et al., 2006; The Boston Consulting Group and Harris Interactive, 2003), and three studies finding no significant difference in adherence (Bame et al, 1993; Curtin et al, 1999; DiMatteo, 2004). In a longitudinal study by Caro, Salas et al., (1999) the medication adherence gap between the genders closed at 4.5 years into the study with both males and females becoming less adherent ($p < .001$). In the initial year of diagnosis of hypertension, women were more persistent in their hypertensive medication use than

men (80% compared to 77% respectively) with the gap closing at 4.5 years (47% compared to 46% respectively).

Race. Only one study reported finding a significant relationship between race and illness representation, that being African Americans reported higher treatment control beliefs than Caucasians and other races (Glasgow et al., 1997). No other illness representation studies reviewed addressed the association of race with illness representation dimensions. Two of the studies reviewed, specific to medication adherence among chronic disease patients, revealed a significant relationship between race and medication adherence (Curtin et al., 1999; and Shenolikar et al., 2006) and two studies found no significant differences in race and medication adherence, one of which was with ESRD participants (Bame et al., 1993; Kressin et al., 2007). In general, the studies finding significant relationships reported African American participants were less adherent than Caucasians and other races. Prescribed medication adherence data was highly skewed toward perfect adherence in a study of use of prescribed medications and home remedies among African American and white Americans (Brown & Segal, 1996). However, it was also found that African American participants were significantly more likely to admit non-adherence than white American participants. In a large study of race and medication adherence of DM Type 2 enrollees of Medicare, Caucasians refilled and consumed a significantly higher total number of oral DM prescriptions, and had higher rates of medication adherence with oral DM medications than African Americans and other race groups after adjusting for age, gender, healthcare cost, number of medications, and co-morbidities (Shenolikar et al., 2006). Six of the medication adherence studies reviewed did not address race as a variable of study (The Boston Consulting Group,

2003; Caro, Salas et al., 1999; Caro, Speckman et al., 1999; Shrank et al., 2006; George et al., 2005; DiMatteo, 2004).

Education. Among the studies examining illness representation of chronic disease patients and adherence, education was significantly related to two illness representation dimensions: identity and control/cure (Glasgow et al., 1997; Heckler et al., 2008; & Lawson et al., 2007). Higher education was significantly associated with lower identity of illness related symptoms and treatment control beliefs, but higher personal control beliefs. One study found no significant correlation with education and illness representation or adherence (Griva et al., 2000) and one found no significant correlation with adherence (Ross et al., 2004). Three illness representation studies did not address relationships between education and illness representation (Kart et al., 2007; Meyer et al., 1985; & Searle et al., 2007). Two medication adherence studies found no significant relationships between education level and medication adherence (Bame et al., 1993; Curtin et al., 1999) and one study found a significantly positive relationship between education level and chronic illness treatment regimens, but not acute condition treatment regimens (DiMatteo, 2004). Five medication adherence studies did not examine the variable of education (Caro, Salas et al. 1999; George et al., 2005; Shenolikar et al., 2006; Shrank et al., 2006; & The Boston Consulting Group, 2003).

Financial status. None of the illness representation studies reviewed addressed illness representation and income. Significant associations were found in the medication adherence studies reviewed, however, how income is measured raises questions of the usefulness of the findings. Bame et al. (1993) found a significant association between medium income ($10,000 - 25,000) participants and medication adherence versus low

income patients (< $10,000), and no significant association between higher income (> $25,000) participants and medication adherence. Shank (2006) found significant associations between medication adherence with patients residing in higher income zip codes. This measurement seems to be an indirect measurement, since a lower income person may be living with someone in a higher income zip code area. A meta-analysis of adherence and demographic studies found a significant and positive correlation when studies used actual numeric measures of income rather than non-numerical categories (DiMatteo, 2004). Two medication adherence studies reviewed did not address income as a variable (Caro, Salas et al., 1999; & Curtin et al., 1999).

Marital/living with partner status. One study of illness representation and adherence reported a significant association with illness representations and participants living with partners (Lawson et al., 2007). Participants who reported living with a partner identified fewer illness related symptoms than those living alone ($p < .05$). One study reported significant findings ($p < .05$) of decreased medication adherence if participants were married (Kart et al., 2007). Two studies found no significant difference in medication adherence behavior between participants married/living with a partner and those living alone (Bame et al., 1993; Searle et al., 2007). Searle et al. (2007) posited that a person's medication adherence practices are beyond the partner's influence.

Co-morbidity. Searle et al. (2008) studied the illness representation of patients with type 2 DM without complications, with retinopathy, and active ulcers. The illness representation beliefs of DM were generally consistent across the groups, however there were significant differences found between the group with active ulcers and those without complications and with retinopathy. The group with the co-morbidity of active ulcers

reported higher scores regarding personal control, lower scores regarding treatment control, a more cyclical timeline perception and believed that excess weight and lack of exercise were causes of DM than the other two groups. None of the studies examining illness representation of chronic disease patients and adherence addressed illness representation and co-morbidities and the only medication adherence studies that addressed it found no significant association between the number of co-morbidities and medication adherence (Curtin et al., 1999).

Length of time after diagnosis of CKD. The studies do not produce a clear picture of the effect of the length of time since an illness was diagnosed with illness representation beliefs or medication adherence. Two illness representation studies found no significant correlation between length of time since diagnosis of chronic illness and illness representations (Griva et al., 2000; and Hekler et al., 2008). One longitudinal study of four groups of hypertensive participants, normotensive, new to treatment, continued treatment and return to treatment found that illness representation beliefs evolve over time to a closer match with the medical model and more coherent understanding of hypertension. Two medication adherence studies found no significant associations with length of time diagnosis and adherence. If used as an indirect measure of time of illness diagnosis, the time from when a medication was first prescribed was shown to affect adherence rates. If the prescription was filled upon first being prescribed (presumably when first diagnosed), adherence rates were highest at 97% in the first six months and then declined to 78% over the next four years (Caro, Salas et al., 1999).

Family history of CKD/Dialysis. A family history of CKD is a risk factor for susceptibility of CKD (NKF, 2004). Patients' experiences living with family members

with CKD and dialysis may affect their own health beliefs and health behaviors. Diabetes and hypertension studies indicate that living with family members with DM or HTN significantly affects the health behaviors of the next generation (Godoy-Izquierdo et al., 2007; Lawson et al., 2007, Scollan-Koliopoulos et al., 2005; Scollan-Koliopoulos et al., 2007). Participants with family members having DM complications had perceived higher emotional distress than those without family members with DM ($p < .01$) (Lawson et al., 2007) and HTN participants with family members also having high blood pressure perceived a less chronic and more cyclical timeline ($p < .05$), less serious consequences ($p < .01$) and more controllability of their disease than those without family members with HTN ($p < .05$) (Godoy-Izquierdo et al., 2007) . Scollan-Koliopoulos et al., (2007) found significant relationships between participants' recollections of family members' experiences and management of DM and their own perceptions of increased consequences and controllability of their disease which was significantly associated with a lower rate of medication adherence.

Total number of medications. The total number of medications patients were prescribed were not included in the illness representation studies reviewed. In the medication adherence literature, the findings of the impact of the total number of medications a person is prescribed on medication adherence is conflicting. Some study findings indicated that an increased number of medications were associated with a lower adherence rate (Col, Fanale, & Kronholm, 1990; Monane, Bohn, Gurwitz, Glynn, & Avorn, 1994) while other studies found the opposite (Ownby, Hertzog, Crocco, & Duara, 2006; Shalansky & Levy, 2002). One of the objectives in a study of 1054 patients at high risk for drug-related problems, by Billups, Malone, and Carter (2000) was to identify

indicators of compliance. In this study patients with a higher number of medications were significantly more adherent with their medications than those prescribed few medications ($p < 0.001$). Upon further analyses, Billups et al. (2000) suggested that patients prescribed more chronic medications may perceive they are sicker and become more attentive to their drug regimen.

Summary

This review of the literature examining the illness representation of patients with ESRD, DM, and HTN supports the value of unveiling patient perspectives of their illness and treatment. It also exposes several gaps that remain to be closed by further research in patient illness and treatment beliefs leading to choices of strategies to address the threats their illness poses to their health and well-being. For the purposes of this study of early stage CKD patients' illness representation in relation to medication adherence to preserve kidney function, the lack of patient illness perception studies in this population is a glaring gap. This gap necessitated the use of study samples drawn from chronic illnesses such as ESRD, DM, and HTN as proxy samples in which to study CSM guided research.

The findings of Hagger and Orbell 's (2003) meta-analysis of 45 empirical studies guided by the CSM of patients living with 23 illnesses (including DM and HTN) attest to the validity of the CSM as a guiding framework for this study. This meta-analysis concluded that the CSM has remained constant in its focus of the individual's self-regulating belief system of illness representation, coping and appraisal across cultures, disciplines and illnesses. The review of four ESRD, sixteen DM, and six HTN studies from 1980 to 2008 included 5394 participants drawn from various age groups, cultures, and settings. The majority of the study designs were cross sectional (15) with the

remaining study designs being qualitative (4), random control trials (3), longitudinal (2), quasi-experimental (1), and review of literature (1). There was consensus among all of the studies that understanding patients' illness representation lends important information about the experience of living with and self-managing chronic illness.

All illness representation dimensions revealed significant findings in one or more of the reviewed studies. Most illness representation correlations were consistent across the studies. Some inconsistencies were noted that need further elucidation such as a higher belief in treatment controllability of symptoms or illness predicting improved treatment adherence in some studies, and poorer adherence in others. Considering the grave consequences of disease progression in CKD patients and the benefits of adherence with renal protective medications, it is important that several major research limitations be addressed in the proposed CKD study. This study will (1) rectify the lack of studies examining CKD patients' illness representation of this progressive chronic disease; (2) build on the limited research of the ability of illness representation to predict the problem-focused coping strategy of medication adherence behaviors; and (3) strengthen the validity of medication adherence findings in CSM guided studies by using more than one tool in the measurement of medication adherence.

CHAPTER 3

Research Design and Method

The purposes of this study were to: (a) describe the illness and treatment beliefs of CKD patients in stage 3 guided by the CSM, and the relationship of those beliefs to adherence with renal protective medications, ACE-I, as measured by self-report; (b) determine the adherence level of ACE-I among CKD stage 3 patients as measured self-report and retrospectively with pharmacy refill records; (c) examine relationships between individual and clinical characteristics with patient beliefs and self-reported medication adherence with ACE-I; and (d) determine the relationship between patient self-report of adherence with ACE-I and adherence as measured by the MPR. This chapter includes the description of the study design, sampling, recruitment and setting, human subject protection, operational definitions and instruments, data collection procedures and preliminary analysis.

Study Design

A descriptive correlational, cross-sectional design was used to examine the illness and treatment beliefs of patients with stage 3 CKD and their relationship to renal protective medication adherence. The cross sectional design allows an examination of relationships between variables in this understudied population.

Sampling and Setting

The study participants were drawn from a convenience sample of renal clinic patients seen in a Midwestern Veterans Administration Medical Center (VAMC). Pre-study it was concluded that there were approximately 580 unique patients with an eGFR of 30-59 mL/min/1.73m^2 (stage 3 CKD) on record at the VAMC study location who had

appointments in the renal clinic within the last 12 months. If 80-85% of those patients have been prescribed an ACE-I or ARB by their VAMC providers, as has been suggested (Cooke & Fatodu, 2006; Schmieder, 2005), this would indicate that there would be approximately 464-493 patients being seen in the VAMC renal clinic with stage 3 CKD receiving an ACE-I or ARB. More patients at the VAMC are prescribed an ACE-I as it is recommended first line as formulary agent over the ARB which is non-formulary. Therefore, the ACE-I is the class of medication used in this study.

Power was calculated to determine an adequate sample size to perform multiple regression analyses taking into account effect size and number of possible predictor variables. Power analysis was based on the formula: $N \geq (8/f^2) + (M-1)$, where f^2 = effect size and M = number of independent variables (Tabachnick & Fidell, 2007, p. 123). A medium effect size of 0.15 was proposed based on published research examining the relationship between illness representations and medication adherence (O'Connor, Jardine, & Millar, 2008; Scollan-Koliopoulos, O'Connell, & Walker, 2007). Based on this information, an estimated sample size of 68 would provide 80% power to detect a medium effect size of .15 of 16 predictors on the value of f to detect correlations at an alpha of .05. However, a larger sample size of 100 was set as a goal and recruited in anticipation of the possibility of the dependent variable not being normally distributed as has been evidenced in research studies examining medication adherence in patients with chronic illness (Ediger et al., 2007; Horne & Weinman, 2002; Senior, Marteau, Weinman, & Genetic Risk Assessment for F.H.T.S.G., 2004). To complete the study with 100 participants based on the power analysis and on sample recruitment in IR-medication adherence studies (Barnes, Moss-Morris, & Kaufusi, 2004; Griva, Myers, &

Newman, 2000; O'Connor et al., 2008), approximately 240 patients were to be invited to participate in an attempt to secure 134 consented participants agreeing to complete the questionnaires. It was anticipated that approximately 25% of the participants would not complete the questionnaires due to time constraints, change in health status, or simply disinterest in participating in the study.

The inclusion criteria guiding selection of participants for the sample was:

1. Stage 3 CKD diagnosis (ICD-9 585-3 or eGFR 30-59 mL/min/1.73m$^{2)}$. This information was obtained through chart review. Stage 3 CKD is an early stage of kidney disease where efforts to prevent or slow the progression has a higher success rate; also the stage often associated with additional complications from the disease progression and patients are being seen by nephrologists in renal clinics.
2. Prescribed an ACE-I in the 12 months preceding the study through the VAMC pharmacy. This information was obtained through chart review. An ACE-I is a medication that is shown to be renal protective.

All of the VAMC renal clinic patients are over the age of 18 and able to read and speak English as a requirement of entering military service.

Protection of Participants' Human Rights

Institutional Review Board approval as an expedited study (Appendix A) was obtained from Indiana University and the VAMC Research and Development department. The purpose, risks, and benefits of the study were explained in understandable written form for the VAMC population. Confidentiality, privacy of patient information, and participants rights were addressed as well as contact information

provided if participants had questions about their rights. Voluntary participation and the right to decline to participate were also addressed. Informed consent and authorization for release of health information for research forms were obtained in writing before data collection. Participant's personal private information was removed and anonymous identification (ID) numbers were assigned to data from questionnaires and chart reviews. Master files with participant private information was kept in a locked file cabinet in the research office with access limited to the PI and research assistant. Identifying information and study data were kept separate at all times.

All data were kept confidential on secured, password protected computers. Data were entered into an SPSS database using assigned study ID numbers. No personal identifiers were entered into the database. The data was reported as group data with no individual identifying information. All identifying information was destroyed as soon as possible after data collection.

Study Procedures

Recruitment was carried out by the principal investigator (PI) who had staff privileges in the VAMC renal clinic. The PI was an authorized delegate of an attending nephrologist in the renal clinic and the renal clinic medical director. The renal clinic medical director granted permission to the PI to screen medical records of clinic patients in order to determine eligibility (Appendix B).

The medication records of 914 renal clinic patients were screened in order to determine participant eligibility. Specific eligibility criteria confirmed via medical record review included the patient being: 1) diagnosed with CKD stage 3, or had an estimated Glomerular Filtration Rate (eGFR) of 30-59 mL/min/1); and 2) prescribed an ACE-I

within 12 months before recruitment started. A total of 350 patients were seen in the renal clinic who had stage 3 CKD of which 200 were prescribed an ACE-I. As the PI had authority to screen for eligibility status only, a chart review to investigate why only 200 patients met criteria was not possible. A reasonable explanation would be that some of the stage 3 CKD patients were unable to tolerate an ACE-I and some may have been prescribed a non-formulary ARB. A contact list of 200 eligible patients was created by the PI that contained eligible patients' names, addresses, and phone numbers only.

The initial contact with 200 eligible patients was made by mail. Cover letters (Appendix C) were mailed along with the self-administered survey, an informed consent form (Appendix D), an authorization for release of health information for research form, a stamped self-addressed return envelope, and $2.00 bill in appreciation and as an incentive to complete the study.

One week after the survey packet was mailed, the PI or research assistant followed-up with a telephone call to answer any questions the participants may have had about participating in the study or completing the questionnaire, consent form, or authorization form. If a participant did not receive a survey packet, the PI or research assistant confirmed name and address and mailed another packet, and then called one week later to answer any questions. Patients were informed that participation was completely voluntary and that they were free to decline participation.

Approximately one week after the prospective participant received the packet and was contacted by telephone, a reminder letter (Appendix E) was mailed to participants who had not returned survey packets.

At completion of the study period, a total of 200 survey packets were mailed out to eligible participants. During follow-up phone calls, 10 eligible participants indicated that they had not received a packet and requested that another be sent. The address was confirmed and 10 packets were re-sent a second time. A third packet was mailed to one prospect who reported not having received the first or second packet and requested a third packet be mailed. A total of 92 participants returned signed informed consent, authorization form and completed survey questionnaire. A total of 33 subjects returned blank survey packets as an indication that they did not wish to participate. A total of 75 did not respond at all. The final number of participants for this study is 92 which is a 46% response rate. A delay in follow-up phone calls was encountered approximately midway in the study due to changes in research assistants which may have contributed to a less than desired response rate.

Information obtained by the PI from medical records after obtaining informed consent included:

1. Individual and clinical characteristic information: age, co-morbid conditions, and total number of prescribed medications.
2. Pharmacy records were also accessed by the PI to measure participants' refill rates of ACE-I using the Medication Possession Ratio.

Operational Definitions and Instruments

Individual and Clinical Characteristics

A demographic data sheet was used to collect self-reported: gender, race, education, financial status, living with partner status, history of living with family member with ESRD or dialysis, and length of time with CKD diagnosis (Appendix F).

A chart review was performed by the PI to collect: age, co-morbid conditions and total number of medications prescribed. Age is defined as the number of years based on documented age in the VAMC medical record at the time of chart review. The co-morbid conditions are operationally defined as the presence of diabetes mellitus, hypertension, and/or cardiovascular conditions. Diabetes is operationally defined as a documented diagnosis of type 1 or type 2 diabetes. Hypertension is operationally defined as a documented diagnosis of hypertension. Cardiovascular co-morbid condition is operationally defined as general cardiovascular disease (CVD) including documented diagnosis of myocardial infarction, coronary insufficiency, angina, ischemic stroke, hemorrhagic stroke, transient ischemic attack, peripheral artery disease, or heart failure (D'Agostino et al., 2008). The total number of medications prescribed is defined as the sum of medications prescribed for outpatient use and is listed as VAMC or non-VAMC active medications in the patient's electronic chart at the time of chart review.

Illness Representation

Illness Representation is conceptually defined as the CKD patient's cognitive perceptions of and emotional responses to their illness and treatment which determines how they will respond to the threats imposed by CKD. The cognitive perceptions, termed cognitive representations, are composed of five dimensions: identity, cause, timeline,

control/cure, and consequences. The emotional representation scale and the five cognitive representation dimensions, identity, timeline, control/cure, consequences, and cause, are operationalized independently and measured with the Revised Illness Perception Questionnaire (IPQ-R).

The IPQ-R is a psychometrically enhanced version of the original Illness Perception Questionnaire (IPQ) (Moss-Morris et al., 2002; O'Connor et al., 2008). The developers of the original IPQ, were also involved in the revision process (Moss-Morris et al., 2002; Weinman, Petrie, Moss-Morris, & Horne, 1996). The revised format of the scale was improved by separating the causal and identity subscales from the rest of the scale. The causal scale range was extended suggesting that causes of many illnesses factor out into psychological, risk factor, immune system and chance factors. The changes made in the identity scale separate the concept of illness identity from the somatization process. The original IPQ scale rates symptom severity, while the IPQ-R rates symptoms that the patient identifies as related to their illness. Whereas the original IPQ instrument measured only the cognitive dimension of illness representation, the IPQ-R was extended to include a subscale to measure the emotional dimension of illness representation.

The reliability of the IPQ-R has been supported in studies with variety of illnesses, including chronic illnesses such as diabetes and hypertension, and with various racial and ethnic populations (Broadbent, Petrie, Main, & Weinman, 2006; Hagger & Orbell, 2005; Kaptein et al., 2007; Marcos, Cantero, Escobar, & Acosta, 2007; Searle, Norman, Thompson, & Vedhara, 2007). Moss-Morris et al. (2002) verified factorial structure of the IPQ-R with principal components analysis in a sample of 711 patients from eight different illness groups (asthma, n = 86; diabetes, n = 73; rheumatoid arthritis, n = 76;

chronic pain n = 63; acute pain, n = 35; myocardial infarction, n = 47; multiple sclerosis, n = 170; and HIV, n = 161). Analysis also revealed evidence of good internal subscale reliability with Cronbach's alpha of: .84 for timeline, .81 for control/cure, .84 for consequences, and .88 for emotional responses). The internal consistency of the identity subscale was considered less important than the other subscales due to the disparate symptoms among different illnesses. However, the Cronbach's alpha of .75 for the identity subscale demonstrated a relatively high degree of internal reliability. A separate principal components analysis with varimax rotation was conducted on the causal items and produced four factors which accounted for 57% of the total variance. Psychological attributions, the first factor, accounted for 33% of the total variance and had a Cronbach's alpha of .86. The remaining factors, labeled risk factors, immunity, and accident or chance had Cronbach's alpha of .77, .67, and .23 respectively for the mixed illness samples in the Moss-Morris et al. study. Investigation of the test-retest reliability of the IPQ-R was carried out with 76 rheumatoid arthritis (RA) patients over a long-term interim of six-months and with 28 inpatient renal patients in a short-term interim of three weeks. Generally good stability was evidenced over both periods with Pearson's correlations ranging from .46 to.88 (the only correlation less than .5 was personal control) for the short-term renal patients and from .35 to .82 (the only correlation less than .5 was timeline, cyclical) for the long-term RA sample.

For this study, the Illness Representation is measured with the IPQ-R instrument which has been adapted to reflect items specific to chronic kidney disease patients (see Appendix F). The word "illness" has been changed to kidney disease throughout the instrument. Additional items were added to the Identity subscale and were tested for

content validity by five expert reviewers (discussed in more detail below in Identity section). The authors of the IPQ-R encourage researchers to use the questionnaire, adapt it to particular illnesses and research settings and share the results with others through the IPQ website: http://www.uib.no/ipq/ (Moss-Morris et al., 2002).

Discussion of the IPQ-R is divided into three sections, covering the identity and causal subscales separately from timeline, control/cure, consequences and emotion response subscales. It is important to note that the Illness Representation construct in this study is the unique and dynamic perceptions specific to CKD stage 3 patients in the renal clinics of a VAMC. There is no overall Illness Representation score, rather the Illness Representation is described by the scoring of the subscales: identity, cause, timeline, control/cure, consequences, and emotional response. Thus, the relationships between the Illness Representation and medication adherence is drawn from analyses of these same subscales.

Identity. Identity is conceptually defined as the label assigned to the illness by the patient, often associated with symptoms they perceive to be related to their illness. The identity subscale consists of 14 commonly experienced symptoms: pain, sore throat, nausea, breathlessness, weight loss, fatigue, stiff joints, sore eyes, wheeziness, headaches, upset stomach, sleep difficulties, dizziness, and loss of strength. In the IPQ-R questionnaire for this study, eight items were added to the identity subscale to reflect symptoms CKD patients may experience and/or associate with their kidney disease: itching, back pain, problems with urinating, not hungry, bad taste in mouth, bad breath, legs swelling, and puffy eyes. These symptoms, specific to CKD patients, have been described by CKD patients in personal clinical encounters with the PI as well as

described and reported in two recent studies (Agarwal, 2009; Harwood, Wilson, Locking, Sontrop, & Spittal, 2009).

A panel of five expert clinical and research reviewers was chosen to examine the content of the IPQ-R adapted identity subscale for evidence of content validity before using the added items for data collection. These experts were chosen for their research and clinical experience evidenced by published papers in refereed journals, papers presented at professional meetings, research experience with the target population and focus topic, as well as work with theoretical guided research and instrument construction. Content validity was quantified by using a four-point scale index of content validity (CVI) measurement tool that is included in Appendix G (DeVon et al., 2007; Grant & Davis, 1997; Lynn, 1986; Waltz, Strickland, & Lenz, 2005). Newly added items were rated as valid with a minimum score of .83 CVI (Lynn, 1986). After items were considered for revision, elimination and addition according to CVI and expert reviewer communications, three of the 8 proposed new items were retained and added to the original scale. Each item added, bad taste in mouth, legs/feet swelling, and puffy eyes, had a CVI score of 1. Item wording changes were made based on expert reviewer recommendations: "breathlessness" was changed to "short of breath"; "wheeziness" to "wheezing"; "sleep difficulties" to "problems sleeping"; "dizziness" to "dizzy". The final identity subscale contains 17 symptoms.

