PERCEIVED PHYSICAL FUNCTIONING, PERCEIVED PAIN INTERFERENCE AND HEALTH SEEKING BEHAVIORS IN LUMBAR DEGENERATIVE SPINE CONDITIONS

By

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ABSTRACT

PERCEIVED PHYSICAL FUNCTIONING, PERCEIVED PAIN INTERFERENCE AND HEALTH SEEKING BEHAVIORS IN LUMBAR DEGENERATIVE SPINE CONDITIONS

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Ninety percent of persons over the age of 65 have some type of degenerative spine condition. While degenerative spine conditions are becoming increasingly common in the United States, the treatment outcomes are inconsistent presumably because the degree or severity of degenerative disease by clinical diagnostic testing does not correlate well with the person's level of self-reported pain and physical functioning. Lumbar degenerative spine conditions increase with age, wear and tear, and can result in considerable pain and physical functioning deficits. Poor treatment outcomes in persons with lumbar degenerative spine conditions can lead to chronic pain and long term disability and affect health related quality of life.

Health promotion theories posit that patient perceptions are critical to engagement in health seeking behaviors and ultimately affect quality of life. This study uses an adapted theoretical model that utilizes concepts from the Wilson and Cleary's health related quality of life model and Pender's health promotion model. This study sought to determine how the demographic, biologic, and social antecedent factors affect health perceptions such as perceived physical functioning and perceived pain interference, and how health perceptions in turn, affect health seeking behaviors such as medication use and participation in prescribed exercise regimens. A retrospective record review of 130 patients from an urban community spine clinic was combined with a database of health perceptions at entry into treatment and 12 weeks of treatment. Females experienced lower perceived physical functioning than males (p = .014) at start of treatment. Persons with Medicaid insurance had higher levels of perceived pain

interference (CI 5.53, 28.31) than any other insurance type at start of treatment. At 12 weeks of treatment persons with Medicaid insurance experienced lower levels of perceived physical functioning (CI -9.23, -28.81), higher levels of perceived pain interference (p = .001), and a higher number of comorbidities (p = .003) than persons with other insurance types. Higher levels of pain interference predicted the use of medications (p = .028) but lower perceived physical functioning predicted higher numbers of medications used (p = .001). Lower numbers of medications were used by persons with Medicaid insurance (p = .000).

In this study, 3 factors were associated with poorer perceived physical functioning and/or higher levels of perceived pain interference-female sex/gender, Medicaid insurance and higher levels of comorbidity. In nursing practice, evaluation of the patient's environment and unique barriers can decrease the patient's frustration and increase physical functioning for patients with lumbar degenerative spine conditions. In persons with Medicaid insurance, careful assessment of patient access issues is necessary since persons with Medicaid insurance are at risk for being referred later in the process of their condition. Further research regarding the specific needs and barriers experienced by persons with Medicaid insurance is needed to develop and test interventions that improve care outcomes in lumbar degenerative spine conditions. Less aggressive treatment for painful musculoskeletal conditions has been well documented in persons with Medicaid insurance. This study provides evidence that persons with lumbar degenerative spine conditions and Medicaid insurance may have decreased levels of perceived physical functioning and increased levels of pain interference. Assuring that health care policy includes mechanisms that provide adequate access and services to persons with Medicaid insurance may decrease the likelihood of long term disability in lumbar degenerative spine conditions.

DEDICATION

This work is dedicated in honor of my parents, William Richard and Ellen Kathleen Roberts for teaching me that value of a good book, a good education and a great adventure.

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AAOS	American Association of Orthopaedic Surgeons
ACA	Affordable Care Act
AEDs	Anti-Epileptic Drugs
BMI	Body Mass Index
CDC	Centers for Disease Control
DDD	Degenerative Disc Disease
EMR	Electronic Medical Record
HHS	Health and Human Services
HRQoL	Health Related Quality of Life
HUI	Health Utilities Index
ICD-9	International Classification of Diseases (9th edition)
ICF	International Classification of Functioning
IRB	Institutional Review Board
MANCOVA	Multiple Analysis of Covariance
MODEMS	Musculoskeletal Outcomes Data Evaluation System
MOS	Medical Outcomes Study
MSU	Michigan State University
NASS	North American Spine Society
NIH	National Institutes of Health
NRSA	Nursing Research Service Award
NSAIDS	Non-Steroidal Anti-Inflammatory Drugs
ODI	Oswestry Disability Index

PLUM	Polytomous Universal Model
SEM	Structural Equation Modeling
SF-36	Short Form 36
SPORT	Spine Outcomes Research Trial
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization

CHAPTER 1: INTRODUCTION

A person's ability or inability to perform activities and tasks of daily living can greatly affect his/her health care outcomes such as physical functioning and health related quality of life (Groll, To, Bombardier, & Wright, 2005). In primary care offices, low back pain and related symptoms account for up to 31 million annual office visits (Licciardone, 2008). According to the American Association of Orthopedic Surgeons (AAOS), the direct costs for persons with low back disorders have been estimated at 192.9 billion dollars annually and indirect costs exceed 14 billion dollars when lost income is included (AAOS, 2008).