The instructions for the Identity scale are congruent with the concept of illness identity, rather than just reporting symptoms. Theoretically individuals will attempt to link symptoms to an illness label, therefore, after asking the participants to indicate whether or not they have experienced a symptom, in a yes or no response, they are then

asked to indicate, in a yes or no response, if they believe that symptom is related to CKD. Only the data from the second part of this scale, symptoms related to CKD, are used in analyses. Coding for the identity scale is: yes = 1; no = 0. The yes-rated responses indicate that the participant believes the symptom is CKD related. Scores are summed to indicate a heavier or lighter symptom burden relative to CKD, as perceived by the participants.

Cause. Cause is conceptually defined as the patient's ideas of CKD etiology. Cause is operationalized with a subscale of 18 attribution items: stress or worry, hereditary, germ or virus, diet, chance, poor medical care, pollution, own behavior, mental attitude, family problems or worries, overwork, emotional state, aging, alcohol, smoking, accident or injury, personality, and altered immunity. Participants were instructed to share their own views about the causes of their illness rather than what medical providers or family members may suggest as causes. Participants were asked to rate all 18 attribution items on a 5-point scale, where strongly disagree = 1, disagree = 2, neither agree nor disagree = 3; agree = 4, and strongly agree = 5, the extent to which they believe causes such as stress or worry, hereditary factors, germs or viruses, diet are responsible for their CKD. Initial analysis for these items will start with separate items grouped according to mean of scores rated for each of the 18 attribution items. The causal items are not independently used as a scale. With a sufficient sample size of 90 participants, groups of causal beliefs can be identified with factor analysis (e.g. stress, lifestyle, environment). The identified groups are then used as subscales and examined as possible predictors of coping strategies, which in this study is medication adherence (Moss-Morris et al., 2002). The measure also includes a section for the participants to

rank the top three causes perceived as most important in causing their illness. They were invited to choose from the list of 18 causes or list others that are not on the list. This information is not included in the analysis, but will be examined for future refinement of the measurement instrument.

Timeline, control/cure, consequence, and emotion. The timeline, control/cure, consequence, and emotion subscales include items soliciting patient responses on a continuum scale from agreement to disagreement that reveal their perceptions of these illness representation dimensions of CKD. Their responses are coded as follows: strongly disagree = 1, disagree = 2, neither agree nor disagree = 3; agree = 4, and strongly agree = 5. The mean scores, standard deviations, and ranges for each subscale are calculated for analysis. For subscales with six items, a maximum of two missing items are allowed and for the remainder, a maximum of one missing item per subscale are allowed with the individual participant's mean inserted for adjustment.

Timeline is conceptually defined as the patient's perception of duration or pattern of illness (i.e. acute, chronic, cyclical). The timeline subscale consists of six items that measure the patient's perceived duration of CKD as acute or chronic, using the aforementioned 5-point scale (i.e. I expect to have this illness for the rest of my life) and four items that measure the patient's perceived pattern of recurrence as cyclical (i.e. My symptoms come and go in cycles). Items are coded, with reverse coding appropriately so that higher scores indicate the patient's perception of CKD being more chronic and more cyclical in nature and lower scores indicating a perception of CKD being more acute and less cyclical in nature. Items 18, 21, and 35 are reverse scored.

Control or cure is conceptually defined as the patient's perception of how well he or she can control or cure the illness and how well a treatment can control or cure their condition. The control or cure subscales consists of six items that measure the patient's perceived ability to personally control/cure their illness (i.e. What I do can determine whether my chronic kidney disease gets better or worse) and five items that measure beliefs that treatment can effectively control/cure their illness (i.e. My treatment can control my chronic kidney disease). Items are coded, with reverse coding appropriately so that higher scores indicate the patient's perception that control or cure is possible through personal efforts or in response to treatment. Items 32, 34, 36, and 40 are reverse scored.

Consequence is conceptually defined as the effects the patient associates with the illness and aspects of life such as social and economical changes. The consequence subscale consists of six items that measures the perceived financial, social, family and self-image impact of CKD on the patient's life (i.e. My chronic kidney disease has major consequences on my life; and My chronic kidney disease has serious financial consequences). Items are coded, with reverse coding appropriately so that higher scores indicate the patient's perception that CKD carries serious consequences. Item 25 is reverse scored.

Emotional representations are internal emotional responses to the mental image of possible dangers imposed by the illness threat, such as depression, fear, anger, or anxiety. The emotion subscale consists of six items measuring emotional distress specific to illness (i.e. Having chronic kidney disease makes me feel anxious.) and also found to predict health related responses (Cameron, Leventhal, & Leventhal, 1993). Items are

coded, with reverse coding appropriately so that higher scores indicate strong negative feelings associated the illness. Item 53 is reverse coded.

Medication Adherence

Medication adherence is conceptually defined as the patient's decision to take his medication as prescribed. An accurate assessment of adherence to medication is essential to achieve valid, reliable, and generalizable research findings. One of the greatest challenges in medication adherence research is the lack of a gold standard measure. Many years of adherence research producing hundreds of studies and thousands of papers have yet to answer the question of how best to operationalize the concept of adherence (DiMatteo, 2004; Garber, Nau, Erickson, Aikens, & Lawrence, 2004). The use of multiple strategies (i.e. self-report, refill records, pill count, biological markers, electronic monitoring) with a variety of advantages and disadvantages of each, adds to the challenge (Balkrishnan & Jayawant, 2007; National Quality Forum, 2005; World Health Organization, 2003).

Farmer (1999) recommends basing the choice of the method for measuring adherence to medication "on the usefulness and reliability of the method in light of the researcher's or clinician's goals. He goes on to state that "specific methods may be more applicable to certain situations, depending on the type of adherence being assessed, the precision required, and the intended application of the results." (p. 1074). Using more than one adherence measurement method is considered a more effective analysis of medication adherence than reliance on one single method, with caution and understanding of the limitations of each (Cook, Wade, Martin, & Perri, 2005; Farmer, 1999; Steiner, Koepsell, Fihn, & Inui, 1988). Steiner et al. (1988) posited that pharmacy-

based measurements of adherence should always be examined and explained taking into account the patient's self-reported adherence behavior. With this in mind, medication adherence of ACE-I is measured by a self-report questionnaire, the Medication Adherence Report Scale (MARS) and by pharmacy refill records.

Self-report questionnaire. Using self-report measures of medication adherence is appropriate, in light of the theoretical framework of the study examining medication adherence from patient perspectives of their illness and treatment. Although subjective, self-report measures are more qualitatively informative than some more objective adherence measures and can add insight into reasons for lack of therapeutic responses to prescribed treatment (Choo et al., 1999). Self-report measures have been shown to overestimate adherence and are more accurate in identifying nonadherence (Cook et al., 2005; Farmer, 1999; R. E. Grymonpre, Didur, Montgomery, & Sitar, 1998). In general, the benefits of self-report questionnaires are that they are inexpensive, easy to use, can be validated, and may explain patient behavior. Limitations include being subject to response bias, overestimate adherence, accuracy is instrument dependent and may lack continuous data (Balkrishnan & Jayawant, 2007; Farmer, 1999; National Quality Forum, 2005; World Health Organization, 2003). Steps to minimize limitations were taken in the study.

Several precautions were taken to minimize skewed data resulting from response bias and overestimation of adherence, the tendency of participants to respond in a socially desirable manner rather than report actual medication adherence behavior which may be different than prescribed. Research indicates response bias can often be found in self-report studies and several instruments exits to measure social desirability in order to

control for it. However, even though the social desirability measures have been used and published in respectable publications and institutions over the years, when subjected to rigorous psychometric evaluation, they were found lacking and researchers are cautioned about using scores from these scales to correct scores from other scales (Barger, 2002; T. P. Johnson & Fendrich, 2002; Leite & Beretvas, 2005). For this reason and to avoid adding to participants' questionnaire burden, rather than add a social desirability questionnaire, strategies for reducing socially desirable responses were implemented. Waltz, Strickland, and Lenz (2005), recommended several strategies for minimizing socially desirable response:

1. Offering participants two socially desirable options rather than offering only the extremes of one socially desirable and one socially undesirable option helps to alleviate the judgmental dimension of the rating system. Avoid dichotomous formats such as true/false, yes/no. The five point MARS offers multiple options with degrees of social desirability or social undesirability (i.e. never, rarely, sometimes, often, and very often) rather than being dichotomous (i.e. yes, no) or having one socially desirable option and one socially undesirable option (i.e. always, never, not applicable).
2. The probability of socially desirable responses increases when respondents are faced with repeated closely related items in a multi-item single dimension measure. Using a measurement tool that assesses multiple dimensions of the variable of interest helps reduce bias. The MARS is designed so that respondents are not asked to respond to multiple closely related items on the medication adherence scale. The five items of the MARS assesses multiple dimensions

(intentional, unintentional, timing, dosing) of medication non-adherence with questions that are not closely related, (i.e. how often they forget to take it, take less, stop taking, miss a dose, and alter their medication dose).

3. Caution must be taken when wording instructions or writing scenarios in order not to induce a situation in which the information given leads respondents to answer in a way that will put them in a more favorable light. Clear and concise wording avoiding ambiguity helps reduce the potential for social desirable responses. Word items with general rather than personal referents are preferable. Avoid communicating that the responses will be positively or negatively valued by the investigator. The MARS was designed to minimize socially desirable response bias with item wording intentionally written to "diminish the social pressure on patients to report high adherence…" (Horne & Weinman, 2002, p. 22). The items are written in a fashion validated by adherence researchers in the early 1990s (Kravitz et al., 1993; Rand & Wise, 1994) that being to elicit reports of non-adherence. The scale is prefaced with instructions written in clear and concise wording with general referents that avoids implications of responses being judged positively or negatively by the investigator: "Many people find a way of using their medicines which suits them. This may differ from the instructions on the label or from what their doctor has said. Here are some ways in which people have said they use their medicines. For each statement please check the box that best applies to you." (Horne & Weinman, 2002, p. 22).
4. Multiple sources used to support the results of a single measure helps reduce social desirability bias. Multiple methods of measurement of a phenomena helps

reduce social desirability bias. Multiple measures are used to measure medication adherence in this study, the self-report MARS and chart review Refill Records.

5. Anonymity decreased participants concern for having their responses judged for social approval. Mailing the survey to the participant's home to complete encourages anonymity. The less identifying information, the less social desirability bias is evidenced. The participant's name did not appear on the questionnaire. Each questionnaire was numbered and cross referenced with name securely filed with investigator. Multiple methods, written and verbal, served as assurance of information confidentiality and responses not being shared with patient providers.

To address the limitations of accuracy of self-report instruments and data type, the self-report measurement instrument for the study was carefully chosen, with understanding that the accuracy of self-report data is instrument dependent and continuous is preferable to dichotomous data. The self-report instrument chosen is congruent with the theoretical framework of the study and has been tested for reliability and validity among participants with various illnesses, including chronic illness. The tool is designed and has been implemented in studies with data analysis using both continuous and dichotomous data.

The MARS self-report measure is also referred to as the MARS-5 in some studies. This is a relatively new instrument (Horne & Weinman, 2002) and has not been used in studies with CKD patients. The instrument was chosen for this study because of the close theoretical underpinnings of patients' illness representations and intentional decisions to adhere or not adhere to prescribed medication regimen. The MARS is written to provide

an estimation of intentional non-adherence with only one question related to unintentional non-adherence (how often they forget to take a medication dose) and four questions focused on the extent that patients follow recommendations in a way they find more suitable, but different from the way they perceived the provider recommended (how often they take less, stop taking, miss, and alter their medication dose). The MARS has been used in studies of medication adherence among 1674 patients including those with migraine headaches (Hedenrud, Jonsson, & Linde, 2008), chronic obstructive pulmonary disease (COPD) (George, Kong, Thoman, & Stewart, 2005), inflammatory bowel disease (IBD) (Ediger et al., 2007), familial hypercholesterolemia (Senior et al., 2004), chronic pain (Kendrew, Ward, Buick, Wright, & Horne, 2001), asthma (Menckeberg et al., 2008) and general pharmacy clients with prescribed medications (Mårdby, Åkerlind, & Jörgensen, 2007). Of these studies, internal reliability was reported with a Cronbach's alpha of 0.68 by Hedenrud et al. (2008), 0.73 by Mardby et al. (2007), and 0.81 by Menckeberg et al. (2008). The original MARS was developed as a nine item measure to assess non-adherence to preventive asthma inhalants (Horne & Weinman, 2002) and was utilized in a later asthma study by (Ohm & Aaronson, 2006), both with a Cronbach's alpha of 0.85. Barnes et al. (2004) adapted the MARS by adding two culturally appropriate questions to the original nine item scale in their study of Tongan and European diabetes patients, with a Chronbach's alpha of 0.79. The five-item MARS excludes the asthma specific questions (i.e. I only use it [inhaler] when I feel breathless) and in a non-threatening way asks the participant to rate how often they forget to take, take less, stop taking, miss and alter their medication dose on a 5-point scale where 1 = very often, 2 = often, 3 = sometimes, 4 = rarely, and 5 = never. The responses are

summed for each of the five items for a total range of 5 to 25. Higher levels of self-reported adherence are indicated with higher scores.

Previous studies have scored the MARS as a continuous or dichotomous variable. Some studies reported the MARS scores to be skewed toward higher values and selected to dichotomize the data with a priori cut-off points (Mårdby et al., 2007). Others chose cut-off points close to the mean value (Ediger et al., 2007). The MARS items are delivered in a manner in which the response options are congruent with a continuum of adherence behavior rather than an explicit adherent or non-adherent label (Ediger et al., 2007; Horne & Weinman 2002). Subjects are able to describe their typical medication adherence pattern even when they are not currently taking the medication rather than give an account of their medication adherence behavior over a specific timeframe.

Pharmacy refill records. Findings from using pharmacy refill records are encouraging in that there is consistency among studies using this method, and there are useful associations with the results derived from these measures and clinical outcomes in specific illnesses or medications (R. Grymonpre, Cheang, Fraser, Metge, & Sitar, 2006; Steiner & Prochazka, 1997). It is also generally acknowledged that measurement using pharmacy records are measuring refill patterns and not actual drug-taking behaviors (Christensen et al., 1997; Hess, Raebel, Conner, & Malone, 2006; Steiner & Prochazka, 1997). However, R. Grymonpre et al. (2006), in their study of medication adherence in older persons, found concordance between the rates with which patients refilled their medications and the rate that they consumed them. Refill records have been found to be positively related with direct measurements such as serum ($r = 0.42$, $p = 0.005$) and urine ($r = 0.45$, $p<0.05$) drug levels, self-reported medication consumption ($r = 0.47$, $p <$

0.001), and pill counts ($r = 0.68$, $p < 0.001$) (Steiner and Prochazka, 1997; Choo et al. 1999).

In general, the benefits of using pharmacy refill records includes: records accurate frequency and timeliness of refills; is inexpensive; avoids Hawthorne Effect; is non-invasive; and provides long-term data for large populations. Some of the limitations include: lack of information on quantity taken or timing of intake; difficult to classify unique refill patterns; problems with multiple pharmacies used; validity depends on completeness of database; assumption that a filled prescription equates to a prescription taken; and using electronic records requires database knowledge (Balkrishnan & Jayawant, 2007; Farmer, 1999; Vermeire et al., 2001; World Health Organization, 2003). Steps to minimize limitations have been used in this study.

The limitation of pharmacy refill records lacking information on quantity taken or timing of intake is more applicable to medications with difficult to measure exact doses (i.e. topical, drops, liquid) or when the timing of oral consumption is imperative (i.e. asthma inhalants, seizure medications). Pharmacy refill records are suitable for the proposed study of ACE-I since they are in oral pill form, and the timing of medication consumption is not a crucial factor. Unique refill patterns are problematic when using refill records as a measurement of adherence. Pharmacy refill records are appropriate for this study, since ACE-I are prescribed on a structured, consistent pattern and not on an "as needed" basis.

Multiple pharmacies used are not a limitation in this study. The participants in the study are veterans most of whom receive their medications from the centralized VAMC pharmacy. The limitations of pharmacy refill records depending on the

completeness of the database, is reduced by the Veteran's Health Information System Technology Architecture (VISTA) database, the well established computerized medical records system used by the VAMC (Morgan, 2005; Wannemacher, Schepers, & Townsend, 2002). The VAMC electronic pharmacy registry records the name of the drug, the dosage of each pill, the date of issue of the prescription, dosage instruction (i.e. pills per dose per times a day) and the quantity of pills released for a specified number of days.

The assumption that a filled prescription equates to a prescription taken is a well known limitation of pharmacy refill records. This limitation is also recognized in pill count and electronic monitoring devices, where the absence of a pill or the opening of the electronic pill bottle cap is assumed to equate consumption of the medication. Although this limitation can not be eliminated, there are studies with findings suggesting concordance between filled prescriptions and consumed medications (R. Grymonpre et al., 2006; Steiner & Prochazka, 1997) and with direct measurements such as serum ($r = 0.42$, $p = 0.005$) and urine ($r = 0.45$, $p < 0.05$) drug levels (Steiner and Prochazka, 1997). The limitation of electronic records requiring knowledge of database is reduced in the study because the PI has a working knowledge of the VAMC electronic records and database needed to successfully acquire pharmacy refill information for the proposed study.

Prescription refill records are used in conjunction with patient self-report to measure medication adherence. Medication adherence using pharmacy refill records have become more prominent with growth in computerized records systems (Christensen et al., 1997; Farmer, 1999; Karve et al., 2008). Even though pharmacy refill records have

been validated using biochemical assays, pill counts, and patient reports, there is no gold standard refill adherence measurement.

The Medication Possession Ratio (MPR) derived from VAMC electronic pharmacy records data will be used as a medication adherence measure in the proposed study. This measurement method reveals both length of therapy and gaps in therapy over a specified period of time in continuous measurement form. The MPR was chosen after reviewing the literature on pharmacy refill record medication adherence measures, especially with samples drawn from renal disease, diabetes, and hypertensive populations. The review of literature on pharmacy refill records was complicated by the inconsistent terminology used where a common term may have different definitions or mathematical expressions. On the other hand, there were also common definitions or mathematical expressions used for different terms.

Validity testing of pharmacy refill records suggests that the MPR is a valid adherence measure and that it is the term that should be applied across medication adherence studies using the formula: Number of days supply in index period divided by number of days in the study period (Cooper, Hall, Penland, Krueger, & May, 2009; Hess et al., 2006; Karve et al., 2008). MPR (or the same formula with a different term) is widely used in medication adherence studies using pharmacy records, and more important to the proposed study, is used in many of the studies examining medication adherence with ACE-I, and in studies with samples drawn from renal disease, diabetes, and hypertension patient populations (Cooke & Fatodu, 2006; R. Grymonpre et al., 2006; Hess et al., 2006; Karve et al., 2008; Mattke et al., 2007; Roe et al., 2000; Steiner & Prochazka, 1997). The MPR is operationally practical for research and for clinical

purposes in the VAMC and using the MPR term and formula in this study will contribute to the standardization of medication adherence terminology thus contributing to comparability and combining of research results (Cooper et al., 2009; Cramer, Benedict, Muszbek, Keskinaslan, & Khan, 2007).

Pharmacy records were examined for cohort dates of ACE-I starting 12 months or earliest date less than 12 months before study participation date as suggested by Karve et al. (2008). Participant adherence with ACE-I therapy was measured using the MPR formula: Number of days supply in index period divided by number of days in the study period. The MPR is truncated at 100% to prevent overestimation of MPR that does not equate with non-adherence behaviour (i.e. lost medication replacement, change in prescription, vacation extras). A one month run-out (grace) period is allowed for pharmacy record entry lag; therefore, the measure is calculated one month after the last refill record for each patient. In the case of hospitalization, it is assumed that the patient was perfectly adherent during hospitalizations in the index period. For the purposes of this study, MPR = Released / Issued. Released = Number of days ACE-I was supplied to patient in index period (filled within 12 months from start of study). Issued = days within 12 months of start of study in which the ACE-I was available by prescription to the patient. The number of issued days is calculated by subtracting the time between date the prescription was issued and the date of cancellation or index date if prescription is not canceled before then. The index date is the date of the start of study (initial survey packets mailed), August 10, 2010, therefore, the index period would be 365 days before, August 11, 2009. Allowing a grace period of 31 days is common in medication refill

literature and is allowed in this study. The end date for the grace period for this study is September 10, 2010.

The MPR results are reported as a percentage on a continuum from 0% to 100% adherence rather than the often used cut-offs of 80% or greater equating to adherence and 20% or less equating to non-adherence. When there is no scientific justification for cut-off points, using continuous rather than categorical data is preferable (Cramer et al., 2007; Steiner & Prochazka, 1997).

Preliminary Analysis

Quantitative data were collected, coded, entered into a database and analyzed using the Statistical Package for Social Sciences (SPSS) version 18.0 (SPSS Inc., Chicago, IL). Data were screened for errors prior to analysis. Identified errors were linked to appropriate data files, corrected then screened again in attempt to obtain error free data. Descriptive statistics, mean, median, standard deviation, and range for all continuous variables and subscale items were examined with raw data before reversal or recoding (Table 1); multi-item questionnaires, IPQ-R and MARS, were tested for internal consistency reliability using Cronbach's coefficient alpha.

Reliability

Support for internal consistency is recognized with a Cronbach's alpha of 0.70 or greater (Netemeyer, Bearden, & Sharma, 2003). If Cronbach's alpha is less than 0.70, item deletion was considered as well as Corrected Item-Total Correlation, especially for scales with a small number of items. As shown in Table 1, the Cronbach's alpha for the IPQ-R of 0.85 with subscales ranging from 0.76 to 0.86, before factoring the cause

subscale, indicates adequate internal consistency. The IPQ-R Cause subscale was examined before and after factor analysis.

Table 1

IPQ-R Subscale Item Statistics and Chronbach's Alpha

Scale (# of Items)	Possible Range	Mean	SD	Alpha
IPQ-R Questionnaire				0.85
Timeline acute - chronic (6)				0.86
short time	1 - 5	2.16	1.11	
permanent	1 - 5	3.73	1.17	
long time	1 - 5	3.69	1.16	
pass quickly	1 - 5	2.02	1.03	
rest of life	1 - 5	3.78	1.16	
improve in time	1 - 5	2.50	0.94	
Consequences (6)				0.81
Serious condition	1 - 5	3.72	1.14	
Major consequences	1 - 5	3.54	1.17	
Not much effect on life	1 - 5	2.46	1.24	
Affects how others see me	1 - 5	2.34	0.96	
Financial	1 - 5	2.91	1.13	
Difficulties for those close to me	1 - 5	2.63	1.05	
Personal Control (6)				0.86
A lot I can do	1 - 5	3.36	0.98	
I determine	1 - 5	3.64	0.85	
Course depends on me	1 - 5	3.46	1.06	
Nothing I do affects my disease	1 - 5	2.21	0.97	
I have power to influence disease	1 - 5	3.21	1.04	
My actions have no affect	1 - 5	2.34	0.97	
Treatment Control (5)				0.76
Little can be done	1 - 5	2.81	0.97	
Treatment effective in curing	1 - 5	2.83	0.97	
Negative affects can be avoided	1 - 5	3.22	0.87	
Medications can control	1 - 5	3.24	0.86	
No treatment can help	1 - 5	2.58	0.96	

Possible Range 1 = Strongly disagree to 5 = Strongly agree

Table 1 continued

IPQ-R Subscale Item Statistics and Chronbach's Alpha

Scale (# of Items)	Possible Range	Mean	SD	Alpha
IPQ-R Questionnaire				
Timeline cyclical (4)				0.83
Change day-to-day	1 - 5	2.41	0.81	
Comes and go in cycles	1 - 5	2.62	0.89	
Unpredictable	1 - 5	2.82	0.95	
Gets better and worse	1 - 5	2.80	0.89	
Emotional Representation (6)				0.76
Depressed	1 - 5	2.76	0.99	
Upset	1 - 5	2.49	0.92	
Angry	1 - 5	2.46	0.83	
Does not worry	1 - 5	2.68	0.98	
Anxious	1 - 5	2.83	0.91	
Afraid	1 - 5	2.78	0.86	
Cause				0.81
Stress/Worry	1 - 5	2.94	1.05	
Heredity	1 - 5	2.63	1.13	
Germ or virus	1 - 5	2.62	3.00	
Diet or eating habits	1 - 5	3.32	0.98	
Chance or bad luck	1 - 5	2.49	0.93	
Poor medical care in past	1 - 5	2.83	1.07	
Pollution or environment	1 - 5	2.69	0.91	
Own behavior	1 - 5	2.97	0.98	
Negative mental attitude	1 - 5	2.37	0.82	
Family problems and worries	1 - 5	2.52	0.92	
Overwork	1 - 5	2.53	0.91	
Emotional state	1 - 5	2.48	0.90	
Aging	1 - 5	3.39	0.99	
Alcohol	1 - 5	2.36	1.12	
Smoking	1 - 5	2.49	1.13	
Accident or injury	1 - 5	2.41	0.97	
Personality	1 - 5	2.25	0.80	
Altered immune system	1 - 5	2.77	1.00	
Identity:				
Symptoms related to kidney disease	N/A	N/A		0.84

Possible Range 1 = Strongly disagree to 5 = Strongly agree

Table 1 continued

IPQ-R Subscale Item Statistics and Chronbach's Alpha

Scale (# of Items)	Possible Range	Mean	SD	Alpha
Cause Subscale Factors				
Psychological (7)	1 - 5	2.55	0.92	0.84
Lifesyle (3)	1 - 5	2.55	1.14	0.73
Environmental (4)	1 - 5	2.65	0.97	0.60
Behavioral (2)	1 - 5	3.15	0.97	0.63
Destiny (2)	1 - 5	2.95	0.90	0.50

Study participants responded to the 18 item Cause subscale regarding their beliefs of the cause of their kidney disease. A separate principal components analysis (PCA) with varimax rotation was conducted on the causal items and produced five components with eigen values greater than 1 (Table 2) which accounted for 63% of the total variance. Nunnally and Bernstein (1994) recommend checking the data to make sure it warrants factoring. Sample size and strength of relationship among items are important considerations. Although there is disagreement in the literature about the appropriate sample size for factoring, the general consensus is the larger the better. The goal of the current study was to have a minimum of 90 responses to the cause subscale which would equal five responses per item. The actual response rate for the cause subscale was 88 slightly below the goal of 90. As recommended by Nunnally and Bernsetin, prior to performing PCA, the data was assessed for suitability for factor analysis. The correlation matrix revealed many coefficients of 0.3 or above. The Kaiser-Meyer-Oklin value was 0.71, exceeding the recommended value of 0.6, and the Barlett's Test of Sphericity reached statistical significance. These results indicated that the Cause subscale was suitable for factoring. Five factors were produced and labelled as Psychological, Lifestyle, Environment, Behavioral, and Destiny. Psychological causes, the first factor,

accounted for 27.87% of the total variance and had a Cronbach's alpha of 0.84 (Table 1). Lifestyle causes, the second factor, accounted for 10.95% of the total variance and had a Cronbach's alpha of 0.73. The remaining factors labelled environmental, behavioural, and destiny had a Cronbach's alpha of 0.60, 0.63, and 0.50 respectively for this study sample. Based on recommendations by Netemeyer et al. (2003), further investigation was performed on the factors with Cronbach's alpha less than 0.70. The Environmental factor had a Cronbach's alpha based on standardized items of 0.60 with only one item-total correlation below 0.3 (altered immune system 0.28) and the mean inter-item correlation of 0.27. The behavioural and destiny factors each had only two loadings and also had Cronbach's alphas based on standardized items of less than 0.70; all corrected item-total correlations were less than 0.30; and the mean inter-item correlation was 0.17. Three factors, psychological, lifestyle, and environment were retained for further analysis. Two factors, behavioural, and destiny were not used in further analyses.

Table 2

IPQ-R Cause Subscale Factor Loadings

Item #	Original Item Name	Cause Factors 1	2	3	4	5
50	Cause - emotional state	.815				
48	Cause - family problems and worries	.805				
47	Cause - negative mental attitude	.785				
39	Cause - stress/worry	.661				
55	Cause - personality	.647				
49	Cause - overwork	.539				
44	Cause - poor medical care in past	.462				
52	Cause - alcohol		.873			
53	Cause - smoking		.803			
40	Cause - heredity		.608			
41	Cause - germ or virus			.676		
45	Cause - pollution or environment			.648		
56	Cause - altered immune system			.637		
54	Cause - accident or injury			.621		
42	Cause - diet or eating habits				.824	
46	Cause - own behavior				.658	
43	Cause - chance or bad luck					.790
53	Cause – aging					.664

The Cronbach's alpha coefficient for the MARS scale was 0.64 which is below the recommended 0.70 (Table 3). Investigation of items revealed an increase in the alpha coefficient to 0.68 if item number 77 (I forget to take it) was deleted. This is understandable since this is a small scale of five items and the item in question is the only item of the five items that refers to unintentional nonadherence, whereas the other four

items refer to intentional nonadherence. Based on recommendations by Netemeyer et al. (2003), further investigation was performed and revealed a Cronbach's alpha based on standardized items of 0.73; all corrected item-total correlations were greater than 0.30; and the mean inter-item correlation was 0.35. Based on these findings, and theoretical and clinical importance of all five items in examination of medication adherence with ACE-I in this study population, it was decided that the MARS with all five questions would be used for analyses.

Table 3

MARS Subscale Item Statistics and Chronbach's Alpha

Scale (# of Items)	Possible Range	Mean	SD	Mean inter-item correlation	Alpha	Alpha on Standardized Items
MARS (5)				0.35	0.64	0.73
Forget	1 - 5	4.39	0.90			
Change dose	1 - 5	4.88	0.54			
Take less	1 - 5	4.85	0.67			
Stop taking	1 - 5	4.93	0.25			
Miss a dose	1 - 5	4.87	0.48			

Possible Range 1 = Strongly disagree to 5 = Strongly agree

Missing Values

Missing values were examined to understand the type of missing data and, if needed, the appropriate adjustment made. As seen in Table 4, only two Individual and Clinical Characteristic variables had greater than 5% missing data, ethnic origin (10.9%) and time since diagnosed with kidney disease (12%).

Table 4

Missing Data on Individual and Clinical Characteristics (Total *N* = 92*)*

Variables	Valid *N*	%	Missing *N*	%
Age	92	100	0	0
Gender	92	100	0	0
Race	90	97.8	2	2.2
Ethnic origin	82	89.1	10	10.9
Education	89	96.7	3	3.3
Financial status	89	96.7	3	3.3
Live with partner	90	97.8	2	2.2
Live with relative with ESRD/dialysis	90	97.2	2	2.2
Co-morbid conditions	92	100	0	0
Time since diagnosed with kidney disease	81	88	11	12
Number of prescribed medications	92	100	0	0

All IPQ-R subscale items had less than 5% missing values except for the Cause and Identity subscales. Missing values in the Cause subscale items ranged from 3.3 to 8.7%. With the exception of the identity subscale, there was acceptable missing data in the IPQ-R questionnaire (Table 5).

Table 5

Missing Values on IPQ-R Subscales (Total N = 92)

Subscale/Items	Valid *N*	%	Missing *N*	%
Timeline acute/chronic				
Short time	89	96.7	3	3.3
Permanent	91	98.9	1	1.1
Long time	89	96.7	3	3.3
Pass quickly	89	96.7	3	3.3
Rest of life	90	97.8	2	2.2
Improve in time	90	97.8	2	2.2
Consequences				
Serious condition	89	96.7	3	3.3
Major consequences	89	96.7	3	3.3
Not much effect	90	97.8	2	2.2
Affect how others see me	90	97.8	2	2.2
Financial	91	98.9	1	1.1
Difficulties for those close to me	91	98.9	1	1.1
Personal Control				
A lot I can do	90	97.8	2	2.2
I determine	91	98.9	1	1.1
Course depends on me	92	100	0	0
Nothing I can do	90	97.8	2	2.2
Power to influence disease	89	96.7	3	3.3
My actions have no affect	90	97.8	2	2.2
Treatment Control				
Little can be done	91	98.9	1	1.1
Treatment effective cure	90	97.8	2	2.2
Negative effects can be avoided	91	98.9	1	1.1
Medications can control	91	98.9	1	1.1
No treatment can help	90	97.8	2	2.2
Timeline Cyclical				
Change day-to-day	90	97.8	2	2.2
Comes and goes in cycles	89	96.7	3	3.3
Disease unpredictable	91	98.9	1	1.1
Gets better and worse	92	100	2	2.2

Table 5 continued

Missing Values on IPQ-R subscales (Total N = 92)

Subscale/Items	Valid *N*	%	Missing *N*	%
Emotional Representation				
Depressed	91	98.9	1	1.1
Upset	89	96.7	3	3.3
Angry	89	96.7	3	3.3
Does not worry	88	95.7	4	4.3
Anxious	88	95.7	4	4.3
Afraid	88	95.7	4	4.3
Cause	85	92.4	7	7.6
Stress/worry	88	95.7	4	4.3
Heredity	85	92.4	7	7.6
Germ or virus	85	92.4	7	7.6
Diet or eating habits	84	91.3	8	8.7
Chance or bad luck	87	94.6	5	5.4
Poor medical care in past	88	95.7	4	4.3
Pollution or environment	88	95.7	4	4.3
Own behavior	87	94.6	5	5.4
Negative mental attitude	88	95.7	4	4.3
Family problems and worries	85	92.4	7	7.6
Overwork	86	93.5	6	6.5
Emotional state	87	94.6	5	5.4
Aging	89	96.7	3	3.3
Alcohol	87	94.6	5	5.4
Smoking	87	94.6	5	5.4
Accident or injury	89	96.7	3	3.3
Personality	86	93.5	6	6.5
Altered immune system	85	92.4	7	7.6

There was a marked difference of missing values on the Identity subscale with more respondents answering “yes” or “no” to experiencing a symptom as opposed to answering whether or not they perceived that symptom being related to kidney disease (Tables 6 and 7). Initial analysis of the identity scale revealed a large range of non-random missing responses to the section asking the participants to indicate if they perceived the symptom to be related to kidney disease. This was an important finding since that is the section of the identity subscale that is used for analyses. An investigation

of responses to the identity scale often revealed that if an individual had not experienced the symptom, they did not answer the second part of the item, asking if the symptom they experienced was believed to be related to their kidney disease. It is understandable that they may have believed that since they did not have the symptom, it was not necessary to address the second statement. Since the intent of the identity subscale is to evaluate the perceptions of participants' contribution of an experienced symptom to their kidney disease, further exploration was required. Post hoc analysis was performed to filter only those participants who answered "Yes" they had experienced a symptom since knowing they had kidney disease, and then frequency statistics was run on the filtered data to investigate if they answered whether or not they believed the symptom was related to their kidney disease. As Table 7 indicates, there are fewer missed responses with the filtered data; however the valid number of cases is reduced substantially. The Identity subscale will be used for descriptive purposes only and will be deleted from further analysis.

Table 6

Missing Values of Identity Subscale: Symptoms Experienced ($N = 92$)

Symptoms Experienced	Valid *N*	%	Missing *N*	%
Pain	85	92.4	7	7.6
Sore throat	83	90.2	9	9.8
Nausea	82	89.1	10	10.9
Short of breath	86	93.5	6	6.5
Weight loss	83	90.2	9	9.8
Fatigue	85	92.4	7	7.6
Stiff joints	85	92.4	7	7.6
Sore eyes	83	90.2	9	9.8
Wheezing	82	89.1	10	10.9
Headaches	84	91.3	8	8.7
Upset stomach	83	90.2	9	9.8
Problem sleeping	86	93.5	6	6.5
Dizzy	83	90.2	9	9.8
Loss of strength	86	93.5	6	6.5
Bad taste in mouth	84	91.3	8	8.7
Legs/feet swelling	85	92.4	7	7.6
Puffy eyes	81	88	11	12

Table 7

Missing Values on IPQ-R Identity Subscale (Total *N* = 92)

	UNFILTERED*				FILTERED*			
Symptoms related to kidney disease	Valid *N*	%	Missing *N*	%	Valid *N*	%	Missing *N*	%
Pain	54	58.7	38	41.3	31	91.1	3	8.8
Sore throat	49	53.3	43	46.7	17	100	0	0
Nausea	44	47.8	48	52.2	17	85	3	15
Short of breath	38	41.3	38	41.3	15	65.2	8	34.8
Weight loss	47	51.1	45	48.3	46	97.9	1	2.1
Fatigue	57	62	35	38	56	82.3	12	17.6
Stiff joints	59	64.1	33	35.9	53	85.5	9	14.5
Sore eyes	48	52.2	44	47.8	18	81.8	4	18.2
Wheezing	47	51.1	45	48.9	21	87.5	3	12.5
Headaches	48	52.2	44	47.8	27	81.8	6	18.2
Upset stomach	50	54.3	42	45.7	25	83.3	5	16.7
Problem sleeping	57	62	35	38	46	85.2	8	14.8
Dizzy	49	53.3	43	46.7	32	78	9	22
Loss of strength	56	60.9	36	39.1	51	83.6	10	16.4
Bad taste in mouth	46	50	46	50	19	86.4	3	13.6
Legs/feet swelling	59	64.1	33	35.9	47	90.4	5	9.6
Puffy eyes	47	51.5	45	48.9	16	88.9	2	11.1

*Only computed among patients who answered “Yes” to having experienced the symptom

Examination of the values missing for the MARS items (Table 8) revealed less than desirable results with a range from 16 - 18 (17.4 - 19.6 %). Further analysis was employed to examine difference between observations.

Table 8

Missing Values on MARS ($N = 92$)

MARS Items	Valid *n*	%	Missing *n*	%
Forget	76	82.6	16	17.4
Change dose	75	81.5	17	18.5
Take less	75	81.5	17	18.5
Stop taking	74	80.4	18	19.6
Miss a dose	75	81.5	17	18.5

After examination of missing values from variables, further examination of the number of missing observations was indicated to identify patterns of missing data. When considering missing data, it must be determined if observations with missing values are systematically different from observations with observed values. If such a difference exists, bias can be easily introduced. Therefore, an analysis was employed (through the use of chi-squares and t-tests) in order to decipher if study participants that completed and did not complete the MARS scale differed by individual and clinical characteristics, as well as the cognitive representation and emotional response scales. This procedure was not deemed necessary for missing values regarding the cognitive representation and emotional response scales, due to the fact that only 2 - 4 (2% - 4%, respectively) study participants failed to provide sufficient data for these scales, relative to 20 (21.7%) of study participants on the MARS scale. For subscales with six items, a maximum of two missing items were allowed and for the remainder, a maximum of one missing item per subscale are allowed to be considered sufficient data. In these cases the missing values are replaced by the individual participant's mean score for that subscale.

Tables 9 and 10 indicated study participant Response/Non-response on the MARS did not vary significantly by the Individual Characteristics (Age, Education, Financial Status, Race and Living with a Partner). However, Response/Non-response on the MARS varied significantly by the clinical characteristic number of medications, $t(90) = 2.85$, $p < .01$. All other clinical characteristics were unrelated to response.

Table 9

T-test Analysis of Study Participant Response/Non-response on the MARS by the Individual (Age, Education, and Financial Status) and Clinical Characteristics (Length of Time Since CKD Diagnosis and Number of Medications)

Individual Characteristic	n	M (SD)	Possible Range	t
Age				
Responded	72	68.25 (8.62)	NA	-1.61
Did not respond	20	72.05 (11.68)	NA	
Education (years)				
Responded	69	13.97 (3.02)	1.00 - 19.00	.29
Did not respond	20	13.75 (2.99)	1.00 - 19.00	
Clinical Characteristic				
Length of Time (months) since CKD Diagnosis				
Responded	63	72.76 (86.57)	0 - 480	-.17
Did not respond	18	77.50 (109.37)	0 - 480	
Number of Medications				
Responded	72	12.86 (5.42)	NA	2.85**
Did not respond	20	10.25 (2.94)	NA	

**$p < .01$

Table 10

Chi-square Analysis Examining of Study Participant Response/Non-response on the MARS by the Individual (Race and Living with a Partner) and Clinical (Co-morbidity and Family history of ESRD/dialysis) Characteristics

Individual Characteristic	n	Responded	Did Not Respond	X^2
Race				
Caucasian/White	80	63 (78.8%)	17 (21.3%)	.01
African-American/Other	10	8 (80.0%)	2 (20.0%)	
Living with Partner				
Yes	54	43 (79.6%)	11 (20.4%)	.04
No	36	28 (77.8%)	8 (22.2%)	
Financial Status				
Not enough	23	17 (73.9%)	6 (26.1%)	.46
Just enough	44	35 (79.5%)	9 (20.5%)	
Comfortable level	22	18 (81.8%)	19 (21.3%)	
Clinical Characteristic				
Co-morbidity				
DM, HTN, or CVD	11	10 (90.9%)	1 (9.1%)	1.86
Combination of two	49	36 (73.5%)	13 (26.5%)	
Combination of three	32	26 (81.3%)	6 (18.8%)	
Living with Partner				
Yes	7	5 (71.4%)	2 (28.6%)	.25
No	83	66 (79.5%)	17 (20.5%)	

Table 11 indicated study participant Response/Non-response on the MARS varied significantly by the cognitive representation personal control, $t(89)=2.09$, $p<.05$. All other cognitive and emotional representation scale variables were unrelated to response. Thus, analysis indicated a slight bias among study participants regarding Response/Non-response on the MARS scales in terms of the number of medications and personal control variables.

Table 11

T-test Analysis Examining of Study Participant Response/Non-response on the MARS by the Cognitive and Emotional Representation Scales

Scale	n	Possible M (SD)	Range	t
Timeline (acute/chronic)				
Responded	72	3.78 (.84)	1.00-5.00	.70
Did not respond	19	3.62 (.84)	1.00-5.00	
Consequences				
Responded	72	3.18 (.78)	1.00-5.00	1.52
Did not respond	19	2.87 (.78)	1.00-5.00	
Personal Control				
Responded	72	3.59 (.80)	1.00-5.00	2.09*
Did not respond	19	3.17 (.66)	1.00-5.00	
Treatment Control				
Responded	72	3.19 (.62)	1.00-5.00	.23
Did not respond	19	3.15 (.86)	1.00-5.00	
Timeline (cynical)				
Responded	72	2.63 (.67)	1.00-5.00	-1.02
Did not respond	19	2.82 (.88)	1.00-5.00	
Cause: Psychological				
Responded	70	2.57 (.63)	1.00-5.00	.51
Did not respond	19	2.48 (.72)	1.00-5.00	
Cause: Lifestyle				
Responded	70	2.50 (.94)	1.00-5.00	.26
Did not respond	19	2.44 (.73)	1.00-5.00	
Cause: Environment				
Responded	70	2.50 (.94)	1.00-5.00	1.32
Did not respond	19	2.44 (.79)	1.00-5.00	
Emotional Response				
Responded	72	2.80 (.60)	1.00-5.00	.52
Did not respond	18	2.71 (.70)	1.00-5.00	

* $p = <.05$

Normality of Variables

Independent variables. Prior to analysis, data were screened for the assumptions of normality, homoscedasticity, linearity, and presence of outliers. Each variable was tested individually and multivariate normality was assumed with individual normality.

Individual and clinical characteristics. As seen in Table 12, normality of individual and clinical characteristic variables were explored with descriptive statistics and with visual examination of histograms, QQ Plots and Box Plots. The results indicate an acceptable degree of skewness and kurtosis for age, education, family income, live with partner, time since diagnosed with kidney disease, co-morbid conditions and number of prescribed medications for use in further analyses.

The subject's responses on the original questionnaire were examined for subscales with extreme outliers. Outlier scores were checked for errors and if found, corrected. If Outlier scores were genuine, then the original mean was compared to the 5% trimmed mean. The trimmed mean is obtained by removing the top and bottom 5 percent of cases and recalculated for a new mean value. The original mean and the 5% trimmed mean should be compared to evaluate whether the outliers have a large influence on the mean. If the mean values are very different, the outliers have a large influence on the mean (Duffy & Jacobsen, 2001). As noted in Table 12, the mean and the 5% trimmed means in the subscales were all very similar for age, education years, family income, lived with partner, co-morbid conditions and number of prescribed medications indicating that the outliers will not have a large influence on the mean. These variables also have acceptable skewness and kurtosis; therefore these cases will be retained for further analyses.

Gender and ethnic origin is not suitable for further analysis at this point. The

outliers indicated in the QQ and Box Plots greatly affect the mean so that if the outliers are removed only one group is left in gender and ethnic origin (male, non-Spanish/Hispanic). These variables also exhibit extreme skewness or kurtosis. The time since being diagnosed with kidney disease variable has acceptable degrees of skewness and kurtosis, however there is a large difference between the Mean and the 5% Trimmed Mean, indicating that the outliers greatly affect the Mean and thus would pose problems for further analysis. This is a theoretically and clinically important variable and was adjusted by collapsing into percentiles around the median in order to be acceptable for use in further analysis.

Table 12

Individual and Clinical Characteristics Tests for Normality

Variable	Mean	5% Trimmed Mean	Skewness	Kurtosis
Age	69.08	69.06	.235	-.697
Gender	N/A	N/A	9.59	92
Ethnic Origin	N/A	N/A	-1.59	25.75
Race	N/A	N/A	-2.52	5.15
Education Years	13.92	13.89	.323	-1.10
Family Income	N/A	N/A	.02	-1.01
Live with Partner	N/A	N/A	.415	-1.87
Lived with ESRD relative	N/A	N/A	-3.21	8.47
Diagnosed with kidney disease	73.81	61.85	.812	1.19
Co-morbid conditions	5.23	5.33	-.82	-.27
# prescribed medications	12.29	12.07	.812	1.19

Illness representation subscales. As seen in Table 13, normality of subscales were explored with descriptive statistics and with visual examination of histograms, QQ Plots and Box Plots. The results indicate an acceptable degree of skewness and kurtosis

for use of these subscales for further analyses. The original questionnaire responses were examined for subscales with extreme outliers. Outlier scores were checked for errors and if found, corrected. If Outlier scores were genuine, then the original mean was compared to the 5% trimmed mean. As noted in Table 13, the mean and the 5% trimmed means in the subscales were all very similar, therefore all cases in the subscales will be retained for further analyses.