Ninety percent of persons over the age of 65 have some type of lumbar degenerative spine condition (Licciardone, 2008). Despite the increasing prevalence of lumbar degenerative spine conditions, outcome models that focus on structural spinal pathology have not yielded consistent or accurate treatment predictions of clinical outcomes (Haig et al., 2006). In lumbar degenerative conditions of the spine, a person can experience physical functioning deficits such as difficulty sitting, bending forward, lifting and walking. According to the North American Spine Society (NASS) and a number of individual researchers (Block, 2003; Lin, Lin, & Huang, 2006; NASS, 2010) pain and numbness of the lower extremities can accompany the described functional deficits resulting in a constellation of impairments that can lead to problems with everyday activities. Persons seeking care for degenerative spine conditions expect relief from symptoms and improved function, but treatment outcomes are inconsistent (Block, 2003). Despite ever-changing diagnostic and treatment modalities, improvement in physical functioning, relief from disability concerns and consistent relief of pain can be elusive (Block, 2003).

Complicating matters, the chronic nature of degenerative spine conditions can lead to the development of negative cognitions that can affect patient health perceptions (Schmidt et al., 2010). The relationships between pathology, health perceptions and health seeking behaviors have been shown to affect treatment outcomes in surgical spine conditions (Mannion et al., 2009; Tang, 2007) but are largely unexplored in non-surgical degenerative spine conditions. Psychological factors and personal perceptions have been identified as influential factors that may improve or be detrimental to patient recovery of physical functioning (Block, 2003) and influence health related quality of life (HRQoL) in surgical spine populations. Like other degenerative musculoskeletal conditions such as osteoarthritis, the trajectory of degenerative spine disease is understood to be multifactorial and occurs over long periods of time as a result of mechanical and biomechanical causes (Martin, Boxell, & Malone, 2002).

In order to provide a structure for this chapter, the major concepts and conceptual definitions are described first, in order to provide clarity to the discussion of the scientific gap and contributions to science. Next, the research questions are presented. Lastly, an overview is provided of the remainder of the chapters.

Definition of Lumbar Degenerative Spine Conditions

Lumbar degenerative spine conditions, for purposes of this research, included chronic back conditions, such as spondylosis, spondylolisthesis and spinal stenosis and disc disorders, such as herniated discs and degenerative disc disease (AAOS, 2008; NASS, 2010). Most episodes of lumbar sprain and strain resolve without clinical intervention, therefore the focus of this research was on degenerative conditions, which are more prone to long term sequelae (Hicks, Morone, & Weiner, 2009). Although each of these degenerative lumbar spine conditions have discrete diagnostic criteria, these conditions have the commonality of chronicity, creating

mobility dysfunction and symptoms such as numbness and tingling that can result in alterations in physical functioning and varying levels of pain (Block, 2003). Persons affected by lumbar degenerative spine conditions are at risk for physical functioning limitations, disability, and possible neurologic deficit (Van Tulder et al., 2006). Since the focus of this study was on chronic conditions of the back, acute episodes such as fractures, dislocations and sprains were not included.

Definition of Health Perceptions

Health perceptions, such as perceived physical functioning and perceived pain interference are important in spine care because traditional observational measures such as spine mobility and trunk strength do not correlate well with issues important to patients such as physical functioning, work status, and pain relief (Mousavi, Parnianpour, Mehdian, Montazeri, & Mobini, 2006). Perceptions, specifically health perceptions, are cognitive appraisals of one's health condition and are influenced through a complex process involving interactions of personal factors such as sex/gender, and race/ethnicity; biological factors such as specific spinal diagnoses and other comorbidities; social factors such as insurance status; and previous behaviors such as physical activity experiences (Bandura, 1986; Dixon & Johnston, 2008; Foster et al., 2008). The health perceptions examined in this study are perceived physical function and perceived pain interference. For purposes of this study, *perceived physical functioning* is defined as the patient's appraisal of his/her ability to perform a variety of physical activities of varying difficulty, intensity, and function (Stewart, 1992). *Perceived pain interference* is defined as the perceived interference of pain in vocational, social/recreational, and family/marital functioning (Kerns, Turk, & Rudy, 1985).