Table 13

IPQ-R Summed Subscales Test for Normality

Subscale	Possible Range	Mean	5% Trimmed Mean	Skewness	Kurtosis
Timeline acute/chronic	6 - 30	22.69	22.98	-.61	.41
Consequences	6 - 30	18.66	18.76	-.22	-.45
Personal Control	6 - 30	21.13	21.17	-.18	-.51
Treatment Control	5 - 25	15.91	15.97	-.45	.90
Timeline Cyclical	4 - 20	10.68	10.75	-.39	.124
Emotion Representation	6 - 30	16.68	16.64	.25	.25
Total Cause	18 - 90	49.10	49.58	-.87	.62
Cause Factored					
Psychological	7 - 35	17.95	18.10	-.625	.241
Lifestyle	3 - 15	7.49	7.40	.311	-.002
Environmental	4 - 20	10.62	10.55	.385	1.23
Behavioral	2 - 10	6.29	6.35	-.525	.516
Destiny	2 - 10	5.90	5.99	-.767	.512

Dependent variable. As seen in Table 14, normality of the MARS subscale was explored with descriptive statistics and with visual examination of histograms, QQ Plots and Box Plots. The results indicate a violation of the assumption of skewness. Five

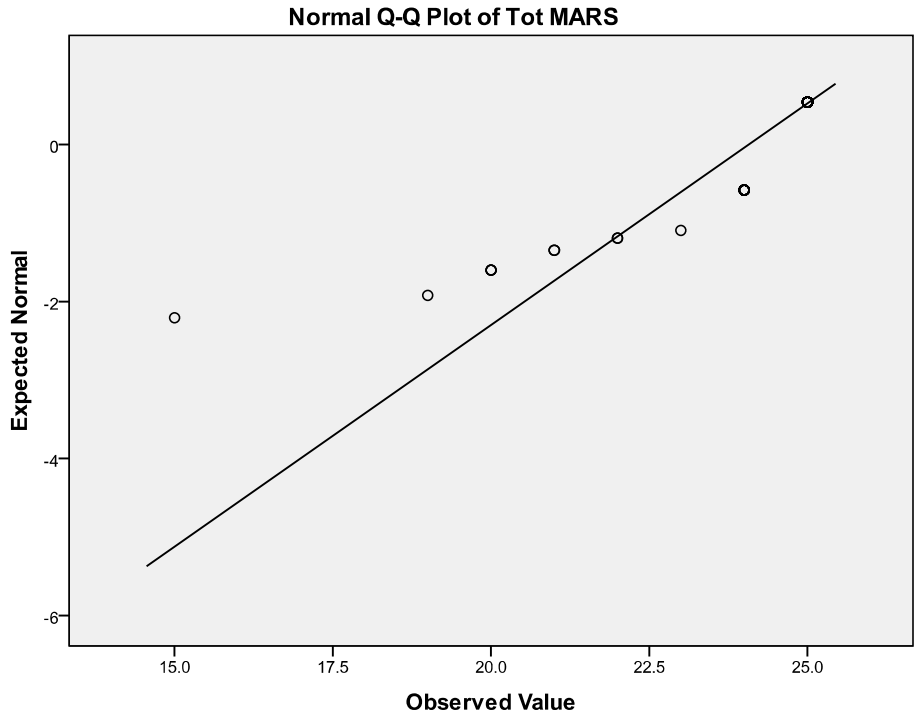
outliers were noted. The original questionnaire responses were examined for extreme outliers. Outlier scores were checked for errors and if found, corrected. The Total MARS mean was compared to the 5% trimmed mean. The MARS mean and the 5% trimmed mean in the subscale were very similar, indicating that the outliers should not have a major affect on further analyses. The Normal Q-Q Plot of the MARS was examined with some deviations from normality indicated (Figure 2). Transformation of the distribution for the MARS variable was considered, however, criteria for a problematic level of skewness is inconsistent in the literature (Norris & Aroian, 2004). The effect of skew on the Cronbach alpha and correlation analyses have not been substantive (Norris & Aroian, 2004; Greer, Dunlap, Hunter, & Berman, 2006), inferring that transformation may not be necessary. In addition, transformation often complicates interpretation of data in relation to theoretical or clinical purposes; therefore, transformations will not be used in this study.

Table 14

Summed MARS Tests for Normality

Scale	Mean	5% Trimmed Mean	Skewness	Kurtosis
MARS	24.07	24.34	2.93	.56

Figure 2



Homogeneity and Linearity

Homogeneity of variance was evaluated as part of the t-test and analysis of variances analyses (ANOVA). Levene's test for equality of variances was used to test the assumption of homogeneity when answering the research questions in Chapter 4. When there were violations to the assumption of homogeneity in t-test analyses, Leven's test < .05, the Equal variances not assumed t-value was used. There were no violations to this assumption in the ANOVA analyses. Linearity was evaluated using scatter plots and correlation indicating no violation of this assumption.

Summary

This chapter provided information about the study design, procedure for data collection, sample and setting, operational definitions and instruments. Preliminary analysis was conducted to examine means, standard deviations, and ranges of variables

and subscales, reliability of instruments, effect of missing values, normality, homogeneity, and linearity.

Descriptive means were within the possible ranges. Chronbach's alpha was found to be in acceptable ranges except for two Cause Factors which were ultimately dropped from further analyses.

Missing values was examined indicating acceptable levels for all of the IPQ-R subscales except Identity, which is retained for descriptive purposes, but not for further analyses. The MARS was examined to determine if missing values were systematically different from observed values. Study participant Response/Non-response on the MARS did not vary significantly by Individual and Clinical Characteristics or IPQ-R subscales except in two cases. This analysis indicated a slight bias among study participants regarding Response/Non-response on the MARS in terms of number of medications and personal control.

Normality tests indicated the presence of skewness and kurtosis which is noted as limitations that might weaken the outcomes. However, transformation will not be used for analyses. Homogeneity and linearity were evaluated with no major violations of assumption noted.

A description of study participants will be discussed and research questions answered in Chapter 4. Descriptive statistics including frequency, mean, standard deviation, median, and range will be used to describe study participants. Descriptive statistics including frequency, mean, standard deviation, and range were used to answer research questions 1 and 2. Pearson's correlation coefficients were used to answer research questions 3, 5, and 8. A series of correlations and t-tests were used to answer

research question 4. A series of correlations, t-tests, and ANOVA were used to answer research question 6 and 7.

CHAPTER 4

Results

In this chapter, the results of analyses are presented in two sections. The first section describes the participants in terms of individual and clinical characteristics. The second section focuses on analysis of the research questions.

Sample Characteristics

A total of 92 VAMC veterans diagnosed with stage 3 CKD and prescribed an ACE-I agreed to participate in the study by returning completed or partially completed survey questionnaires. As shown in Table 15, the participants ranged in age from 50 to 89 years with a mean age of 69 (*SD* = 9.43) years. The sample included 98.9% (*n* = 91) males with 87% (*n* = 80) self-reporting race as Caucasian or White and 85.9% (*n* = 79) reporting not being of Spanish or Hispanic origin. The majority reported having 12 years or more education (77%), living with a partner (58.7%) and had enough or comfortable family income (71.7%). Only 7.6% (*n* = 7) of the respondents reported having lived with a relative diagnosed with end stage renal disease. The gender and ethnic origin variables will not be used in further analyses due to the extreme bias toward the male gender and non-Hispanic ethnic origin, though they are representative of the VAMC patient population. As illustrated in Table 16, the reported length of time, in months, since being told they had kidney disease ranged from 0 to 480 (Mean = 73.8, SD = 91.4; median = 36) months. The co-morbid conditions extracted from chart review indicated approximately 84% (*n* = 81) of the participants were diagnosed with some combination of DM, HTN, and general cardiovascular disease and were prescribed an average of 12.3 medications.

Table 15

Frequencies and Percentages for Individual Characteristics of Participants *(N = 92)*

Variable		n	%
Age (*n* = 92)	Range 50 - 89 years *M* = 69.08 *SD* = 9.43		
Gender (*n* = 92)	Male	91	98.9
	Female	1	1.1
Race* (*n* = 90)	Caucasian/White	80	87.0
	African American/Black	9	9.8
	Other (not specified)	1	1.1
Ethnic origin - Spanish/Hispanic(*n* = 82)	Yes	2	2.2
	No	79	85.9
Education* (*n* = 89)	Range 8 – 19 years *M* = 13.92 *SD* = 3.00		
	8-11 years	19	21.3
	12 years	21	22.8
	13 – 15 years Technical and/or some college	25	28.1
	17 years Completed college	6	6.5
	18 years Some graduate school	10	10.9
	19 years Completed graduate school	8	8.7
Financial Status* (*n* = 89)	Not enough	23	25.0
	Just enough	44	47.8
	Comfortable level	22	23.9
Living with Partner* (*n* = 90)	Yes	54	58.7
	No	36	39.1
Lived with relative with ESRD* (*n* = 90)	Yes	7	7.6
	No	83	90.2

*Total does not equal to the total sample size due to missing values

Table 16

Frequencies and Percentages for Clinical Characteristics of Participants ($N = 92$)

Variable		n	%
Co-morbid conditions ($n = 92$)	DM	2	2.2
	HTN	8	8.7
	CVD	1	1.1
	DM + HTN	23	25.0
	DM + CVD	3	3.3
	HTN + CVD	23	25.0
	DM + HTN + CVD	32	34.8
Months since diagnosed with kidney disease ($n = 81$)	Range 0 – 480 mos		
	$M =$ 73.81 SD 91.40		
	Median 36		
	Less than 6 months	2	2.2
	6-11 months	5	5.5
	1 - 2 years	30	32.7
	3 - 5 years	19	20.7
	6 - 9 years	8	8.7
	10 + years	17	18.6
Number of prescribed medications ($n = 92$)	Range = 2 – 29		
	M = 12.3 SD 5.10		
	less than 5	3	3.3
	5 to 8	17	18.4
	9 to 10	17	18.5
	11 to 12	17	18.5
	13 to 15	16	17.4
	16+	22	23.9

* Total does not equal to the total sample size due to missing values

DM = diabetes mellitus, HTN = hypertension, CVD = General Cardiovascular Disease

Research Questions

Data analysis used to answer the research questions included descriptive statistics (frequency, mean, standard deviation, median, and range) to describe the illness and treatment perceptions of the participants. Correlation analysis using Pearson's correlation coefficients, as well as independent sample t-tests and ANOVA, were used to

describe variables, and relationships. To aid increasing the number of responses that could be included in the analysis, mean subscale scores for individual participants have been substituted for missing data on each of the subscales if less than 25% of the items were missing data. Gender and ethnic origin were eliminated from analysis as there was not enough variance to compose more than one group. The significance level was set at .05.

Research Question 1

What are the illness representations (cognitive representation [identity, cause, timeline, control/cure, consequences] and emotional representation) of patients with CKD stage 3?

The illness representations as measured by the self-report IPQ-R is divided into three sections, covering the identity and causal subscales separately from timeline, control/cure, consequences and emotion response subscales.

Identity. The identity subscale is composed of 17 symptoms with two sections; one section asks participants to answer "yes" or "no" to having experienced the symptoms listed since having kidney disease. The second section asks participants to answer "yes" or "no" regarding their belief that the symptom is related to their kidney disease. As seen in Table 17, all 17 symptoms were reported as having been experienced by participants and all 17 symptoms reported as having been experienced were perceived as related to CKD by at least one respondent with most reporting legs and feet swelling (n = 31), followed by fatigue (n = 28).

Table 17

IPQ-R Identity Subscale $N = 92$

Symptom Experienced	*n*	AND *n*	Related symptom to kidney disease %
Legs/feet swelling	42	30	71.4
Fatigue	44	28	63.6
Loss of strength	41	21	51.2
Problem sleeping	38	18	47.4
Pain	28	14	50
Stiff joints	44	14	31.8
Short of breath	38	13	34.2
Bad taste in mouth	16	11	68.8
Upset stomach	20	9	45
Nausea	14	8	57.1
Weight loss	14	7	50
Dizzy	23	7	30.4
Puffy eyes	14	7	50
Sore eyes	14	6	42.9
Wheezing	18	6	33.3
Headache	21	5	23.8
Sore throat	17	3	17.6

Cause. Cause is operationalized with a subscale of 18 attribution items (Table 18). Participants were asked to rate the extent to which they believed the items were causes of their kidney disease on a 5-point scale, where strongly disagree = 1, disagree = 2, neither agree nor disagree = 3; agree = 4, and strongly agree = 5. All 18 causes were reported as being a cause of kidney disease with over half of the participants indicating agreement or strong agreement that aging and diet or eating habits are a cause of kidney

disease (n = 52 (59.8%) and n = 44 (51.8%) respectively). There were even stronger perceptions that personality and alcohol are not causes of kidney disease indicated by disagree or strongly disagree ratings (n = 57 (64%) and n = 55 (61.8%) respectively). The greatest ambivalence toward possible causes of kidney disease was indicated by 37 (42%) respondents answering "neither agree nor disagree" that pollution and environment were causes of kidney disease (not reported in table). As noted in Table 19 the overall mean for the cause subscale (M = 2.73, SD = 0.47) indicates general ambivalence or disagreement that the list of causes from which they could choose from were perceived as attributing to kidney disease.

Table 18

IPQ-R Cause Subscale Frequencies

		Agree/Strongly Agree		Disagree/Strongly Disagree	
Cause	Total *n*	Valid *n*	%	Valid *n*	%
Aging	87	52	59.8	16	18.4
Diet or eating habits	85	44	51.8	18	21.2
Stress/worry	85	31	36.5	29	34.1
Own behavior	88	29	33	27	30.7
Poor medical care in past	87	22	25.2	37	42.5
Heredity	88	22	25	44	50
Smoking	87	18	20.7	48	55.2
Altered immune system	86	17	19.8	34	39.5
Alcohol	89	17	19.1	55	61.8
Accident or injury	87	13	14.9	53	60.9
Pollution or environment	88	13	14.7	38	43.2
Family problems/worries	88	13	14.7	45	51.1
Germ or virus	85	12	14.1	40	47.1
Overwork	85	12	14.1	40	47.1

Chance or bad luck	84	11	13.1	40	47.6
Emotional state	86	10	11.7	44	51.2
Personality	89	5	5.6	57	64
Negative mental attitude	87	4	4.5	47	54

Timeline, Control, Consequences, and Emotion. IPQ-R items (Table 19) have a possible range of 1 to 5 with higher scores indicating perceptions of higher personal and treatment control of chronic, cyclical illness with serious consequences and negative emotional reactions (Figure 3).

Figure 3

IPQ-R Scoring Indications

Higher Scores on subscale → indicates patients' perception of:	
Cognitive Representation	
Timeline Acute/Chronic	Kidney disease being more chronic, long-term condition
Timeline Cyclical	Kidney disease being more cyclical in nature; symptoms come and go
Consequences	Higher burden on negative consequences resulting from kidney disease
Personal Control	Higher sense of personal control over kidney disease
Treatment control	Higher sense of ability of treatment to control kidney disease
Emotional Representation	Higher negative emotional responses to having kidney disease

As can be seen in Table 19, the CKD timeline was perceived as a long-term chronic rather than short-term acute condition ($M = 3.78$, $SD = 0.84$), with minimal cyclical exacerbations ($M = 2.67$, $SD = 0.72$), and moderate severity of consequences (M

= 3.11, *SD* = 0.80). Respondents perceived having both, but more personal control than treatment control of CKD (*M* = 3.52, *SD* = 0.75 vs. *M* = 3.18, *SD* = 0.65). Participants did not perceive CKD as related to a great negative emotional response (*M* = 2.78, *SD* = 0.62).

Table 19

IPQ-R Subscales Descriptive Statistics

Subscale (# of Items)	Possible Range	Mean	SD
Illness Representation Subscales			
Timeline acute - chronic (6)	1 - 5	3.78	0.84
Personal Control (6)	1 - 5	3.52	0.75
Treatment Control (5)	1 - 5	3.18	0.65
Consequences (6)	1 - 5	3.11	0.80
Emotional Representation (6)	1 - 5	2.78	0.62
Timeline cyclical (4)	1 - 5	2.67	0.72
Cause (18)	1 - 5	2.73	0.47

Research Question 2

What are the medication adherence levels of ACE-I among patients in CKD stage 3 as measured by self-report MARS?

Descriptive statistics (e.g., frequencies, means, standard deviations and ranges) were used to examine the self-reported medication adherence patterns of the respondents. Self-reported medication adherence with ACE-I is measured by the MARS self-report instrument. The MARS was written with a focus on an estimation of intentional non-adherence with only one question related to unintentional non-adherence (how often they forget to take a medication dose) and four questions focused on the extent that patients

follow recommendations in a way they find more suitable, but different from the way they perceived the provider recommended (how often they take less, stop taking, miss, and alter their medication dose). Participants were asked to check the response that best describe how they take their ACE-I. Responses were scored on a 5-point scale where 1 = ery often, 2 = often, 3 = sometimes, 4 = rarely, and 5 = never. Higher scores indicate higher levels of self-reported adherence patterns.

Table 20 presents descriptive data regarding the MARS items. Data indicated that study participants reported a high frequency of adherent responses regarding MARS variables. Specifically, regarding Forgetfulness, only 5.3% (n = 4) reported often/very often forgetting to take their ACE-I. Regarding both Change Dose and Take Less, 4% (n = 3) reported often/very often. For the variables Stop Taking and Miss a Dose, 0% reported often/very often. Looking at the MARS scale as a whole, the mean value score (M = 4.81, SD=.35) of this variable was very close to the highest scale value of 5.00.

Table 20

MARS Frequencies, Mean, and Standard Deviation (N = 92)

		Often/Very Often	Sometimes	Rarely/Never
MARS Items	Total *n*	Valid *n* (%)	Valid *n* (%)	Valid *n* (5)
Forget	76	4 (5.3)	3 (3.9)	69 (90.8)
Change Dose	75	3 (4)	1 (1.3)	71 (94.7)
Take Less	75	3 (4)	0	72 (96)
Stop Taking	74	0	0	74 (93.2)
Miss a Dose	75	0	4 (5.3)	71 (94.7)

	Total *n*	Possible Range	Mean	SD
MARS Scale	72	1 - 5	4.81	0.35

Research Question 3

Does illness representation (cognitive representation [identity, cause, timeline, control/cure, consequences] and emotional representation) of patients with CKD stage 3 predict self-reported adherence to ACE-I?

Pearson correlation coefficients were used to examine strength and direction of the linear relationship between cognitive and emotional illness representation dimensions and medication adherence. The original intent of analysis was to use multiple regression to test the predictability of illness representation dimensions that had statistically significant r values indicating strong correlation to self-reported medication adherence. However, correlations were so low that taking the next step to multiple regression analysis was unwarranted, as prediction would not be found. Table 21 presents correlations between the MARS and all Illness Representation variables. Data indicated that the MARS was not significantly correlated with any of the variables reflecting Illness Representation.

Table 21

Correlations Between MARS and Illness Representations

Variables	Timeline Acute/Chronic	Consequence	Personal Control	Treatment Control	Timeline cyclical	Emotional Representation	Psychological Causes	Lifestyle Causes	Environmental Causes
MARS	0.13	-0.03	-0.05	0.10	-0.01	-0.16	-0.03	0.02	0.06

Research Question 4

What are the relationships among each of the Individual Characteristics (age, gender, race, education, financial status, and living with a partner status) with the

individual Cognitive Representation dimensions (identity, cause, timeline, control/cure, consequences) and self-reported medication adherence with ACE-I?

A series of correlations and t-tests were used to examine research question 4. Table 22 presents the correlations among age, years of education, financial status, and illness representation dimensions. Correlations and t-tests examining relationship among age, years of education, financial status, and MARS are also presented in Table 22.

Analysis indicated a negative correlation in which older age was significantly related to lower levels of the cognitive representation dimension of Timeline - acute/chronic, $r = -0.25$, $p < .05$. Additionally, analysis indicated a negative correlation in which older age was significantly related to lower levels of the cognitive representation dimension of consequences, $r = -0.25$, $p < .05$ and personal control, $r = -0.29$, $p < .01$. All other variables representing cognitive representation were not significantly correlated to age.

Correlation analysis indicated that higher levels of education was significantly correlated with higher levels of the cognitive representation dimension Timeline acute/chronic, $r = 0.31$, $p < .05$. Analysis indicated that education was not significantly correlated with other variables representing illness representation. Analysis indicated that financial status was not significantly correlated with other variables representing cognitive representations.

Correlation analysis indicated no statistically significant correlations between age, education, financial status and MARS.

Table 22

Correlations Between Age, Education, and Financial Status with Cognitive Representation and MARS

	AGE	Years of Education	Financial Status
Timeline Acute/Chronic	-0.25*	0.31**	0.07
Consequence	-0.25*	0.09	-0.12
Personal Control	-0.29**	0.09	-0.11
Treatment Control	0.05	-0.15	0.09
Timeline cyclical	-0.14	-0.13	-0.08
Psychological Causes	0.06	-0.13	-0.13
Lifestyle Causes	-0.19	-0.16	-0.01
Environmental Causes	-0.03	0.13	-0.12
MARS	-0.14	-0.04	0.01

* p = < .05 (2-tailed); **p = < .01 (2-tailed); MARS = Medication Adherence Report Scale

Table 23 presents t-test analysis examining mean value scores of cognitive representation variables by race and living with a partner. Analysis indicated that African-Americans/Others had significantly higher mean value scores regarding the variable Treatment Control relative to Caucasian/White study participants, $M = 3.61$, $SD = 0.64$ vs. $M = 3.10$, $SD = 0.59$, $t(87) = 2.37$, $p < .05$, respectively. Mean value scores reflecting Personal Control were also significantly higher among African-American/Black study participants, $M = 3.99$, $SD = 0.52$, relative to Caucasian/White study participants, $M = 3.44$, $SD = 0.81$, $t(87) = 2.09$, $p < .05$.

Analysis also indicated that those living with a partner had a significantly lower mean value regarding Lifestyle Causes, $M = 2.31$, $SD = 0.82$, relative to those that do not live with a partner, $M = 2.74$, $SD = 0.98$, $t(87) = -2.25$, $p < .05$.

Table 23

T-test Analysis Examining Mean Value Scores of Cognitive Representation Variables by Race and Living with a Partner

Cognitive Representation	*n*	*M (SD)*	Possible Range	t	95% CI Lower - Upper
Treatment Control					
Race					
Caucasian/White	79	3.10 (.59)	1.00-5.00	2.37*	.08 - .93
African-American/Other	10	3.61 (.64)			
Living with Partner					
Yes	53	3.17 (.67)	1.00-5.00	.24	-.25 - .32
No	36	3.14 (.64)			
Timeline (acute/chronic)					
Race					
Caucasian/White	79	3.83 (.78)	1.00-5.00	-1.82	-1.04 - .05
African-American/Other	10	3.33 (1.06)			
Living with Partner					
Yes	53	3.88 (.76)	1.00-5.00	1.51	-.08 - .62
No	36	3.61 (.90)			
Timeline (cynical)					
Race					
Caucasian/White	79	2.68 (.68)	1.00-5.00	.85	-.26 -.65
African-American/Other	10	2.88 (.70)			
Living with Partner					
Yes	53	2.69 (.65)	1.00-5.00	-.26	-.33 - .25
No	36	2.73 (.72)			
Personal Control					
Race					
Caucasian/White	79	3.44 (.81)	1.00-5.00	2.09*	.03 – 1.07
African-American/Other	10	3.99 (.52)			
Living with Partner					
Yes	53	3.48 (.84)	1.00-5.00	-.29	-.39 - .30
No	36	3.53 (.76)			

p = < .05; CI = Confidence Interval of the Difference

Table 23 continued

T-test Analysis Examining Mean Value Scores of Cognitive Representation Variables by Race and Living with a Partner

Cognitive Representation	*n*	*M (SD)*	Possible Range	t	95% CI Lower - Upper
Consequences					
Race					
Caucasian/White	79	3.19 (.74)	1.00-5.00	-1.73	-.94 - .064
African-American/Other	10	2.75 (.87)			
Living with Partner					
Yes	53	3.26 (.78)	1.00-5.00	1.80	-.03 - .62
No	36	2.96 (.70)			
Psychological Causes					
Race					
Caucasian/White	78	2.57 (.65)	1.00-5.00	-1.24	-.70 - .16
African-American/Other	10	2.30 (.62)			
Living with Partner					
Yes	53	2.53 (.72)	1.00-5.00	-.20	-.31 - .25
No	35	2.56 (.54)			
Lifestyle Causes					
Race					
Caucasian/White	78	2.44 (.84)	1.00-5.00	1.18	-.25 - .96
African-American/Other	10	2.80 (1.34)			
Living with Partner					
Yes	53	2.31 (.82)	1.00-5.00	-2.25*	-.82 - -.05
No	35	2.74 (.98)			
Environmental Causes					
Race					
Caucasian/White	78	2.60 (.64)	1.00-5.00	.66	-.30 - .60
African-American/Other	10	2.75 (.95)			
Living with Partner					
Yes	53	2.55 (.58)	1.00-5.00	-1.12	-.46 - .13
No	35	2.72 (.79)			

p = < .05; CI = Confidence Interval of the Difference

Table 24 presents t-test analysis examining mean value scores of MARS by race and living with a partner. Analysis indicated that mean value scores of MARS did not vary at a statistically significant level by race and living with a partner.

Table 24

T-test Analysis Examining Mean Value Scores of MARS by Race and Living with a Partner

	n	*M (SD)*	Possible Range	t	95% CI Lower - Upper
MARS					
Race					
Caucasian/White	63	4.21 (.37)	NA	.30	-.23 - .31
African-American/Other	8	4.85 (.10)			
Living with Partner					
Yes	42	4.78 (.41)	NA	-1.10	-.27 - .08
No	27	4.87 (.26)			

CI = Confidence Interval of the Difference

Research Question 5

What are the relationships among each of the Individual Characteristics (age, gender, race, education, financial status, and living with a partner status) with the Emotional Representation construct?

A series of correlations and t-tests were used to examine research question 5. Table 25 presents the correlations between the age, years of education, financial status and Emotional Representation. Analysis indicated that emotional response was not significantly correlated with age, education or financial status.

Table 25

Correlations Between Age, Education, Financial Status and Emotional Representation

	AGE	Years of Education	Financial Status
Emotional Representation	-0.06	0.06	-0.18

Table 26 presents a t-test analysis examining mean value scores of emotional response by race and living with a partner. Analysis indicates that Caucasian/White study participants evidenced a significantly higher mean values score regarding Emotional Representation relative to African American/black study participants, M = 2.85, SD – 0.56 vs. M = 2.40, SD = 0.56, t(87) = -2.35, $p < .05$. Emotional Representation was not related to living with a partner.

Table 26

T-test Analysis Examining Mean Value Scores of Emotional Representation by Race and Living with a Partner

	n	M (SD)	Possible Range	t
Race				
Caucasian/White	78	2.85 (.56)	1.00-5.00	-2.35*
African-American/Other	10	2.40 (.56)		
Living with Partner				
Yes	52	2.90 (.65)	1.00-5.00	.24
No	36	2.66 (.47)		

* $p < .05$

Research Question 6

What are the relationships among clinical characteristics (Co-morbidity, Length of time CKD diagnosis, Family history of ESRD/dialysis and Number of medications)

with individual Cognitive Representation dimensions (identity, cause, timeline, control/cure, consequences) and self-reported medication adherence with ACE-I?

A series of correlations, t-tests, and ANOVAs were used to examine research question 6. Table 27 presents correlations between length of time since CKD diagnosis and number of medications with cognitive representation. Correlations examining relationships between length of time since CKD diagnosis and number of medications with Mars are also presented in Table 27.

Analysis indicated that greater time since diagnosis was significantly correlated with higher levels of timeline - acute/chronic, $r = .23$, $p < .05$, and lower levels of Timeline cyclical, $r = -.26$, $p < .05$. All other cognitive representation variables were unrelated to time since CKD diagnosis. Data indicated that greater time since CKD diagnosis was significantly correlated with lower MARS scores ($r = -.33$, $p < .01$). Data indicated that number of medications was unrelated to all cognitive representation variables and the MARS.

Table 27

Correlations Between Length of Time since CKD Diagnosis and Number of Medications with Cognitive Representation and MARS

	Length of Time since CKD Diagnosis	Number of Medications
Timeline Acute/Chronic	0.23*	-0.03
Consequence	0.17	0.10
Personal Control	-0.01	0.02
Treatment Control	-0.06	-0.04
Timeline cyclical	-0.26*	0.04
Psychological Causes	-0.11	0.07
Lifestyle Causes	0.06	0.12

Environmental Causes	0.09	0.16
MARS	-0.33**	0.02

* p = < .05 (2-tailed); **p = < .01 (2-tailed); MARS = Medication Adherence Report Scale

Table 28 presents t-test analysis examining differences in mean value scores of cognitive representation variables by history of living with relative with ESRD/dialysis. T-test analysis examining differences in mean MARS scores by history of living with relative with ESRD/dialysis is also presented in Table 28.

Data indicated that study participants who lived with relative with ESRD/dialysis had significantly higher mean scores on Timeline cynical relative to those that did not report living with a relative with ESRD diagnosis, $M = 3.21$, $SD = .27$, vs. $M = 2.67$, $SD = .68$, respectively, $t(87) = 4.39$, $p < .001$. Living with a relative with ESRD/dialysis was unrelated to all other cognitive representation variables. Analysis indicated that mean value scores of the MARS did not vary at a statistically significant level by family history of ESRD/dialysis.

Table 28

T-test Analysis Examining Mean Value Scores of Cognitive Representation and MARS Variables by Lived with relative with ESRD/dialysis

Cognitive Representation	*n*	*M (SD)*	Possible Range	*t*
Timeline (acute/chronic)				
Lived w/relative w/ESRD/dialysis				
Yes	7	3.98 (.92)	1 – 5	.68
No	82	3.75 (.81)		
Consequences				
Lived w/relative w/ESRD/dialysis				
Yes	7	3.22 (.78)	1 – 5	.30
No	82	3.13 (.76)		
Personal Control				
Lived w/relative w/ESRD/dialysis				

Yes	7	3.57 (.77)	1 – 5	.24
No	82	3.50 (.81)		
Treatment Control				
Lived w/relative w/ESRD/dialysis				
Yes	7	3.09 (.68)	1 – 5	-.31
No	82	3.17 (.65)		
Timeline (cyclical)				
Lived w/relative w/ESRD/dialysis				
Yes	7	3.21 (.27)	1 – 5	4.39***
No	82	2.67 (.68)		
Psychological Causes				
Lived w/relative w/ESRD/dialysis				
Yes	7	2.29 (.67)	1 – 5	-1.10
No	81	2.57 (.65)		
Lifestyle Causes				
Lived w/relative w/ESRD/dialysis				
Yes	7	2.14 (.72)	1 – 5	-1.03
No	81	2.51 (.92)		
Environmental Causes				
Lived w/relative w/ESRD/dialysis				
Yes	7	2.68 (.49)	1 – 5	.25
No	81	2.61 (.69)		
MARS				
Lived w/relative w/ESRD/dialysis				
Yes	5	4.72 (.52)	1 – 5	-.61
No	66	4.82 (.35)		

***$p < .001$ MARS = Medication Adherence Report Scale

Table 29 presents an Analysis of Variance (ANOVA) examining mean value scores of cognitive representation variables by co-morbidity. Analysis indicated that mean value scores of all cognitive representation variables did not vary significantly whether by a single co-morbid condition (DM, HTN, or CVD), a combination of two of these conditions, or a combination of all three. Analysis also indicated that mean value scores of the MARS did not vary at a statistically significant level by co-morbidity.

Table 29

Analysis of Variance (ANOVA) Examining Mean Value Scores of Cognitive Representation Variables and MARS by Co-morbidity

Cognitive Representation	*n*	*M (SD)*	Possible Range	*F*
Timeline (acute/chronic)				
DM, HTN, or CVD	10	4.00 (.68)	NA	.70
Combination of two	35	3.67 (.94)		
Combination of three	25	3.84 (.84)		
Consequences				
DM, HTN, or CVD	10	3.43 (.58)	NA	.92
Combination of two	35	3.07 (.80)		
Combination of three	25	3.22 (.83)		
Personal Control				
DM, HTN, or CVD	10	3.56 (1.03)	NA	.28
Combination of two	35	3.51 (.76)		
Combination of three	25	3.67 (.77)		
Treatment Control				
DM, HTN, or CVD	10	3.00 (.65)	NA	1.32
Combination of two	35	3.17 (.64)		
Combination of three	25	3.35 (.54)		
Timeline (cynical)				
DM, HTN, or CVD	10	3.05 (.40)	NA	2.34
Combination of two	35	2.57 (.70)		
Combination of three	25	2.56 (.65)		
Cause Factor 1				
DM, HTN, or CVD	10	2.61 (.67)	NA	.03
Combination of two	35	2.55 (.68)		
Combination of three	25	2.58 (.58)		
Cause Factor 2				
DM, HTN, or CVD	10	2.57 (.72)	NA	.15
Combination of two	35	2.43 (.93)		
Combination of three	25	2.56 (1.04)		
Cause Factor 3				
DM, HTN, or CVD	10	2.83 (.56)	NA	.96
Combination of two	35	2.71 (.65)		
Combination of three	25	2.52 (.72)		

MARS				
DM, HTN, or CVD	10	4.76 (.36)	NA	.52
Combination of two	36	4.79 (.40)		
Combination of three	26	4.87 (.28)		

Research Question 7

What are the relationships among each of the clinical characteristics (Co-morbidity, Length of time CKD diagnosis, Family history of ESRD/dialysis and Number of medications) with the Emotional Representation construct?

A series of correlations, t-tests, and ANOVAs were used to examine research question 7.

Table 30 presents correlations between length of time since CKD diagnosis, number of medications, and emotional response. Data indicated that emotional representation was not significantly related to time since diagnosis and number of medications.

Table 30

Correlations Between Length of Time since CKD Diagnosis and Number of Medications with Emotional Representation

	Length of Time since CKD Diagnosis	Number of Medications
Emotional Representation	-.14	0.09

Table 31 presents a t-test analysis examining mean value scores of emotional representation by living with relative with ESRD/dialysis. Analysis indicated that emotional representation was unrelated to whether or not participants had lived with a relative with ESRD/dialysis.

Table 31

T-test Analysis Examining Mean Value Scores of Emotional Representation by Lived with relative with ESRD/dialysis

Emotional Representation	*n*	*M (SD)*	Possible Range	*t*
Timeline acute/chronic				
Lived w/relative w/ESRD/dialysis				
Yes	7	3.05 (.70)	1 – 5	1.15
No	81	2.78 (.58)		

Table 32 presents Analysis of Variance (ANOVA) examining mean value scores of emotional representation variables by co-morbidity. Analysis indicated mean value scores of emotional representation variables did vary significantly by a single co-morbid condition (DM, HTN, or CVD), a combination of two of these conditions, or the combination of all three, $F(2,67)=5.62$, $p<.01$. A Post-hoc Bonferroni Test of Multiple Comparisons indicated that the mean value score of DM, HTN, or CVD, $M = 3.31$, $SD = .77$, was significantly higher relative to the mean value of those respondents having a Combination of two, $M = 2.64$, $SD = .52$.

Table 32

Analysis of Variance (ANOVA) Examining Mean Value Scores of Emotional Representation Variables by Co-morbidity

Cognitive Representation	*n*	*M (SD)*	Possible Range	*F*
DM, HTN, or CVD	10	3.31 (.77)	NA	5.62 **
Combination of two	35	2.64 (.52)		
Combination of three	25	2.82 (.52)		

**p<.01.

Research Question 8

What is the relationship between the Medication Adherence Report Scale (MARS) and the Medication Possession Ratio (MPR)?

Correlation analysis was used to examine research question 8. Table 33 presents correlations between MARS and MPR. Analysis indicated that higher levels of MPR were correlated with higher levels of MARS, $r = .35$, $p < .01$, variables.

Table 33

Correlations between MARS and MPR Variables

	MPR
MARS	.35**

**$p < .01$ (2-tailed); MARS = Medication Adherence Report Scale; MPR = Medication Possession Ratio

Summary

In this chapter, the results of analyses were presented in two sections. The first section described the sample of VAMC renal clinic patients who were in stage 3 CKD and were prescribed an ACE-I. A cross sectional design was used in the second section to answer the research questions. Descriptive statistics, correlation, independent t-test, and ANOVA were used to describe variables and relationships in answering the research questions. The findings are discussed in more detail in Chapter 5, along with the limitations of the study and recommendations for future research.

CHAPTER 5

Discussion

This chapter begins with a summary of the study, followed by a description of the individual and clinical characteristics of the study sample. A discussion of results in relation to the purposes, conceptual framework and research literature is presented next. Along with this discussion, challenges encountered during the study are addressed. At the conclusion of the chapter, limitations of the study and recommendations for future research are discussed.

Summary of the Study

Chronic kidney disease places a high personal and economic burden on individuals, families, society, as well as national and international healthcare systems. Research indicates that adherence to medications that can slow progression of CKD to ESRD and help prevent cardiovascular events is suboptimal. Patient perceptions about illness and beliefs about treatment have been shown to be related with adherence (Haynes et al., 1996; Wetzels et al., 2006). The theoretical framework chosen to guide this study is the Common Sense Model (Figure 1) which proposes that an individual is an active participant with unique cognitive beliefs and emotional responses when faced with illness threats such as kidney disease. These beliefs and responses direct the individual to using common-sense coping strategies, such as taking medications, to manage the life changing challenges of CKD. At the time of this study, studies could not be found examining Illness Representations or predictors of adherence to ACE-I, renal protective medications, in CKD stage 3 patients. The current study contributed to this area of research by 1) describing the illness and treatment beliefs of CKD patients in stage 3 guided by the

CSM; 2) examining the relationship of those beliefs with adherence to renal protective medications, ACE-I; 3) describing the adherence levels of ACE-I among patients with CKD stage 3; 4) examining relationships between individual and clinical characteristics with patient beliefs and with self-reported medication adherence with ACE-I; and 5) examining the relationship between the self-report Medication Adherence Report Scale (MARS) and the Medication Possession Ratio (MPR) extracted from pharmacy refill data.

Individual and Clinical Characteristics

The findings in this study of the individual characteristics of patients seen in the VAMC renal clinic, diagnosed with stage 3 CKD, and prescribed ACE-I are very similar to the general population of patients with stage 3 CKD (USRDS, 2008a), with the exception of a slightly higher education and financial status and the overwhelming predominance of males. This gender bias is to be expected in the veteran population which has a history of and is still, at this time, predominantly male. The profile of participants in this study includes being an older (69+ years) white, non-Hispanic male with 12 or more years of education, living with a partner, and a financial status that is adequate or comfortable.

The clinical characteristics are also similar to the general population of patients with stage 3 CKD. Very few participants reported having lived with a family member who had ESRD or had been on dialysis. Having a predominantly White sample may be a contributory factor since the adjusted incidence of ESRD among African American individuals is almost four times that of White individuals (K. C. Norris, et al., 2006). In a study by Tan, Hoffman, and Rosa (2010) African American patients with CKD stages 3

and 4 were six times more likely to report a family history of ESRD than Caucasian patients. A wide range of months since being diagnosed with kidney disease was reported by the respondents (0 – 480 months), with a median of 36 months. Even though the study sample was drawn from CKD patients in stage 3 who were being seen in the renal clinic, some still reported not being diagnosed, or told, that they had kidney disease. The PI received several phone calls from eligible participants questioning why they had been invited to participate in the study when they did not have kidney disease. They confirmed that they were seen in the renal clinic on a regular basis, but were not aware that they had kidney disease, even when in stage 3 of the disease process. This may seem strange, however, there are several studies reporting this is not unusual and that there is a low awareness of having kidney disease. Plantinga, and colleagues (2008) found that disease awareness among U.S. adults with CKD to be generally low, even into stage 4, with fewer than half of the persons with CKD aware of their disease. Plantinga reported improvement in awareness among those with CKD has been noted in CKD stage 3, but still with awareness among these persons fewer than 1 in 10. Chart review of co-morbid conditions, DM, HTN, and general CVD is congruent with literature findings of these illnesses being often found in common with CKD (USRDS, 2008a; NKF, 2002). The majority of the study sample had a combination of two of more of these co-morbid conditions. Participants in this study, on average, were prescribed 12 medications. A complex medication regimen with several medications is not unexpected since CKD patients often have multiple co-morbidities. However, the finding of 12 prescribed medications for patients in stage 3 CKD are higher than that found in the literature for early CKD stage. Bailie et al. (2005) examined patterns of medication use of 619

patients in stages 2-5 CKD, of which 81% were in stages 2-4. The average number of prescribed medications for this cohort of CKD participants was eight. Eight was also the average number of prescribed medications for patients with stages 3-5 CKD in a study by Rifkin et al. (2010). In a pooled analysis of seven studies including 395 stage 5 CKD hemodialysis patients, Manley, Cannella, Bailie, and St. Peter (2005), found the average number of prescribed medications for this later stage of CKD patients was 12. A larger number of prescribed medications would be expected for patients in stage 5 CKD on dialysis who have not only more advanced kidney disease, but usually more advanced co-morbid conditions as well. The higher of number of medications prescribed to the participants in the current study may be because the VAMC medications are provided at a low to no co-payment. The findings may be related to the fact that VAMC patients are seen regularly in specialty clinics for their multiple co-morbid conditions and their providers may not feel hindered by the patient's ability or inability to afford the needed medications. A comparative study of medication prescribing patterns among various stages of CKD and different systems would help shed more light on this interesting finding.

Primary Purposes

The primary purposes of this study were to: 1) describe the illness and treatment beliefs of CKD patients in stage 3 guided by the CSM; and 2) examine the relationship of those beliefs with adherence to renal protective medications, ACE-I. Secondary purposes of this study included determining adherence levels of ACE-I among patients with CKD stage 3; examining relationships between individual and clinical characteristics with patient beliefs and medication adherence with ACE-Is; and examining the relationship

between the Medication Adherence Report Scale (MARS) and the Medication Possession Ratio (MPR).

Description of Illness Representations

Findings of the illness representation dimensions will be described in sections. Discussion of the cognitive and emotional representation dimensions are divided into three sections Identity, Cause, and the remainder of the dimensions, Timeline, Control, Consequences, and Emotion.

Identity. According to the theoretical framework for this study, when individuals are faced with threats to their health, they build unique cognitive and emotional representations that determine how they will respond to the threat. The individual faced with a health treat will use these representations to guide their choices of coping strategies in attempt to reduce the threat of illness or symptoms (Leventhal et al., 1997, Leventhal et al., 2003)

One of the reasons for choosing participants in stage 3 of CKD was because this is the stage in which individuals begin to experience symptoms secondary to organ dysfunction and decline in renal function leading to patient awareness of renal disease (Garcia-Donaire, et.al, 2005; NKF, 2004). According to the theoretical framework of CSM, at this stage an individual will try to make sense of their illness by identifying symptoms that they then label to define the disease. The participants in this study labeled their kidney disease with a wide range of symptoms some of which are not typically associated with kidney disease at this stage by the medical community, such as sore throat, weight loss, sore eyes, and being dizzy. This finding supports the theoretical construct of individuals' illness representation being dynamic and are drawn from

experiences and sociocultural environments that are unique to the individual and not necessarily congruent with medical knowledge (Bauman, Cameron, Zimmerman, & Leventhal, 2000; Velez & Ramasco, 2006). However, the two symptoms most reported by participants as being related to their kidney disease, legs/feet swelling and fatigue are found in the medical literature and are generally found true for this patient population (Agarwal, 2009; Harwood et al. 2009). Both findings, that patients identify their illness by symptoms not supported with medical research and, most often, those symptoms that are recognized by the medical community as related to kidney disease, have clinical and research relevance. Clinically, the findings alert health care providers to the fact that patients develop their own mental model of their disease process which may not match the medical model, even when they also recognize the accepted medical model. Rather than assuming that the patient understands or agrees with the description of kidney disease offered by the health care community during visits and classes, it may be more important to ask the patient to describe the symptoms they are experiencing that they relate to their kidney disease. Findings from this study suggest this method could help educate the health care community of how patients identify and understand their illness. Understanding how the patient perceives their illness may help establish a stronger patient-provider partnership in which to discuss disease management. The findings from the responses on the Identity subscale are inviting to qualitatively research how and why patients assign symptoms to their illness in order to identify their illness. A well designed qualitative study might strengthen the theoretical construct of the Illness Representation and bring understanding of the origins of illness identity perceptions.

The information gathered from the Identity subscale was valuable for descriptive purposes, however, challenges were encountered with the number of results produced by the subscale. The low response rate on the Identity subscale resulted in this variable being dropped from further analysis. On examination of the scale and individual responses, a systematic pattern of missing values was identified. The scale was divided into two sections. The items in the first section ask the participant to indicate if they had experienced any of the symptoms that were listed since knowing that they had kidney disease. They were then instructed in the second section to report if they believe that this symptom was related to their kidney disease. Identifying the experienced symptoms as related to their CKD was the intent of the IPQ-R Identity subscale, thus the findings from the second section was to be used for further analysis. The second section of the Identity subscale had an unacceptable high level of missing values. It appears that if the participants answered "No" to the first part, many left the second part unanswered, leaving items blank. The unanswered items were treated as missing values which decreased the number of responses for analysis. In the future, it may be wise to redesign the scale and instructions so that a "skipped pattern' is planned and participants are instructed to answer the second part of the question only if they answered "Yes" to the first part of the question in order to eliminate missing responses. Even in making these changes to the subscale design, experience from this study would indicate that the sample size would have to be increased to accommodate the variance of participant answers among the 18 item Identity subscale.

Cause. Cause is conceptually defined as the patient's ideas of the etiology of their kidney disease and is operationalized with a subscale of 18 attribution items. The

cause items are intentionally broad in spectrum and not confined to kidney disease etiology as defined in medicine. The fact that every cause listed was reported as a perceived cause of kidney disease by at least one respondent supports the theoretical model of patient's understanding their illness in a way that makes sense to them, not necessarily how medical science views it. Like the Identity subscale, participants perceived causes of their kidney disease beyond those recognized by the medical community, but the causes most often attributed to kidney disease were directly or indirectly recognized by the medical community as causes of kidney disease. Some examples of perceived causes of kidney disease not consistent with the medical model were negative mental attitude, personality, chance or bad luck and family problems and worries. The items most cited as causes of kidney disease were aging, which is supported in the medical literature, and diet or eating habits, which is indirectly related to kidney disease by way of contributing to DM and HTN which are the two main causes of kidney disease (NKF, 2002; USRDS 2008b).

It is impossible to compare the specific causes attributed to early stage kidney disease with other studies because there were no studies examining patient perceptions of causes among stage 3 CKD patients. Since each Cause item represents a specific causal belief, the use of a single score for analysis would be meaningless. As recommended by the IPQ-R authors, Moss-Morris and colleagues (2002), a principal components analysis was computed on the 18 causal items. Varimax rotation produced five factors accounting for 63% of the total variance. The first factor was labeled Psychological causes and accounted for 27.87 % of the total variance. The remaining factors were labeled Lifestyle causes, Environmental causes, Behavioral causes, and Destiny. Psychological, Lifestyle,

and Environmental cause factors were entered into analyses. Behavioral causes and Destiny were dropped from further analysis secondary to having low internal consistency scores and only two items each. The Cause factors in this study are different, but similar to other studies in the literature. Whereas the current study produced five factors accounting for 63% of the total variance, Moss-Morris et al. (2002) produced four factors accounting for 57% of the total variance. The Psychological factor in the present study contained items similar to the Moss-Morris et al. factor labeled Psychological attributions which accounted for 33% of the total variance. The second factor in the Moss-Morris et al. study, Risk Factors, contained all of the items in the Lifestyle cause factor in the present study plus additional factors. The Risk Factors item also loaded the items that are in the Behavioral Cause factor in the current study. The Environment Cause factor in the present study was similar to the Immunity factor in the Moss-Morris et al. study.

A review of the literature revealed that some studies produced the same or similar Cause factors to Moss-Morris et al. (2002) (Cherrington, Lawson, & Clark, 2006; Searle et al., 2007; Vaughan, Morrison, & Miller, 2003). Rutter and Rutter, (2007) produced two factors and labeled them Internal and External. Some researchers using the IPQ-R did not include the Cause subscale in their study (Covic et al., 2004; Fowler & Baas, 2006; Lau-Walker, 2004).

The similarity of the Cause subscale factors in this study to Moss-Morris et al. (2002) and other studies may have been increased if the sample size of the current study had been larger. Sample size is an important consideration when assessing the suitability of data for factor analysis, however there is little agreement on what that sample size should be. The proposed sample size of 100 for this study included having a minimum of

five cases for each of the 18 causal items. Although the actual sample size was 92 participants, only 88 subjects completed the Cause subscale in entirety, this small 4% non-response affected the reliability of the factor structure. Although the ratio of respondents to items was lower than desired, the strength of the inter-correlations among the items was tested and found suitable for factor analysis. The coefficients were greater than .3, the Bartlett's test of sphericity was significant with $p < .05$, and Kaiser-Meyer-Olkin index of 7.6 indicating a minimum value for a good factor analysis (Tabachnick & Fidell, 2007). Even so, a larger ratio of respondents to items should be proposed in future studies to increase the reliability of the measure and the generalizability of the data.

Timeline, Control, Consequences, and Emotion. A brief review of the construct definitions of each of the Illness Representation dimensions, Timeline, Control, Consequences, and Emotion are provided, along with a description of the findings from this study.

Timeline is conceptually defined as the patient's perception of duration and pattern of illness. Two subscales were used to measure Timeline. One subscale measured Timeline as acute or chronic and the other subscale measured Timeline as cyclical.

Regarding Timeline, the participants in this study had strong perceptions of their kidney disease as being a chronic, long-term condition. They also perceived a Timeline with minimal cyclical exacerbations of their kidney disease. These findings support the chronic Timeline findings of research by O'Connor et al. (2008) with ESRD patients, Searle et al. (2008) with DM patients, and Ross et al. (2004) with HTN patients. Meyer et al. (1985) found chronic Timeline perceptions among long term HTN patients, but a

more acute Timeline perception among newly treated patients with HTN. This implies that a perception of chronicity may evolve over time as individuals live with kidney disease, DM, and HTN. The perception of a less cyclical nature of kidney disease in current study was like findings with patients with HTN in the Meyer et al. study. Patients with HTN in the Ross et al. study, however, perceived HTN as cyclical, a condition that comes and goes. All studies included participants drawn from a specialty clinic setting; however the methods used to collect the data were different. The current study was a mail-out design, Meyer et al. used face to face interview sessions, and Ross et al. incorporated both face to face and mail-out methods to obtain completed questionnaires. The difference in methods may have influenced responses.