In individuals diagnosed with lumbar degenerative spine conditions, health perceptions such as perceived physical functioning and perceived pain interference have been investigated over a number of time frames. In order to investigate how health perceptions change over the initial course of treatment, investigators have used many different time frames ranging from a cross-sectional one time measurement (Zanoli, 2006) to multiple repeated measurements up to 5 years (Campbell et al., 2006). In order to have sufficient time to detect changes in condition, this study will use the first 12 weeks of treatment for lumbar degenerative spine conditions. The selection of this time frame is further discussed in Chapter 3.

Definitions of Health Seeking Behaviors

Health seeking behaviors are defined as the engagement in personal and prescribed behaviors and treatments such as exercise and pain management regimens intended to improve health status, mitigate the consequences of chronic conditions or prevent decline in health status. The definition of health seeking behaviors was modified from health promoting behaviors (Pender, Walker, & Sechrist, 1988) and the help seeking literature (SaintArnault, 2009) to recognize the role of health behaviors that improve health conditions as well as those that slow the rate of decline in chronic conditions such as lumbar degenerative spine conditions.

Scientific Gap and Contribution to Science

Although there are many studies regarding low back pain, there are few studies that discretely divide the etiology of lumbar spine problems between short term conditions such as strain/sprain and more disabling long term conditions such as degenerative spine disorders (Cummins et al., 2006). Much of the available science focuses on the *surgical* treatment of lumbar degenerative spine conditions. Surgical treatment of lumbar degenerative spine conditions has been fraught with much controversy due to the modest (30%) improvement in

pain interference and perceived physical functioning (Deyo, Nachemson, & Mizra, 2004). Although there are some clinical instances in which surgery is clearly indicated, there are wide variations across the nation in surgical rates, surgical outcomes such as pain relief and functional improvement, and surgical complications. When comparing surgical interventions to rehabilitation care models, surgery offered no clear advantage in pain relief or improvement in function (Deyo, et al., 2004).

Lumbar degenerative spine conditions are increasingly prevalent and provider office visits increased from 32 million visits to 45 million visits in a six year period ending in 2006 (AAOS, 2008). Improving outcomes in chronic low back conditions has been identified as a priority in the United States Department of Health and Human Services (HHS) Healthy People 2020 objectives (HHS, 2009).

In lumbar degenerative spine conditions, health seeking behaviors can be greatly influenced by a person's perception of his/her physical abilities and pain interference making health perceptions a key variable influencing health related quality of life (HRQoL) and treatment outcomes (Haig, Tong, Yamakawa, et al., 2006; Tang, 2007). The majority of the lumbar degenerative spine conditions research focuses on the structural defects of the spine and fails to account for the role of health perceptions as predictors of behavioral outcomes such as return to work and health seeking behaviors. (Haig, Tong, Yamakawa, et al., 2006).

This study seeks to contribute to science in three ways. First, this study will utilize a model that was inspired by the health related quality of life model (Ferrans, 2004; Wilson, 1995) and the health promotion model (McCullagh, 2004; Pender, Murdaugh, & Parsons, 2006; Pender, et al., 1988). Secondly, this study focuses on how antecedent personal factors influence health perceptions and how health perceptions, in turn, influence health seeking behaviors over

the first 12 weeks of non-operative treatment for lumbar degenerative spine conditions. Multiple studies have examined single antecedent or predictive factors that influence health perceptions such as perceived physical functioning and pain interference, but none have included a multifactorial analysis. This study will use multivariate analysis to determine how multiple antecedent factors influence health perceptions and ultimately health seeking behaviors.

Lumbar degenerative spine conditions have received little research attention within nursing that examined how biological, personal and social factors group together to affect health perceptions in lumbar degenerative spine conditions. The relationships between health perceptions and health seeking behaviors remains largely unexplored despite the increased prevalence and large variance in outcomes (Deyo, et al., 2004) of these common musculoskeletal disorders (Hicks, et al., 2009).

Understanding the antecedent factors that influence health perceptions such as perceived physical functioning and perceived pain interference will contribute to a better understanding of factors that may be influencing the inconsistent health outcomes in lumbar degenerative spine conditions. Clinicians and researchers would also be able to identify those patients who are more likely to fare poorly, thus allowing interdisciplinary clinicians to modify and intensify treatment plans for persons at greater risk for long term disability.

Single predictors of health perceptions have been examined in studies as isolated individual personal factors (Baldwin, 2007; Caldwell, Hart-Johnson, & Green, 2009; Cummins et al., 2006b; Groll, et al., 2005). In this study, health perceptions are conceptualized as the result of a complex and dynamic appraisal process that uses simultaneous cognitive and affective influences from environmental, social and personal factors (Bandura, 1986; Pender, et al., 2006). Understanding how health perceptions influence health seeking behaviors in lumbar degenerative

spine conditions will impact nursing science by providing a research foundation to develop and test cognitive and behavioral interventions to improve health seeking behavior and health outcomes such as HRQoL. In addition, the findings from this research can inform multidisciplinary interventions aimed at modifying cognitive and affective barriers to participation in health seeking behaviors for persons with lumbar degenerative spine conditions, and therefore improve quality of life.

Despite the rising prevalence of lumbar degenerative spine conditions (AAOS, 2008), and the conflicting reports about treatment outcomes (Hicks, et al., 2009), nursing research of the factors that may influence outcomes in lumbar degenerative spine conditions is limited. The unique contribution of this study is to describe how personal, biological and social antecedent factors affect the critical health perceptions involved in engagement in health seeking behaviors. Understanding the influence of the antecedent factors on health perceptions and the influence of health perceptions on health seeking behaviors such as participation in prescribed exercise programs and pain amelioration measures is a priority identified in the proposed objectives of Healthy People 2020 (HHS, 2009). In order to study health perceptions and health seeking behaviors in lumbar degenerative spine conditions this research plan uses an original theoretical model that combines elements of the health promotion model (Pender, et al., 2006) and health related quality of life model (Ferrans, 2004; Wilson, 1995) to understand the relationships among antecedent personal factors, health perceptions and health seeking behaviors in people with lumbar degenerative spine conditions.

Research Questions

The purpose of this research was to determine: 1) which antecedent personal factors are associated with health perceptions such as perceived physical functioning and perceived pain

interference in persons with lumbar degenerative spine conditions; 2) determine how antecedent personal factors and health perceptions at the start of treatment influence health seeking behaviors at 12 weeks of treatment; and 3) determine how antecedent personal factors influence health seeking behaviors.

An adapted theoretical model (Chapter 2) that uses elements of the health promotion model (Pender, et al., 2006; Pender, et al., 1988) and the health related quality of life model (Ferrans, 2004; Wilson, 1995) was used as the framework to guide the research questions in this study.

The research questions for this study were:

- How do antecedent personal factors- (a) demographic, (b) biologic and (c) social- affect health perceptions such as perceived physical functioning and perceived pain interference at start of treatment, and 12 weeks of treatment?
    - How do health perceptions vary between entry and 12 weeks of treatment?
- How do the health perceptions, a) perceived physical functioning and b) perceived pain interference at the start of treatment affect health seeking behaviors at 12 weeks of treatment?
- How do the antecedent personal factors influence health seeking behaviors when considering the relationship between physical functioning and pain interference?

A theoretical model inspired by the health promotion model (Pender, et al., 2006; Pender, et al., 1988) and the health related quality of life model (Ferrans, 2004; Wilson, 1995) was utilized to examine the relationships between the antecedents personal factors, health perceptions and health seeking behaviors. The antecedent personal factors that were studied included age, sex/gender, race/ethnicity, comorbidity, body mass index, spinal condition, and

insurance status. The health perceptions studied were perceived physical functioning and perceived pain interference. The health seeking behaviors studied were participation in prescribed exercise regimens and medications used to improve pain, numbness and tingling. A repeated measures descriptive study was conducted using data obtained from the charts of 130 persons who completed a minimum of 12 weeks of non-surgical treatment from a multidisciplinary spine clinic.

Implications

The purpose of this research was to (a) examine how antecedent personal factors influence perceived physical functioning and perceived pain interference over 12 weeks of treatment for lumbar degenerative spine conditions in patients receiving conservative non operative therapy; and (b) to examine how perceived physical function and perceived pain interference influence health seeking behaviors. The current literature focuses on degenerative spine disease from an episodic perspective rather than from a chronic condition perspective. This study contributes to understanding how antecedents of perceived physical functioning and perceived pain interference influence health seeking behaviors from a chronicity perspective over 12 weeks of treatment. Identification of factors predicting health perceptions in lumbar degenerative spine conditions will provide a platform to develop and research the effect of tailored interventions. Understanding how health perceptions influence health seeking behaviors in lumbar degenerative spine conditions will impact nursing science by providing a foundation for the development and testing of cognitive and behavioral interventions to facilitate health seeking behaviors, and thus will improve the quality and consistency of health outcomes.