Control or cure is conceptually defined as the patient's perception of how well he or she can control or cure the illness and how well a treatment can control or cure their condition. Respondents in this study perceived having both, but more personal control than treatment control over their kidney disease. These findings are congruent with findings in other studies, O'Connor et al. (2008) with ESRD participants, Searle et al. (2008) with DM participants, and Ross et al (2004) and Meyers et al. (1985) with HTN participants. The finding that patients with stage 3 CKD and other chronic illness hold beliefs of being able to personally affect the course of their disease is important to nurses as clinicians and future interventional research. A positive relationship between a perception of personal and treatment control over the course of illness and/or symptoms and self-efficacy was shown in a study of patients with coronary heart disease by Lau-Walker, M. (2006). Furthermore, personal and treatment control beliefs were significantly related to and held constant with self-efficacy and they made significant

contributions to exercise and diet over the long-term. This would suggest that clinicians should incorporate the patient's perceptions of controllability in assessments and self-management of chronic illness behavior education sessions. Future longitudinal interventional studies would be in order to examine Illness Representation dimensions effects on health behaviors over time.

Consequence is conceptually defined as the effects the patient associates with the illness and negative aspects of life such as social, family, self-image, and economical changes. The participants in this study reported having a moderate level of negative consequence burden as a result of having kidney disease. This finding may be related to being in the early stage 3 of kidney disease as exemplified in the perception of severe consequences of later stage 5 ESRD participants in the O'Connor et al. (2008) study. Several studies found that perceptions of lower consequence was related to higher compliance with various health care behaviors (Barnes et al. 2004, Ross et al. 2004, and Scollan-Kolipoulos et al. 2007), thus implying that supporting positive self-management behaviors, such as medication adherence, and instilling the importance to maintain these behaviors over the long run would be most effective starting in the early stages of CKD when the consequence burden is relatively low. Longitudinal studies examining the perceptions of consequences of CKD throughout the stages of the illness in relation to self-management behavior outcomes and maintenance would be beneficial for this patient population.

Emotional representations are internal emotional responses to the mental image of possible dangers imposed by the illness threat, such as depression, fear, anger, or anxiety.

The participants in this study did not perceive their kidney disease to cause a great negative emotional response. This was consistent with Ross et al. (2004) study with HTN patients, but in contrast to the O'Connor et al. (2008) study with ESRD patients. Here again, the difference between early and late stage CKD might be explanatory. Another contributing factor, in the current study, may be a gender and culture effect of the male dominated sample of military veterans in the current study reporting minimal emotional response to their kidney disease. Future studies drawn from a more varied population, might examine the relationship of gender and military culture on Emotional Representation. The level of emotional response to a disease threat has been found to inhibit disease screening decisions and temporarily facilitate disease prevention behavior (Decruyenaere, Evers-Kiebooms, Welkenhuysen, Denayer, & Claes, 2000; Leventhal et al. 2001), thus it is important to ask patients about their emotional perceptions of having kidney disease to help understand how best to help them detect or manage the illness.

In summary, the current study found that patients with stage 3 CKD seen in the VAMC renal clinic identifies their kidney disease with a wide variety of symptoms, but most identified legs/feet swelling and fatigue as most symptomatic of their kidney disease. Most participants attributed the cause to aging and diet, but the Psychological Cause factor accounted for almost 30% of the total variance. The participants perceived their illness to be long-term with few exacerbations. They perceived that they had a relatively high degree of personal control over their illness and also believed that the treatments, including ACE-I medications, were able to control their kidney disease. The participants in this study reported perceptions of a moderate level of consequences and low emotional distress caused by their kidney disease.

The description of Illness Representations as perceived by CKD patients in this study had both similarities and differences with other chronic illness conditions. All Illness Representation dimensions have been found in one or more studies to affect some aspect of patients' choices of coping strategies to manage the illness threat. Therefore the findings from this study and others are important for clinicians to consider when assessing and partnering with patients in healthcare management of chronic illnesses. The findings in this study also indicate a need for more research efforts to learn about patient beliefs and perceptions about their kidney disease at initial stages, later stages and along the continuum.

Illness Representations Prediction of Medication Adherence

In regards to the second primary purpose, the findings of correlation analysis of illness representation dimensions and self-report medication adherence are discussed.

Patient perceptions about illness and beliefs about treatment have been shown to be related with adherence (Haynes et al., 1996; Wetzels et al., 2006). Unlike findings in other studies that found significant relationships between and predictability of illness representation and medication adherence (Horne et al., 2005; Peterson et al., 2003; Vermeire et al., 2001), the findings in this study did not support the conceptual framework that illness representation is related to or can predict patients' medication adherence behaviors. The research question asked if illness representation could predict the participants' coping strategy, which in this study is medication adherence. Multiple regression analysis was originally intended to test the predictability of illness representation dimensions that were significantly correlated with medication adherence. However, the results of the Pearson's correlation coefficients analysis revealed no

statistically correlated illness representation dimensions with medication adherence, therefore no variables were entered into multiple regression analysis.

Based on Tabachnick and Fidell (2007), there were some non-significant correlations with small (r = .02) and medium (r = .15) effects. The largest of which was a medium effect negative correlation (r = - .16) between Emotional Representation and self-reported medication adherence. This indicates that participant's who reported less perceptions of emotional distress in relation to their kidney disease, reported higher adherence with their ACE-I. Several dimensions had non-significant correlations with small effects: Timeline acute/chronic (r = .13), Personal Control (r = - .05), Consequence (r = - .03), and the Cause Factors (Environmental, r = .06; Psychological, r = - .03; and Lifestyle, r = .02). There are several reasons why the correlations may not have maintained statistical significance. An initial power analysis indicated that an estimated sample size of 68 would provide 80% power to detect a medium effect size of .15 of as many as 16 predictors on the value of f to detect correlations at an alpha of .05. There were 72 completed MARS measuring the outcome variable, self-reported medication adherence scale. Even though the sample size was greater than the power analysis estimate, there was insufficient power to detect the small and medium effect correlations. The power may have been weakened by the violation of the normality assumption of the outcome measure. The skewed data of the MARS resulted in a lack of variation in scores, reducing variability in data and thus decreasing the power to detect corrections with small and medium effects. When examining the skewed data of the MARS, a high ceiling effect is noted, which makes discrimination among high score

subjects impossible. The bounded design of the Mars measurement instrument may have contributed to the skewness and ceiling effect.

Another consideration to entertain is whether the Pearson's correlation coefficient test was the best approach for the study measurement design. Arostegui, Nunez-Anton, and Quintana (2010) propose that even though analyzing ranked order variables as continuous values is accepted practice, it may affect the statistical validity of the study findings. Considering this, there may be more appropriate statistical methods to use for ordinal scaled measures. The nature of the outcome variable and the objectives of the study should be given careful thought. Arostegui et al. propose that a beta-binomial regression approach may be more appropriate approach when using ordinal data than one where it is assumed that the ranked variable represents a continuous latent variable.

The mail-out design of the study was designed to allow the optimal amount of confidentiality and anonymity to the participants to encourage non-biased answers to the questionnaires. A different method of self-report questionnaire data collection or a comparison of different methods might yield different findings in future studies. A qualitative designed study might yield more information about how safe patients felt to answer medication adherence questions honestly. There may be a distrust that the information will be held permanently confidential which affected the way the participants answered medication adherence questions.

Although no statistically significant relationships were found in the present study, it is evident from the review of literature that patient perceptions and beliefs about their chronic illness, as measured by self-report, are related to and can predict medication adherence. The theoretical framework of CSM is supported with studies that found

statistical significance of the same variables that the present study found as non-significant correlations. A significant negative relationship between Emotional Representation and medication adherence was found in studies by O'Connor et al. (2008) and Ross et al. (2004). A significant positive relationship was found between Timeline acute/chronic and medication adherence in a study by O'Connor et al. (2008). A significant negative relationship was found with Personal Control and medication adherence by Scollan-Koliopoulos et al. (2007) and Ross et al. (2004). A significant negative relationship was found with Consequence and medication adherence by Barnes, et al. (2004) and Scollan-Koliopoulos et al. (2007) and a significant negative relationship was found with the Psychological Cause factor and medication adherence in a study by Kart et al. (2007).

In summary, this study revealed small non-significant correlations, but did not reveal statistically significant relationships with illness representation and self-reported medications adherence. Several possible reasons for not detecting significance in the relationships were discussed, such as small sample size, skewed data, study design and statistical choices. Other studies found significant relationships with illness representation dimensions and medications adherence. The issues discussed should be taken into consideration in future studies as there is sufficient evidence to support more studies using the CSM to examine medication adherence coping strategies.

Secondary Purposes

Secondary purposes of this study included determining adherence levels of ACE-I among patients with CKD stage 3; examining relationships between individual and clinical characteristics with patient beliefs and medication adherence with ACE-Is; and

examining the relationship between the Medication Adherence Report Scale (MARS) and the Medication Possession Ratio (MPR). The discussion of the secondary purposes will include a section of the adherence levels of ACE-I using two measurement instruments and the relationship between the two instruments. Then the examination of relationships of individual characteristics with illness representation dimensions and self-report medication adherence will be discussed. Lastly, the examination of relationships of clinical characteristics with illness representation dimensions and self-report medication adherence will be discussed.

Medication Adherence Levels of ACE-I

Average medication adherence rates across chronic disease populations and across medications are estimated to be 50% (Balkrishnan, 2005; Gossec et al., 2007). Some studies have shown that adherence with ACE-I is even higher than average at 60 % (Cooke & Fatodu, 2006) and 77% (Pladevall et al., 2004). Using more than one method for measuring adherence to medication is considered to be a more effective analysis choice than relying on one single method. However, there is no gold standard measure when it comes to medication adherence and caution should be used when interpreting results (Cook et al., 2005; Farmer, 1999; Steiner et al., 1988). To add to the validity of the medication adherence with ACE-I findings, medication adherence was measured by self-report MARS and by MPR computed from pharmacy refill data. Both methods indicate high levels of medication adherence in this study sample.

MARS. Self-report measures have been shown to overestimate adherence (Cook et al., 2005, R. E. Grymonpre et al., 1998). Several precautions were taken to minimize bias and overestimation of adherence in this study. However, a very high level of

medication adherence was reported by the study participants (M = 4.81 with perfect adherence being 5). Even though the participants were allowed to answer the survey in the privacy of their own homes and were assured that their responses would not be shared with their providers, they may have had reservations about trusting the system to keep their responses confidential. On the other hand, the high reported medication adherence in this study may be correct and impacted by the VAMC pharmacy system, with patients having no, or low copayments, and access to pharmacy personnel and education. Previous studies have reported MARS scores to be skewed toward higher values and selected to dichotomize the data with a priori cut-off points (Fialko et al., 2008; Mardby et al., 2007). Others chose cut-off points close to the mean value (Ediger et al., 2007). A level of adherence rather than a rate of adherence was desired in the current study, therefore the data were not dichotomized and a cut-off point was not utilized. Considering the skewed results in this study, it may be prudent to consider a dichotomized or set cut-off point in future studies.

There was debate regarding whether to use the MARS instrument as a whole with all 5 items as the internal consistency of the MARS was below the recommended Chronbach's alpha coefficient of .70 (alpha = .64). A review of the literature indicated the values produced in the current study are in line with other studies. An alpha of .75 was produced during the original development of the scale (Thompson, Kulkarni, & Sergejew, 2000), however this scale had 10 items. Other studies using the 5 item MARS have produced alpha values of .60 (Fialko et al., 2008) .73 (Mardby etl al., 2007) and .83 Ohm & Aaronson, (2006). Since the MARS measurement tool has not been used with CKD patients and since the internal consistency was less than desired, it should be

psychometrically tested in the future with CKD subjects to validate its usefulness with this population.

MPR. Pharmacy refill data was used to compute the MPR as a measure of medication adherence in this study. The MPR has been validated using patient reports, pill counts, and biological and chemical markers. It is generally acknowledged that measurement using pharmacy records are measuring refill patterns and not actual drug-taking behaviors. As with the self-reported medication adherence, the data indicated that study participants' medication adherence with 73.3% filling their ACE-I prescriptions, as prescribed, 100% of the time. MPR results are reported on a continuum rather than the often used cut-off of 80% or greater equating to adherence and 20% or less equating to non-adherence (Cramer et al., 2007; Steiner & Prochazka, 1997).

A process of automatic refills might have led to higher prescription refill rates, however such a program is not offered at the VAMC. Patients have to request refills. Knowledge of medications and access to medications are predictive factors in medication adherence (Their, et al., 2008) – both are supplied at the VAMC and may have contributed to the high medication adherence levels found in the current study. Another consideration when looking at the pharmacy refill outcomes is that prescriptions supplying medication for 90 days is very common at the VAMC. The participant may have filled the first prescription without having another fill date come due during the research study period. There was no stipulation that more than one fill date was required to calculate the MPR. This may have contributed to the high refill rate as some studies have shown medication adherence persistence declines after six months (Benner et al., 2002; Cramer et al., 2007). On the other hand, it may not have contributed to the

outcome, based on a study by Wannemacher et al. (2002) in which prescription refill records of a large Veterans Affairs population revealed a 97.6% medication adherence rate with ACE-I. The congruence of a high level of medication adherence reported in the self-report MARS and the pharmacy refill MPR adds to the validity of the measurement of medication adherence in this study. Pearson's correlation coefficient was used to test the relationship between the self-report MARS and pharmacy refill MPR for significance.

Relationship of MARS and MPR

A statistically significant relationship was found between the MARS and MPR ($p < .01$). This is not surprising as high scores of adherence in both instruments are evident in all of the tests of analyses in this study. There are many studies in the literature comparing various methods of measuring medication adherence but no gold standard has been developed. Pharmacy refill records have been positively related to self-reported medication adherence ($p < .001$) (R. Grymonpre et al., 2006). Results from many studies include recommendations to use more than one method to measure medication adherence (Cook et al., 2005; Farmer, 1999; Steiner et al., 1988). It has been recognized that the subjective self-report instrument can supply more qualitative information than the more objective pharmacy refill record; therefore Steiner et al. (1988) posits that pharmacy-based measurements of adherence should always be examined and explained taking into account the patient's self-reported adherence behavior. Validity of the self-report MARS measurement instrument is increased in this study with the finding of a positive significant correlation between the two measurement instruments.

Individual Characteristics Relationship with Illness Representation and MARS

In the current study, older age was significantly associated with a more acute timeline, less consequences, and less personal control. In general, literature findings support that older patients perceive fewer symptoms related to their illness, less severe consequences and emotional distress, and higher treatment control compared to younger patients (Lawson et al., 2007; Heckler, 2008; Glasgow, 2997). Ross et al., (2004) examined age in relationship to both Illness Representation and medication adherence finding older participants perceived less treatment control and reported higher medication adherence rates that younger participants. Unlike the current study, none of the studies found a significant correlation between age and more acute timeline. The current finding that older patients perceive their kidney disease to be acute, rather than chronic is not supported in the literature and is contrary to clinical experiences, thus is an area for further investigation. It may be that as patients with CKD get older, they see everything, including life itself as being less long term, and thus view their illness in the same light. Sacajiu et al. (2007) found this phenomenon in a study of HIV patients who perceived their illness timeline as acute because they believed their life expectancy was short. Other factors may be involved. For example, Heijmans and de Ridder (1998) found that patients with Chronic Fatigue Syndrome who had high perceptions of personal control also perceived a more chronic timeline of their chronic illness. In the current study, age was correlated with a perception of less Personal Control, so therefore it may be this perception that is associated with a more acute Timeline rather than age. Future research in which correlations of Illness Representation dimensions along with mediating and

moderating effects are examined might give more insight about the direct relationships between age and Illness Representation dimensions.

A higher education was significantly associated with the perception of a chronic Timeline of their kidney disease. Considering this finding, it may be that older participants had less education and thus the relationship between age and acute Timeline, was affected by education status. As suggested in the previous paragraph, future research should consider this. A higher level of education has been shown in the literature to be significantly associated with lower symptom burden, less treatment control and higher personal control than those with less education (Glasgow et al., 1997; Heckler et al., 2008). Education was not found to be associated with Illness Representation and or medication adherence by Ross et al., (2004), Bame et al., (1993), and Curtin et al., (1999).

African Americans had a significantly higher sense of personal and treatment control, and reported a lower emotional response to their kidney disease than their Caucasians counterparts in this study. Because of the small number of African Americans in this study, caution should be followed when generalizing these results. However, these findings are consistent with findings in studies by Glasgow et al. (1997) and Kressin et al. (2007).

In the current study, participants living with partners were significantly less likely to contribute Lifestyle causes, such as alcohol consumption and smoking, to the cause their kidney disease, than those living with partners. The review of the literature did not reveal studies examining like variables. It would be hard to offer possible explanations for this finding without more information about individuals who have kidney disease and

are living with partners. Possible areas for inquiry for future research would be to ask if the participants living with partners married, divorced, or widowed; if they are living in a harmonious relationship; do they have children and the ages of their children? There is literature showing associations of lifestyle behaviors, like alcohol consumptions and smoking, are related to home and family environments. The answers to these questions would serve as a guide to possibly answering why living with a partner might influence individuals' perceptions of Lifestyle causes of their kidney disease.

In this study financial status was not significantly related to any of the Cognitive Illness dimensions, Emotional Representations or MARS. Non-significant correlations with small and medium effects were found with age, education, and financial status and Cognitive and Emotional Representations. Age was the only Individual characteristic associated with self-report medication adherence with a small effect of $r = -.14$. As discussed earlier, stronger powered studies may identify significant relationships among these variables.

This study partially supports the CSM that the patient, drawing from personal background, knowledge, life events, experiences and familial experiences, develops a cognitive and emotional illness representation of CKD and its treatments. The relationships of Individual Characteristics with Illness Representation and MARS in this study of CKD patients indicate that age, race, and education were significantly associated with cognitive and emotional representations. All Individual Characteristics were non-significantly related to at least one Illness Representation dimension and MARS. Future studies with more power may reveal more areas of significant relationships.

Clinical Characteristics Relationship with Illness Representation and MARS

In the current study, a longer time span of being aware of having kidney disease was significantly associated with a perception of their illness being more chronic and less cyclical, and with being less adherent with medications. Stage 3 CKD is a chronic condition with few exacerbations at this stage. The finding that the longer participants' were aware of being diagnosed with CKD the closer their perceptions were in line with medical findings is supported in the literature. Studies have found that as patients have lived with their chronic illness and treatments, their perceptions of their illness and treatment evolved over time to be more in line with the medical model (Meyer et al., 1985; Velez & Ramasco, 2006). Horne, et al. (2010) found that participants' perceptions that were more congruent with the medical model of their HTN reported higher rates of medication adherence. These findings should encourage integrating patient perceptions of their illness and treatments into the design of CKD patient education programs, especially when discussing the importance of kidney protection with medication adherence.

Participants who reported having lived with a relative diagnosed with ESRD or being on dialysis were significantly more likely to perceive a more cyclical nature of their kidney disease than those not having lived with relatives with ESRD or on dialysis. The sample size of participants reporting having lived with a relative diagnosed with ESRD or being on dialysis was too small to allow generalization. These results may be expected in this study with a small sample and with a high ratio of Caucasian to African American as African American renal patients are more likely to progress to ESRD than Caucasians and in a shorter time period after diagnosis with CKD (USRDS, 2008). Illness

Representation and medication adherence have been evaluated among people living with family members with chronic illness. Lawson et al., (2007) found participants living with family member with DM had a significantly higher perception of emotional stress ($p <$ .01) than those without family member with DM. Godoy-Izquierdo et al., (2007) found participants with family members having high blood pressure perceived HTN to be less chronic, more cyclical, have more personal control and with less serious consequences than those without family members with HTN. Considering this fact, whether or not a participant lived with a family member with ESRD/dialysis may be an important variable to consider in future studies.

In this study, a significantly higher perception of emotional distress was found in participants diagnosed with DM, HTN, or CVD as opposed to those diagnosed with a combination of two of those co-morbid conditions. It may be that participants diagnosed with just one of these conditions, in addition to their CKD, have lived longer without knowing that they had other medical conditions and are having a more difficult time adjusting. However, there was no statistically significant difference between Emotional Representation means between those with one co-morbid condition and those with three co-morbid conditions. This is an interesting finding that requires more research to arrive at an explanation.

Number of medications was not significantly associated with any of the illness representation dimensions or the MARS, although there were non-significant correlations with small and medium effects. A review of the literature did not reveal studies examining associating the number of medications with Illness Representation. There were many studies that investigated medication adherence with the number of prescribed

medications; however the results were conflicting and without consensus. Medication adherence was not significantly associated with participants having lived with a relative with ESRD/dialysis or co-morbidity status.

As with Individual Characteristics, the findings from the Clinical Characteristics relationships partially supports the CSM that the patient, drawing from personal background, knowledge, life events, experiences and familial experiences, develops a cognitive and emotional illness representation of CKD and its treatments. The relationships of Clinical Characteristics with Illness Representation and MARS in this study of CKD patients indicate that length of time since diagnosis, number of co-morbidity conditions and whether or not a participant lived with a family member with ESRD/dialysis were significantly associated with cognitive and emotional representations and with self-reported medication adherence. All Clinical Characteristics were non-significantly related to at least one Illness Representation dimension and MARS. Future studies with more power may reveal more areas of significant relationships.

Limitations

Several limitations exist in the study. First, the data for the study were obtained from a non-random sample from one site which affects the ability to generalize findings, especially to non-VAMC patients. The sample characteristics, primarily White males with 12 or more years of education and comfortable financial status infer that sample selection bias may influence the results and should be taken into account when interpreting the results. Also noted, is that the patients in this study were being seen in a military-academic healthcare setting by specialized providers making it difficult to

generalize findings to other settings or even patients with stage 3 CKD who are not followed by specialists in the same setting.

The sample size was relatively small ($N = 92$), consequently there was little statistical power to demonstrate relationships between Illness Perceptions and medication adherence. The small sample was complicated by a high level of missing values on some subscales, especially the MARS with skewed data, thus decreasing the power. Future research in this area with larger samples should consider comparing outcomes with this study. Impetus for further research in the area of Illness Representation and medication adherence is given considering significant relationships found in other studies.

The response rate in this study was 46%. Survey questionnaires were mailed out and telephone calls made to eligible participants over a period of five months. Although the response rate was higher during the first three months, a delay in follow-up phone calls was encountered approximately midway in the study when changes in study personnel occurred decreasing the overall response rate. There is the possibility that those individuals who opted to participate were different in some indefinable way that may have affected study results. The ability to recruit and retain study personnel may help improve the response rate in future mailed surveys. An alternative method of data collection, such as in person interviews, may help increase participation rates.

The current study had a cross-sectional design therefore no conclusions could be drawn regarding causality of observed relationships. It also does not allow exploration of the full theoretical framework of the CSM. The CSM construct proposes a dynamic state in which illness representations influence coping mechanisms that are appraised in a feedback loop that affects the original illness representation and coping decisions. Future

research should be designed using prospective longitudinal study designs to capture the nature of this dynamic model.

The decision to use a mail out study design aided in decreasing social bias and offered patient confidentiality benefits, however this type of design limited information about individuals who did not respond to the invitation to participate. No comparisons could be made between study responders and non-responders.

Finally, although the measurement instruments used in the study have been psychometrically tested for validity and reliability among patients with chronic illnesses, they had not previously been applied to the stage 3 CKD patient population. Based on the high level of internal consistency found in the IPQ-R and moderate level found in the MARS in this study, the instruments were considered suitable for use with CKD patients. Revision of some of the subscales may be needed. As discussed previously, the directions and design of the Identity subscale may need revision to address the skipped pattern of answering the second part of a question only if the first part was answered in the affirmative. Revision of the MARS scale might be in order for future studies aimed at intentional adherence as opposed to unintentional adherence. If the outcome is intentional adherence, deleting the unintentional item of forgetting to take medication may be of benefit.

Conclusion and Recommendations for Future Research

Despite its limitations, the present study revealed important information that has helped fill the knowledge gap concerning patient perceptions and medication adherence among patients with stage 3 CKD. This study described the Illness Representations and renal protective medication level of patients with stage 3 CKD. Then the two constructs

were examined to test the relationships of Illness Representations, as measured by the IPQ-R on self-reported medication adherence, as measured by the MARS. In addition, the relationship between the two medication adherence tools, self-report as measured by the MARS and prescription refill rate by MPR were explored. Lastly, relationships of the individual and clinical characteristics of the study sample with the Illness Representation dimensions and self-reported medication adherence were examined.

As there have been no studies on the Illness Representations of early stage CKD patients or renal protective medication adherence studies, the results from this descriptive, cross sectional research help advance the state of science by building a base to support more robust longitudinal and interventional studies.

Recommendations for future studies include design of longitudinal studies to test the whole CSM construct with feedback that purports that illness representations direct the individual's adherence behavior, the individual appraises the results of his or her decisions and either continues the behavior, or alters the illness representations and the loop begins again. Other longitudinal studies of importance might be to examine the change in illness perceptions over the years through the various stages of CKD in order to detect differences that might be significant indicators of coping strategies that lead to kidney preservation. Based on understanding of patient perceptions of their kidney disease, intervention studies to test differences between provider patient encounters addressing Illness Representations and usual care would be valuable. Intervention studies to test effects of including Illness Representations in nurse led CKD patient education clinics on patient self-management and kidney preservation outcomes would be beneficial.

The long term intent of this research effort is to discover ways to help patients preserve kidney function and avoid dialysis or premature death from cardiovascular disease. Focusing on the patient as the driving force and partnering patients with the medical community is an important step in searching for solutions. The findings from this study and future studies will be beneficial in both the research and clinical arena. Nephrology nurses and providers will be better equipped to provide care to CKD patients by understanding patients' Illness Representations.

Appendix A

Institutional Review Board Approval

INTERDEPARTMENTAL COMMUNICATION
Research Compliance Administration (RCA)
Indiana University - Purdue University Indianapolis

DATE: May 21, 2010

TO: Janet Welch
Adult Health
NU 426
IUPUI

FROM: Sherri Ream
Research Compliance Administration

SUBJECT: Final Approval

Study Number: 1003-81B
Study Title: Illness Representations Among Patients with Chronic Kidney Disease - Sponsor: N/A

The study listed above has received final approval from the Institutional Review Board (IRB-01) under Expedited Categories 5 and 7. The IRB has granted a Waiver of informed consent for recruitment only under 45CFR46.116(d). and a Waiver of authorization for recruitment only under 45CFR164.512(i). Please note that subjects must be provided with and sign a current informed consent document containing the IRB approval stamp.

Special requirements for the inclusion of prisoners: Please note that unless your study has received approval for the inclusion of prisoners, you may not enroll and/or otherwise involve a prisoner in your study. Special requirements apply if an individual enrolled on the study either is a prisoner or has become a prisoner during the course of his/her study participation (and the study has not been previously granted approval for the enrollment of prisoners as a subject population). If the investigator becomes aware that a subject is a prisoner, all research interactions and interventions with the prisoner-participant must cease.
If the investigator wishes to have the prisoner-participant continue to participate in the research, Research Compliance Administration (RCA) must be notified immediately (317-274-8289). In most cases, the IRB will be required to re-review the protocol at a convened meeting before any further research interaction
or intervention may continue with the prisoner-participant. Refer to the IUPUI/Clarian Standard Operating Procedure (SOP) on *Vulnerable Populations* for further information. The SOP is available at http://researchadmin.iu.edu/Forms/human_subjects/hs_iupui/Standard_Operating_Procedures%20_03%2008.pdf.

As the principal investigator of this study, you assume the responsibilities as outlined in the SOP on *Responsibilities of Principal Investigators,* some of
which include (but are not limited to):

1. **CONTINUING REVIEW** - A status report must be filed with the IRB at least annually. The RCA staff will generate these reports for your completion. This study is approved from **May 12, 2010** to **May 12, 2011**. **If your study is not re-approved by this date, the study will automatically expire, which means that all research activities, including enrollment of new subjects, interaction and intervention with current participants, and analysis of identified data, must cease.**
2. **STUDY AMENDMENTS** - You are required to receive prospective approval from the IRB for ANY changes to the research study, including changes
to protocol design, dosages, timing or type of test performed, population of the study, and informed consent statement, prior to implementation. This request is made via an amendment form, which can be obtained at: http://researchadmin.iu.edu/HumanSubjects/IUPUI/hs_forms.html.
3. **UNANTICIPATED PROBLEMS INVOLVING RISKS TO SUBJECTS OR OTHERS AND NONCOMPLIANCE** - You must promptly report to
the IRB any event that appears on the **List of Events that Require Prompt Reporting to the IRB.** Refer to the SOP on *Unanticipated Problems Involving Risks to Subjects or Others and Noncompliance* for more information and other reporting requirements. The SOP can be found at: http://researchadmin.iu.edu/Forms/human_subjects/hs_iupui/Standard_Operating_Procedures%20_03%2008.pdf.
NOTE: If the study involves gene therapy and an event occurs which requires prompt reporting to the IRB, it must also be reported to the Institutional Biosafety Committee (IBC).
4. **UPDATED INVESTIGATIONAL BROCHURES, PROGRESS REPORTS and FINAL REPORTS** - If this is an investigational drug or device study, updated clinical investigational brochures must be submitted as they

occur. These are submitted with an amendment form. Progress or final reports must be provided to the IRB with your written assessment of the report, briefly summarizing any changes and their significance to the study.

5. **ADVERTISEMENTS** – You can only use IRB-approved advertisements to recruit participants for your study. If you will be advertising to recruit study participants and the advertisement was not submitted to the IRB at the time your study was reviewed and approved, a copy of the information contained in the advertisement and the mode of its communication must be submitted to the IRB as an amendment to the study. These advertisements must be reviewed and approved by the IRB PRIOR to their use.
6. **STUDY COMPLETION** – You are responsible for promptly notifying the IRB when the study has been completed (i.e. there is no further subject enrollment, not further interaction or intervention with current participants, including follow-up, and no .further analysis of identified data). To notify the IRB of study completion, please obtain a Continuing Review – Closeout Report form at http://researchadmin.iu.edu/HumanSubjects/IUPUI/hs_forms.html and submit it to the RCA office.
7. **LEAVING THE INSTITUTION** - If the principal investigator leaves the Institution, the IRB must be notified as to the disposition of EACH study.

PLEASE REFER TO THE ASSIGNED STUDY NUMBER AND THE EXACT TITLE IN ANY FUTURE CORRESPONDENCE WITH OUR OFFICE.

In addition, SOPs exist which cover a variety of topics that may be relevant to the conduct of your research. Please visit http://researchadmin.iu.edu/Forms/human_subjects/hs_iupui/Standard_Operating_Procedures%20_03%2008.pdf for a current copy of the IUPUI SOPs for Research Involving Human Subjects. All documentation related to this study must be neatly typed and must also be maintained in your files for audit purposes for at least three years after closure of the research; however, please note that research studies subject to HIPAA may have different requirements regarding file storage after closure. If you have any questions, please call Research Compliance Administration at 317/274-8289.

Please see the IRB approval email attached to this document, as well as the Documentation of Review and Approval, for a list of all documents approved with this submission.

Appendix B

Letter of Cooperation

Department of Veterans Affairs

Richard L. Roudebush

VA Medical Center
1481 West 10th Street
Indianapolis, IN 46202
(317) 988-4273

To: M. Sue McManus, PhD(c)
Nephrology Nurse Practitioner
Richard L. Roudebush VAMC
1481 W. 10th Street (111N)
Indianapolis, IN 46202

Date:

From: Asif Sharfuddin, MD
Nephrologist
Medical Director, Renal Clinic
Richard L. Roudebush VAMC
1481 W. 10th Street (111N)
Indianapolis, IN 46202

It is my understanding that you will be pursuing data collection for your doctoral dissertation. It is also my understanding that you will be screening, recruiting, and enrolling patients seen in the renal clinic at RLR VAMC. As a researcher who is also part of the renal department at RLR VAMC, you are considered an Authorized Delegate and have approval to act as a representative of the renal clinic patients' treatment providers to personally screen for eligibility and contact patients regarding participation in your research.

You are already aware of the value we place on preserving kidney function in patients being seen in the renal clinic. This study is concordant with those values.

Sincerely,

Asif Sharfuddin, MD
Nephrologist
Medical Director, Renal Clinic
Richard L. Roudebush VAMC

Appendix C

Cover Letter

Recipient address Date

Dear

We are inviting you to take part in an important research study of people with kidney disease who are patients in the renal clinic at the Veterans Administration Medical Center in Indianapolis, Indiana. We are interested in learning more about your thoughts and opinions about your illness and treatment.

Enclosed is an:

1. Informed Consent form (yellow)
2. Authorization for the Release of Health Information for Research form (green)
3. Survey that includes questions about your thoughts and opinions about your illness and treatment.
4. Self-addressed stamped envelope for returning completed survey packet
5. $2.00 as a thank you for joining the study

Please read and sign the Informed Consent (yellow) and Authorization forms (green), and answer the questions on the survey form. A research assistant will follow the mailing with a telephone call to answer any questions that you might have. When completed, place the forms in the self-addressed stamped envelope and mail.

Completing the survey is completely voluntary and your answers will remain confidential. If you prefer not to participate, please let us know by returning the blank questionnaire in the enclosed stamped envelope. You keep the $2.00.

This study will help doctors and nurses understand how patients with kidney disease manage their illness and treatments.

Thank you for your time and consideration. Our research can only be successful with the help of people like you. If you have any questions or comments about the informed consent, authorization for release of information, or the survey please call Ms. McManus, the nurse researcher at 317-988-4273 or toll free at 1-888-878-6889 and ask for extension 84273.

Sincerely,

Dr. Asif Sharfuddin
Medical Director
Renal Clinic
Richard L. Roudebush VAMC

Sue McManus, PhD candidate
Indiana University School of Nursing
Nephrology Nurse Practitioner
Richard L. Roudebush VAMC

Appendix D

Informed Consent

IU and Department of Veterans Affairs Consent Form

Illness Representations Among Patients with Chronic Kidney Disease

Purpose *of study and how long it will last*:

You are being asked to be in this research study because you are currently receiving treatment for chronic kidney disease in the renal clinic at the VA in Indianapolis. The study will last 10 months.

Description *of the study including procedures to be used*:

If you agree to participate, you will be one of 100 subjects who will be participating in this research

If you agree to be in the study, you will do the following things:

1. Your first step will be to read and sign this Informed Consent form (Yellow). By signing the Informed Consent form, you are stating that you understand what participating in the study means and are agreeing to participate. Please call Sue McManus at 317-988-4273 or toll free 888-878-6889 with any questions.

2. Next, read and sign the Authorization for the release of Health Information for Research form (Green). Signing this form gives us permission to obtain your medical records for information about your illness and treatment.

3. You will receive a telephone call from a research associate to confirm that you did receive the study packet and to answer any questions you might have about the study.

4. Then, you will be asked to complete the survey questions (White) asking about your thoughts and opinions about your kidney disease and treatment. This form is numbered and does not have your name on it. Please do NOT sign it.

5. When you have read and signed the forms and completed the survey questions, place the signed forms and the completed survey questions in the self-addressed, stamped envelope provided, and mail to the nurse researcher. We would like for you to complete and mail them back within two weeks of receiving them.

Risks:
There are no physical risks to being in the study. One risk of taking part in a study involves a possible loss of confidentiality since members of our research team will know who you are and the information that you will share with us in answering the questions about your illness and treatment. Your information will be kept confidential and only the nurse researcher and research assistant will know your identity. Unless we are required

by law, we will not share the information with anyone. Your identifying information (name and address) will be kept in a locked file cabinet in the nurse researcher's private office. Any information you share with us will be confidential and kept in a secure database. The database will be password protected so that only members of the research team will have access to the information. Your name and other identifying information will NOT be included on the survey questions.
Answering questions about kidney disease and treatment may make some people feel uncomfortable. You can refuse to answer any questions that make you uncomfortable. If you feel uncomfortable, we encourage you to talk about these feelings with the nurse researcher. You may call Sue McManus, nurse researcher, at 317-988-4273 or toll free 888-878-6889, ext 4273.

Not all of these things may happen. None of them may happen.

Benefits:

Sometimes good things happen to people who are in research studies. These good things are called "benefits." We don't know for sure if you will have any benefits. Some people benefit by knowing that their participation in this study may help others in the future. By joining this study, you may help improve the care for patients with kidney disease.

Alternate Courses of Action or treatment:
Taking part in this study is voluntary. You may choose to complete part or none of the survey questions. If you do not wish to participate you may mail the blank survey to the nurse researcher in the stamped self-addressed envelope. Choosing not to take part in the study will not affect the care you receive from your doctor or the VA in any way.

Statement of Use of Research Results:
The results of this study may be published, but your records or identity will not be revealed unless required by law.

Confidentiality:
Efforts will be made to keep your personal information confidential. We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law. Your identity will be held in confidence in reports in which the study may be published.

Organizations that may inspect and/or copy your research records for quality assurance and data analysis include groups such as the investigator and his/her research associates, the IUPUI/Clarian Institutional Review Board or its designees and the VA Research and Development Committee's designees.

Research Subject Costs:

1. There will be no cost(s) to you for any of the treatment or testing done as part of this research study. Eligibility for medical care at a VA Medical Center is based

upon the usual VA eligibility policy and is not guaranteed by participation in a research study.

2. You will not be required to pay for medical care or services received as a participant in a VA research project except as follows:
    a. Some veterans are required to pay co-payments for medical care and services provided by the VA. These co-payment requirements will continue to apply to medical care and services provided by VA that are **not** part of this study.

Compensation:

1. You will receive $2.00 as a thank you for completing and returning the survey in the mail.
2. The VA Medical facilities shall provide necessary medical treatment to a research subject injured as a result of participation in a research project approved by a VA Research and Development Committee and conducted under the supervision of one or more VA employees. This does not apply to: (1) treatment for injuries due to noncompliance by a subject with study procedures; or (2) research conducted for VA under a contract with an individual or a non-VA institution.
3. Financial compensation for research-related injuries is not available. However, by signing this form, you do not give up your legal rights to seek

RESEARCH SUBJECT'S RIGHTS:

Participation in this study is entirely voluntary. You may refuse to participate. Refusal to participate will involve no penalty or loss of rights to which individuals are entitled. You may withdraw from this study at any time without penalty or loss of VA or other benefits. You will receive a copy of this signed consent form.

In case there are questions, Ms. McManus, research investigator can be contacted at (317) 988-4273 or toll free 888-878-6889 Monday through Friday between 7:00 am and 4:00 pm. Her research office does not have a 24-hour emergency number. If any medical problems occur in connection with this study, the VA will provide emergency care.

Please direct questions about the consent process and the rights of research subjects to the VA Customer Service Office at (317) 988-2602. For questions about your rights as a research participant or complaints about a research study, contact the IUPUI/Clarian Research Compliance Administration office at 317/278-3458 or 800/696-2949. If you have any questions about the research study or want to check the validity, discuss problems, concerns or obtain information or offer input, please call the Research Office at 317-988-3032.

I understand what participating in this study means and agree to participate. The risks or discomforts and possible benefits of the study have been described.

_____	_____	_____
Subject's Signature	Printed Name of Subject	Date
_____	_____	_____
Signature of Witness to above signature (may be any adult who witnessed you signing this form) If there is no one to witness your signature, please call VA research office at 317-988-3032	Printed Name of Witness	Date
_____	_____	_____
Signature of Person Obtaining Consent	Printed Name of Person Obtaining Consent	Date

Appendix E

Reminder Letter

Recipient address Date:

Dear

A survey asking for your thoughts and opinions about kidney disease and treatments was mailed to you recently.

If you have already completed and returned the survey to us, please accept our sincere thanks. If not, please do so today. We appreciate your help with this important topic.

If you did not receive a survey packet, or if it was misplaced, please call 317-988-4273 or toll free at 1-888-878-6889 and ask for extension 84273, and we will get another one in the mail to you.

Sincerely,

M. Sue McManus
Nurse Researcher, IUPUI School of Nursing
RLR VAMC Research Office
Indianapolis, IN 46202

Appendix F

Survey Questionnaire

Kidney Patient Perception Questionnaire

Your views of

Kidney disease and treatments

We are interested in your personal views about kidney disease and treatments.

Thank you for sharing your views about kidney disease and treatments

SYMPTOMS AND KIDNEY DISEASE

Listed below are a number of symptoms that you may or may not have had since having kidney disease. Please circle "Yes" or "No" , whether you have had any of these symptoms since you were told that you have kidney disease. Then, please say if you believe that these symptoms are related to your kidney disease.

	Symptom	I have had this symptom since knowing that I had kidney disease		→	This symptom is related to my kidney disease		
		▼	▼		▼		
1a	**Pain**	Yes	No	→	Yes	No	**1b**
2a	**Sore Throat**	Yes	No	→	Yes	No	**2b**
3a	**Nausea**	Yes	No	→	Yes	No	**3b**
4a	**Short of breath**	Yes	No	→	Yes	No	**4b**
5a	**Weight Loss**	Yes	No	→	Yes	No	**5b**
6a	**Fatigue**	Yes	No	→	Yes	No	**6b**
7a	**Stiff Joints**	Yes	No	→	Yes	No	**7b**
8a	**Sore Eyes**	Yes	No	→	Yes	No	**8b**
9a	**Wheezing**	Yes	No	→	Yes	No	**9b**
10a	**Headaches**	Yes	No	→	Yes	No	**10b**
11a	**Upset Stomach**	Yes	No	→	Yes	No	**11b**
12a	**Problems sleeping**	Yes	No	→	Yes	No	**12b**
13a	**Dizzy**	Yes	No	→	Yes	No	**13b**
14a	**Loss of Strength**	Yes	No	→	Yes	No	**14b**
15a	**Bad taste in mouth**	Yes	No	→	Yes	No	**15b**
16a	**Legs/feet swelling**	Yes	No	→	Yes	No	**16b**
17a	**Puffy eyes**	Yes	No	→	Yes	No	**17b**

YOUR PERSONAL VIEWS ABOUT YOUR KIDNEY DISEASE

- **We are interested in your personal views about your kidney disease**
- **Please show how much you agree or disagree with each of the following statements about your kidney disease by checking one of the boxes. There are no right or wrong answers.**

I believe that	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree #
My kidney disease will last a short time					18
My kidney disease is likely to be permanent rather than temporary					19
My kidney disease will last for a long time					20
My kidney disease will pass quickly					21
I expect to have kidney disease for the rest of my life					22
My kidney disease is a serious condition					23
My kidney disease has major consequences on my life					24
My kidney disease does not have much effect on my life					25
My kidney disease strongly affects the way others see me					26
My kidney disease has serious financial consequences					27
My kidney disease causes difficulties for those who are close to me					28
There is a lot which I can do to control my kidney disease symptoms					29

What I do can determine whether my kidney disease gets better or worse					30
The course of my kidney disease depends on me					31
Nothing I do will affect my kidney disease					32

I believe that	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree #
My kidney disease will last a short time					18
My kidney disease is likely to be permanent rather than temporary					19
My kidney disease will last for a long time					20
My kidney disease will pass quickly					21
I expect to have kidney disease for the rest of my life					22
My kidney disease is a serious condition					23
My kidney disease has major consequences on my life					24
My kidney disease does not have much effect on my life					25
My kidney disease strongly affects the way others see me					26
My kidney disease has serious financial consequences					27
My kidney disease causes difficulties for those who are close to me					28
There is a lot which I can do to control my kidney disease symptoms					29
What I do can determine whether my kidney disease gets better or worse					30
The course of my kidney disease depends on me					31
Nothing I do will affect my kidney disease					32

I believe that	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree #
I have the power to influence my kidney disease					33
My actions will have no affect on the outcome of my kidney disease					34
My kidney disease will improve in time					35
There is very little that can be done to improve my kidney disease					36
The treatments that my doctor orders for my kidney disease will be effective in curing it					37
The negative effects of my kidney disease can be prevented (avoided) by my medications					38
My medications can control my kidney disease					39
There is no treatment which can help my kidney disease					40
The Symptoms of my kidney disease are puzzling to me					41
My kidney disease is a mystery to me					42
I don't understand my kidney disease					43
My kidney disease doesn't make any sense to me					44
I have a clear picture or understanding of my kidney disease					45
The symptoms of my kidney disease change a great deal from day to day					46
My kidney disease symptoms come and go in cycles					47
My kidney disease is very unpredictable					48
I go through cycles in which					49

my kidney disease gets better and worse					
I get depressed when I think about my kidney disease					50
I believe that	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree #
When I think about my kidney disease I get upset					51
My kidney disease makes me feel angry					52
My kidney disease does not worry me					53
Having kidney disease makes me feel anxious					54
My kidney disease makes me feel afraid					55

CAUSES OF YOUR KIDNEY DISEASE

People are very different. They report different causes of their kidney disease. We are most interested in your own views about the causes of your kidney disease. Please say what you believe, rather than what others, including doctors or family/friends have said to you.

Below is a list of possible causes for your kidney disease. Please show how strongly you agree or disagree that they are causes of your kidney disease and check one of the boxes on each line. There are no right or wrong answers.

POSSIBLE CAUSES	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree #
Stress or worry					56
Hereditary – it runs in my family					57
A Germ or virus					58
Diet or eating habits					59
Chance or bad luck					60
Poor medical care in my past					61
Pollution in the environment					62
My own behavior					63
My mental attitude like thinking about life negatively					64
Family problems or worries					65
Over work					66
My emotional state e.g. feeling down, lonely, anxious, empty					67
Aging					68
Alcohol					69
Smoking					70
Accident or injury					71
My personality					72
Altered immune system					73

Please list the three most important causes that you believe caused your kidney disease. You may use any of the items from the box above, or add other causes that were not listed above. There are no right or wrong answers

74 Most important cause _____

75 Second most important cause _____

76 Third most important cause _____

Medication Experience

We are interested in how you take certain medications. Many people have reasons for taking their medications in ways that are different from the instructions on the label or different from the way they were instructed by their provider. Below are some ways in which others have said they use their medications. For each statement, please check the box that best applies to how you take your **LISINOPRIL**.

Your answers about how you actually take your medications will be confidential, and will not be shared with your provider. The results of this questionnaire will add to the understanding of how medications are actually being used by individuals with chronic kidney disease.

How I take my: LISINOPRIL	**Very Often**	**Often**	**Sometimes**	**Rarely**	**Never**	**#**
I forget to take it						77
I change the dose						78
I take less than instructed						79
I stop taking it for a while						80
I decide to miss a dose						81

Adapted from Medication Adherence Report Scale with permission from the journal article publisher (Appendix H). See reference: Horne and Weinman (2002)

Just a few more questions about you:

82. What is your sex?

Male ……1 (Circle one number)
Female ……2

83. Are you of Spanish or Hispanic origin, such as Mexican American, Chicano, Puerto Rican, or Cuban?

Yes ……..1
No…….2 (Circle one number)
Don't know/Refused …….3

84. What is your race?

African American or Black 1
Native American or Alaska Native……...2 (Circle one number)
Caucasian or White……..….3
Other Race (Specify _____) ….4

85. What is the highest grade or year of school you have finished?

Circle year:

1 2 3 4 5 6 7 8 9 10 11 12

Technical/secretarial/business ……13
1 year of college ……..14
2 years of college……15
3 years of college……16
Graduated from college…….. 17
At least some graduate school……...18
Completed graduate degree……...19

86. Which of the following best describes your family income? (Circle one number)

Family income is not enough to make ends meet ……1
Family income is just enough to make ends meet…….2

Family income is at a comfortable level……..3

87. Do you live with a partner? (Circle one number)

Yes ……1

No……..2

88. Have you lived in the same household for one year or longer with a relative who was
diagnosed with ESRD or received dialysis treatments? (Circle one number)

Yes ……1

No……2

89. Approximately how many months and/or years since you were told that you had kidney disease?

_____Years _____Months

90. Approximately how long did it take you to complete this survey?

_____Minutes

91. Please indicate how difficult it was for you to answer these survey questions.

Not at all difficult ……1
A little difficult ……..2
Moderately difficult……..3
Quite difficult……4
Extremely difficult……5

This is the end of the survey. Thank you for taking the time to complete it.

Please place the:
1) completed survey,
2) the signed consent form (yellow) and
3) the signed authorization for release of information form (green)
in the stamped return envelope and place it in the mail.

If you have any questions before returning the packet by mail, please feel free to call Ms McManus, nurse researcher, at 317-988-4273.

Appendix G

Content Validity Expert Reviewer and Index Scoring Sheet

Dear Expert Reviewer,

Thank you for agreeing to review the Illness Perception Questionnaire – Revised (IPQ-R) Identity subscale. Your professional expertise as a nurse researcher with clinical experience working with nephrology patients is of great value in determining content validity of this instrument subscale for chronic kidney disease patients.

Chronic kidney disease (CKD) is estimated to affect 16 percent of the American population, an estimated 31 million U.S. citizens (USRDS 2008). Unless measures are taken to delay progression, CKD leads to kidney failure requiring life sustaining treatments. Both treatment options, dialysis and transplantation, carry a high burden for the patient, families, communities and society as a whole (Centers for Disease Control and Prevention, 2007b; Coresh et al., 2007).

There are kidney protective medications such as Angiotensin Converting Enzyme Inhibitors (ACE-I) and Angiotensin II Receptor Blockers (ARBs). These renoprotective medications are proven to reduce the risk of renal disease progression, yet the overall estimated prevalence rate of CKD is still increasing at an alarming rate. Examination of CKD patient's medication adherence behaviors may reveal if patients are adherent with renoprotective medications and reasons related to adherence or non-adherence (de Zeeuw et al., 2006; Kopyt, 2005).

The theory of self-regulation provides a sound basis for the study of health behaviors of CKD patients. According to Leventhal's theory of self-regulation's common sense model (CSM), when individuals are faced with threats to their health, they build a cognitive and emotional representation (mental model) and this representation determines how they will respond to the threat (H. Leventhal et al., 1997; H. Leventhal, Brissette, & Leventhal, 2003). These representations of illness, unique to the individual, are based on the individual's sociocultural demographics, knowledge and personal and familial experiences (Petrie & Weinman, 2006). The illness representation leads the patient to reduce the threat of illness or symptoms by guiding their choices of coping strategies (e.g., to stop smoking, take medication, lose weight) directed at reducing the threat. The patient then analyzes the outcomes of his coping actions. If the patient deems them satisfactory, he will continue the action, if less than satisfactory a feedback loop is redirected back to revisit representations and coping strategies (Leventhal et al., 2003). The measurement instrument subscale being reviewed focuses on the CKD patient's perceptions and labeling of symptoms to their chronic kidney disease.

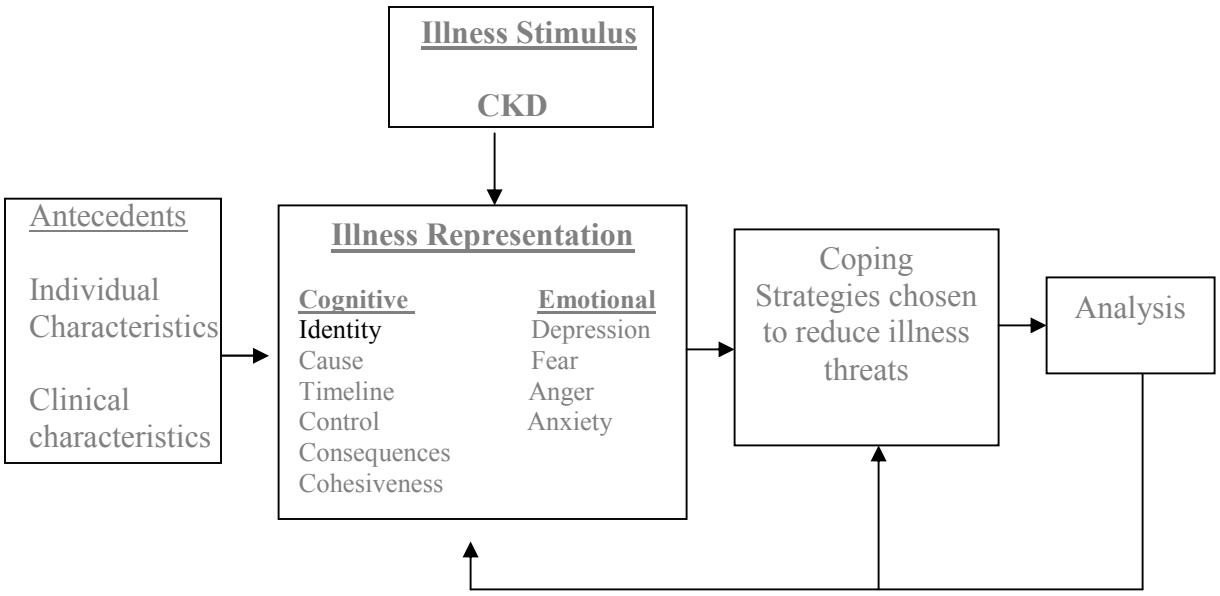


Figure 1

Conceptual Definitions

Illness Representation: The cognitive and emotional mental model individuals make of their illness (Leventhal et al., 2003; Petrie & Weinman, 2006). A parallel cognitive and emotional representation is developed by a person to adapt to and manage their illness (Howard Leventhal, Leventhal, & Cameron, 2001; H. Leventhal & Mora, 2005). **Identity** is one of the six components of the cognitive representation of the health threat included in the model and is conceptually defined as: the patient assigned label to the illness, associated with symptoms they perceive to be related to their illness. It may not be concurrent with the medical model of illness labels or symptoms.

Operational Definitions

- **Illness Representation**: cognitive and emotional representations

Revised Illness Perception Questionnaire (IPQ-R): The IPQ-R is a quantitative measure of the five components of illness representation in Leventhal's Common Sense Model, developed by Moss-Morris et al. (2002). The tool is composed of 19 yes/no questions and 56 Likert style items rated on a five point response scale. There are nine subscales, one of which can be modified to reflect symptoms associated with individuals living with CKD. The subscales represent the dimensions of cognitive

and emotional illness representations theorized by Leventhal et al. (2001, 2003). The higher the score, the stronger is the belief (Llewellyn, McGurk, & Weinman, 2007).

For the purposes of the proposed study, the IPQ-R has been **adapted** to reflect items specific to chronic kidney disease patients. The word "illness" was changed to either chronic kidney disease or kidney disease throughout the instrument. Items were added to the Identity subscale to reflect symptoms perceived by chronic kidney disease patients to be associated with their kidney disease.

Aim

The aim is to elicit expert input in order to validate the content of the Identity subscale, adapted from the IPQ-R. The CKD adapted IPQ-R instrument can then be used to describe the Illness Representation of CKD patients and examine the relationship between the CSM domains and the medication adherence coping strategies chosen by the patient.

The following pages include all items related to Identity subscale with the conceptual definition. Please read the instructions and definition and rate each item.

Identity Scale

Instructions: Below are items designed to represent the concept of **Identity**. These items will be rated, by the participant, on a dichotomous scale as 0 = No or 1 = Yes as symptom experienced and then as 0 = No or 1 = Yes as belief that the symptom is associated with chronic kidney disease.

Please read the conceptual definition below, then rate each of the items for the degree of relevance to the conceptual definition, using the response scale below.
In the comments box, please add any comments or edits that might improve the item.
In the empty rows below, please add additional items or areas of the conceptual definition that are not represented by the items.

Conceptual definition of Identity: the patient assigned label to the illness, associated with symptoms they perceive to be related to their illness

1= NR = Not Relevant
2 = SR = Slightly Relevant
3 = MR = Moderately Relevant
4 = VR = Very Relevant and succinct

Item	NR	SR	MR	VR	Comments
Pain	1	2	3	4	
Sore Throat	1	2	3	4	
Nausea	1	2	3	4	
Breathlessness	1	2	3	4	
Weight Loss	1	2	3	4	

Fatigue	1	2	3	4	
Stiff Joints	1	2	3	4	
Sore Eyes	1	2	3	4	
Wheeziness	1	2	3	4	
Headaches	1	2	3	4	
Upset Stomach	1	2	3	4	
Sleep Difficulties	1	2	3	4	
Dizziness	1	2	3	4	
Loss of Strength	1	2	3	4	
Itching	1	2	3	4	
Back pain	1	2	3	4	
Problems urinating	1	2	3	4	
Not hungry	1	2	3	4	
Bad Breath	1	2	3	4	
Bad taste in mouth	1	2	3	4	
Legs/feet swelling	1	2	3	4	
Puffy eyes	1	2	3	4	
Additional **Identity** areas or items not represented					
	1	2	3	4	
	1	2	3	4	
	1	2	3	4	

Content Validity Index Scoring Sheet

Identity Scale

Expert Reviewer Ratings

Item	ER 1	ER 2	ER 3	ER 4	ER 5	Item proportion	CVI item Score
Pain						/5	
Sore Throat						/5	
Nausea						/5	
Breathlessness						/5	
Weight Loss						/5	
Fatigue						/5	
Stiff Joints						/5	
Sore Eyes						/5	
Wheeziness						/5	
Headaches						/5	
Upset Stomach						/5	
Sleep Difficulties						/5	
Dizziness						/5	
Loss of Strength						/5	
Itching						/5	
Back pain						/5	
Problems urinating						/5	
Not hungry						/5	
Bad Breath						/5	
Bad taste in mouth						/5	
Legs/feet swelling						/5	
Puffy eyes						/5	
Total: Items 22							

Item scoring: proportion of experts who rated item as 3 or 4 divided by the number of experts (5)

Total subscale scoring: proportion of the total number of items considered content valid ($\geq$ .83 CVI item score) divided by the number of items (22):

Appendix H

Permission to Reproduce

Ref: KB/GPSH/P4512

28th March 2011

Dear Sue McManus

Table IV from 'Self-regulation and Self-management in Asthma: Exploring The Role of Illness Perceptions and Treatment Beliefs in Explaining Non-adherence to Preventer Medication' – vol 17 no 1 2002 pp17-32

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Yours sincerely

Karin Beesley
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Wetzels, G., Nelemans, P., van Wijk, B., Broers, N., Schouten, J., & Prins, M. (2006). Determinants of poor adherence in hypertensive patients: Development and validation of the "Maastricht Utrecht Adherence in Hypertension (MUAH)-questionnaire". *Patient Education and Counseling,* 64(1-3), 151-158.

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Williams, G. C., Rodin, G. C., Ryan, R. M., Grolnick, W. S., & Deci, E. L. (1998). Autonomous regulation and long-term medication adherence in adult outpatients. *Health Psychology,* 17(3), 269-276.

Wolf, G., Butzmann, U., & Wenzel, U. O. (2003). The renin-Angiotensin System and progression of renal disease: From hemodynamics to cell biology. *Nephron Physiology,* 92, 3-13.

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Yoshioka, T., Rennke, H. G., Salant, D. J., Deen, W. M., & Ichikawa, I. (1987). Role of abnormally high transmural pressure in the permselectivity defect of glomerular capillary wall: a study in early passive Heymann nephritis. *Circulation Research,* 61(4), 531-5

CURRICULUM VITA

EDUCATION:

Degree Granting Institution	Degree	Date Awarded
Indiana University, School of Nursing	PhD	September 2011
University of Louisiana at Lafayette	MSN	May 2003
Northwestern State University	BSN	May 2000
Louisiana State University at Eunice	ADN	May 1996

ACADEMIC APPOINTMENTS:

Place	Title/Rank	Dates
Louisiana State University at Eunice	Adjunct Clinical Instructor	August 2005 – December 2006

Licensure

Indiana Registered Nurse	2007 - present
Indiana Nurse Practitioner	2007 - present
Indiana Advance Practice Nurse CSR	2007 - present
Louisiana Registered Nurse	1996 - 2007
Louisiana Advance Practice Registered Nurse	2003 - 2007
Louisiana Prescription Drug Approval	2003 - 2007

Specialty Certifications:

American Nurses Credentialing Center
Certified Family Nurse Practitioner (CFNP) 2003 – present

Nephrology Nursing Certification Commission
Certified Nephrology Nurse (CNN) 1998 - present

CLINICAL APPOINTMENTS:

Place	Title/Rank	Dates
Richard L. Roudebush	Nephrology Nurse Practitioner	February 2007 to Present
Veterans Administration	and Transplant Coordinator	Full time
Medical Center	Provide primary and specialty	
Indianapolis, IN	care to renal patients in outpatient clinic	
Paul E. Miller M.D. APMC Miller Dialysis Opelousas, LA	Nephrology Nurse Practitioner and Quality Coordinator Outpatient dialysis clinic	November 2004 to February 2007 Full time
Northwest Louisiana Nephrology	Nephrology Nurse Practitioner Primary and specialty care	August 2003 to November 2004 Full time

Shreveport, LA	to dialysis patients	
Fresenius Medical Care- North America Lafayette, LA Area	Dialysis RN and Area Quality Manager	December 1996 to August 2003 Full time
Eunice Care Center Long term care Eunice, LA	Weekend RN Supervisor	November 1996 to 1998 Part time
Eunice Rehabilitation Hospital Eunice, LA	Weekend Charge RN	November 1996 to 1998 Part time
Eunice Regional Medical Center of Moosa Memorial Hospital Eunice, LA	PRN Charge RN	October 1996 to 1999 Part time
Columbia Regional Health System: Acadiana Care Corp - ECC-SNF-ID Unit Eunice, LA	Staff RN	October 1996 to January 1997 Full time
Our Lady of Lourdes Regional Medical Center Lafayette, LA	Staff RN	June 1996 to October 1996 Full time

PROFESSIONAL SOCIETIES:

National Kidney Foundation	2009 - present
Veterans Administration Advance Practice Nurse Group	2007 - present
Midwest Nursing Research Society	2007 - present
American Nurses' Association	2004 - 2006
Louisiana State Nurses' Association	2004 - 2006
Louisiana Association of Nurse Practitioners	2000 - 2007
Sigma Theta Tau International Honor Society of Nursing	2000 - present
American Nephrology Nurses' Association	1998 - present
Louisiana Organization of Associate Degree Nursing (L-OADN)	1994 – 1996

HONORS:

<u>Student Awards and Honors</u>

Janel Parker Career Mobility Scholarship	2010
Alcavis International Career Mobility Scholarship	2009
Florence Nightingale Scholarship	2008
Watson Pharma Career Mobility Scholarship	2008

University of Louisiana Graduate Nursing Fellowship	2003
Featured in Louisiana Public Facilities Authority and Entergy Louisiana Outstanding Graduates publication	2003
L-OADN Outstanding Associate Degree Alumnus	2003
Lettie Pate Whitehead Nursing Scholarship	1997
Louisiana State University at Eunice	
Chancellor's List of Academic Achievers	1994 – 1996
Outstanding LSUE Sophomore	1995
Outstanding LSUE Unclassified Student	1996
Outstanding LSUE Nursing Graduate	1996

Professional Honors

Profile Feature American Journal of Nursing	November 2006 Issue
American Nephrology Nurses' Association	
Board of Directors Award	2006

TEACHING ASSIGNMENTS:

Clinical Nursing Instructor	**Term**
Louisiana State University at Eunice	
School of Nursing	
General Medicine Floor	Fall 2005
	Spring 2006
	Fall 2006

COMMUNITY SERVICE:

United Way Community Health Clinic	
provided health services at free health clinic	2006
Volunteered for public health screening programs	2000 – 2006
Volunteered as counselor for National Kidney Foundation	
Kidney Early Evaluation Program (KEEP)	2003 – 2005
Local Emergency Disaster volunteer for kidney patients	
after Hurricanes Katrina and Rita	2005

PROFESSIONAL ACTIVITIES:

Committee Service

RLR VAMC – Dialysis Project Committee
Evaluate feasibility of fee base dialysis versus in-center dialysis 2010 - present

RLR VAMC -Diabetes Mellitus Performance	
Improvement Work Group – Rapid Cycle Coach	2008 - present

Louisiana Association of Nurse Practitioners	
Public Policy Committee – Political Action	
Committee Chair	2002

American Nephrology Nurses' Association – Regional
Officer - State Officer - Committee and task force work 2000 - present

LSUE Student Nurse Association
Chaired Incoming Student Committee 1996

LSUE Nursing Dept. Curriculum and By-Laws Committee 1995

Presentations/Posters:

McManus, M.S. and Sandine, J., VA APN Group Continuing Education Presentation, Kidney Disease: Stop the Trend on the Front End 2010

Russ AL, Saleem JJ, **McManus MS**, Zillich AJ. "Medication Order Checks: Design Implications for Prescriber Workflow." Poster to be presented at the Veterans Affairs HSRD/VERC National Field-based Conference, Indianapolis, IN, July 14, 2010 2010

Russ AL, Saleem JJ, **McManus MS**, Zillich AJ. "Medication Order Checks: Design Implications for Prescriber Workflow." Poster presented at the Veterans Affairs Pharmacy Benefits Management (VA PBM) Pharmacy Medication Reconciliation Initiative and Workgroup, Salt Lake City, UT, May 18-20, 2010

McManus, M.S., Welch, J.L., Rawl, S.M., Sloan, R.S., Halstead, J., Weaver, M.T. (2010). *Illness Representations and Medication Adherence Among Patients with Chronic Kidney Disease*. Presented at 2010 Midwest Nursing Research Society Conference, Nursing Research: Bench to Bedside, Kansas City, MO, April 2010 2010

Welch, J.L., Connelly, K., Siek, K.A., Jones, J., Perkins, S.M., Chaudry, B., Kain, J., Scott, L., Astroth, K., Heo, S., **McManus, S**., Mooney, J. T., & Johnson, C. (2009). *Merging literacy with computer technology for self-managing diet and fluid intake*. Presented at Sigma Theta Tau International 20th International Nursing Research Congress Focusing on Evidence-Based Practice, July 2009, Vancouver, Canada. 2009

McManus, M. S., American Nephrology Nurses' Association expert panel continuing education program presenter on *New Science and Evidence for the Utilization of Vitamin D for today's Kidney Patients.* 2009 – 2010

McManus, M.S. guest lecturer Indiana University School of Nursing: *Chronic Kidney Disease: Why is it important?* 2009

McManus, M.S. and Porter, B. to V.A. APN Clinical Lunch Conference *Diabetes and Kidney Disease: What is the Question?* 2008

McManus, M. S. presented to V.A. APN Journal Club: *CKD guideline use by Primary Care* 2008

McManus, M.S. to United Way Community Diabetes Education Class, *Preventing Kidney Disease Progression Through Self-management* 2006

McManus, M.S. to AD nursing renal system guest lecturer, *Hemodialysis and Peritoneal Dialysis – What's It All About?* 2005

McManus, M.S. to American Nephrology Nurses' Association Fleur de Lis Chapter Annual Conference, *Understanding New Hypertension Guidelines* 2004

McManus, M.S., to Medical Center Southwest Louisiana CEU presentation, *Pathophysiology of Acute Kidney Failure* 2002

McManus, M.S., to Medical Center Southwest Louisiana CEU presentation, *Chronic Kidney Failure Patients in the Acute Care setting*, 2001

McManus, M.S.to AD and BSN senior nursing clinical *groups*, *Caring for End Stage Renal Disease Patients in Non-Dialysis settings* 2000, 2001, 2003

McManus, M.S., in-service presentations to Eunice Community Nursing Home staff, *Providing Care to End Stage Renal Disease and Hemodialysis Residents in the Long Term Care Setting.* 1998, 2000

Reviewer

Registered Nurses' Association of Ontario. (2010) *Strategies to Support Self-Management in Chronic Conditions: Collaboration with Clients*. Toronto, Canada. Registered Nurses Association of Ontario 2010

McMaster **O**nline **R**ating of **E**vidence (MORE) for nurses 2008 - present

Chapter reviewer *Core Curriculum for Nephrology Nursing*(2008). 5th Ed. C.S. Counts Ed. 2007

PUBLICATION:

Russ AL, Saleem JJ, **McManus MS**, Frankel, RM, Zillich AJ. "The Workflow of Computerized Medication Ordering in Primary Care is Not Prescriptive", Proceedings of the Human Factors

and Ergonomics Society, 54th Annual Meeting, San Francisco, CA, (In Press) 2010

Zillich AJ, Saleem JJ, **McManus MS**, Russ AL. A Qualitative Study of Medication Alerts and Computerized Prescriber Order Entry (CPOE): Opportunities for Pharmacist Consultation at the Point of Prescribing.(Abstract). Journal of the American Pharmacists Association 2010;50(2):284-285. 2010

Welch, J.L., Siek, K.A., Connelly, K. H., Astroth, K.S., **McManus, M. S.**, Scott, L., Heo, S., & Kraus, M.A. (2010), Merging health literacy with computer technology: Self-managing diet and fluid intake among adult hemodialysis patients. *Patient Education and Counseling* (79), pp192-198 2010

Russ, A. L., Saleem, J. J., **McManus, M.S**., Zillich, A.J., and Doebbeling, B. N. *Computerized Medication Alerts and Mental Models: Observing Routine Patient Care*, In Proceedings of the Human Factors and Ergonomics Society 53rd Annual Meeting. 2009

Russ AL, Zillich AJ, **McManus MS,** Doebbeling BN, Saleem JJ. "A Human Factors Investigation of Medication Alerts: Barriers to Prescriber Decision-Making and Clinical Workflow." In *Proceedings of the American Medical Informatics Association (AMIA) Symposium,* 2009, AMIA Annu Symp Proc. 2009: 548–552. Published online 2009 November 14. 2009

Welch, J. L., Burrows-Hudson, S., Hull, M. A., Kurt, M. J., Mapes, D., Mathers, T. R., **McManus, M. S.,** and Thomas-Hawkins, C.. (2008). Evidence-Based Practice. In C. S. Counts (Ed.), *Core Curriculum for Nephrology Nursing* (Fifth ed., pp. 461-498). Pitman, New Jersey: American Nephrology Nurses' Association. 2008

RESEARCH RELATED ACTIVITIES

McManus, M.S. Immunization: Primary Prevention Efforts to Strengthen the End Stage Renal Disease Patient's Flexible Line of Defense. University of Louisiana at Lafayette, 2003

Grant Funded Projects:

Granting Agency	Project Title	Amount	Dates
Indiana University School of Nursing Graduate Nursing Research Funding	Illness Representation of Patients with Chronic Kidney Disease and Medication Adherence with Renal Protective	$3000	2009-2010

	Medications PI: Janet L. Welch Co-Investigator: **M. Sue McManus**		
VA HSR&D Pilot	Redesigning Medication Alerts to Support Prescriber Workflow PI: Alissa L. Russ Co-Investigators: Jason Saleem, Jeffrey R. Spina, Alan J. Zillich, **M. Sue McManus,** David Haggstrom, and Brad Doebbeling	$100,000	2010 - 2011
National Institute of Biomedical Imaging and Bioengineering	Self Monitoring of Dietary and Fluid Intake Using a PDA PI: Janet L. Welch Co-Investigators: Josette Jones Kay Connelly, Susan Perkins, Laurie Trevino. Collaborator: M. Sue McManus	$416,625	2006-2009

Co-Investigator through employment with Northwest Louisiana Nephrology, Shreveport, LA 2003 – 2004:

- A Randomized, Open Label, Parallel Design Study of Renagel Phosphate Binder Versus Calcium-Based Phosphate Binders in Hemodialysis; Protocol **GTC-68-401;** GelTex Pharmaceuticals, Inc; 3 Year Study
- Correction of Hemoglobin and Outcomes in Renal Insufficiency "CHOIR"; Protocol **PR00-06-014**; Ortho Biotech Products, L.P.; 3 Year Study
- A Randomized, Controlled, Open Label Study of the Safety and Efficacy of Ferrlecit vs. Oral Iron in Iron Deficient Patients with Chronic Kidney Disease Being Treated with Erythropoietic Therapy; **Protocol FER0201**; Watson Laboratories, Inc.; 10 Week Study
- A Randomized, Controlled, Open Label Study of the Safety and Efficacy of Ferrlecit vs. Oral Iron in Iron Deficient Patients with Chronic Kidney Disease; **Protocol FER0202**; Watson Laboratories, Inc.; 10 Week Study
- A Prospective, Randomized, Double-Blind, Double-Dummy, Forced-titration, Multicenter, Parallel Group, One Year Treatment Trial to Compare MICARDIS (telmisartan) 80 mg vs. COZAAR (losartin) 100mg in Hypertensive Type 2 Diabetic Patients with Overt Nephropathy (AMADEO Study); **Protocol 502.397**; Boehringer Ingelheim; 58 Week Study