Understanding the implications of health perceptions in lumbar degenerative spine conditions is an essentially unexplored but potentially important element of clinical patient

assessment for nurses and other health care providers in many settings. Identification of factors predicting health perceptions in lumbar degenerative spine conditions allows clinicians to identify those who are most likely to fare poorly and provide tailored interventions. Identification of persons at risk for poor physical functioning and increased pain interference provides an opportunity for early intervention to prevent deterioration of clinical condition. The findings of this study will be used as a foundation to develop cognitive and behavioral interventions for persons with lumbar degenerative spine conditions.

Summary

The purpose of Chapter 1 was to provide an overview of the study, including the significance, theoretical framework and the major concepts of the study. Antecedent personal factors, health perceptions and health seeking behaviors in lumbar degenerative spine conditions are the major categories of concepts that were used in this study. Chapter 2 describes the theoretical framework that was used to guide this study. The concepts *perceived physical functioning, perceived pain interference* and *health seeking behaviors* were used in the theoretical model that was developed from constructs within the health promotion model (Pender, et al., 1988) and the health related quality of life model (Ferrans, 2004; Wilson, 1995). In this study, an adaptation of the health promotion model was developed to illustrate how HRQoL can be the ultimate outcome of health seeking behaviors within the health promotion model. The health related quality of life model (Ferrans, 2004; Wilson, 1995) definition of HRQoL was used for the construct HRQoL. The review of literature in lumbar degenerative spine conditions is presented in Chapter 3. Each proposed antecedent personal factor, health perception and health seeking behavior is individually discussed. Chapter 4 describes the methodology used in this study including design, procedures, sample variables, instruments and

data analysis. Chapter 5 describes the study results and is followed by Chapter 6 which discusses the findings, implications for nursing practice, health care policy, public health, and further nursing research.

CHAPTER 2: THEORETICAL FRAMEWORK

Persons with lumbar degenerative spine conditions are at risk for long-term physical functioning deficits and chronic pain. In lumbar degenerative spine conditions, patients experience a combination of back and leg pain with varying degrees of motor deficit, sensory deficit, numbness and tingling (Daffner, 2009). Degenerative conditions of the lumbar spine occur over time due to the natural processes of aging, intervertebral disc dehydration, loss of disc flexibility, and degeneration of ligaments that support the spinal column. Secondly, osteoarthritis and demineralization of bone through osteoporosis can make the vertebral body vulnerable to degenerative changes.

Degenerative processes of the spine create complex physiological and structural dynamics that are affected by patient level factors such as posture and/or physical fitness that can result in lumbar degenerative spine conditions. Specifically, medical diagnoses such as spondylosis, spondylolisthesis, spinal stenosis, and disc disorders such as degenerative disc disease and herniated discs are considered degenerative spine disorders (AAOS, 2008; Block, 2003; Hickey, 2003; NASS, 2010). Together, these conditions are responsible for substantial difficulties in physical functioning and pain that interfere with daily living (Zanoli, 2006). Models based on structural pathology and/or medical diagnoses have not been effective in predicting the breadth of outcomes of chronic progressive conditions (Whiteneck, 2006). This has been especially true in conditions such as lumbar degenerative spine conditions where patient perceptions have been related to health outcomes such as participation in health seeking behaviors and health related quality of life (Dixon & Johnston, 2008).

The purpose of this chapter is to describe the theoretical framework which was used to guide the study. First, the importance of perception as a conceptual underpinning of perceived

physical functioning and perceived pain interference is presented, followed by the conceptual relationship between perceived physical function and perceived pain interference. Next, the limitations of other established frameworks are discussed, followed by the foundational theoretical frameworks that were used to develop the theoretical model for this study. Finally, the theoretical model used in this study will be presented.

This study uses a theoretical model that utilizes concepts from the Wilson and Cleary health related quality of life model (Ferrans, 2004; Wilson, 1995) and the health promotion model (Pender, et al., 2006) to examine the antecedents of perceived physical functioning and perceived pain interference in lumbar degenerative spine conditions. To facilitate discussion of the proposed model, several figures are presented. Figure 1 presents the health promotion model (Pender, et al., 2006; Pender, et al., 1988). Figure 2 presents the health related quality of life model (Ferrans, 2004; Wilson, 1995). Figure 3 presents the full theoretical model using concepts and categories from both models. Lastly, Figure 4 shows the same theoretical model with only the concepts used in the research questions for this study.

Theoretical Models in Chronic Care

As has been described in Chapter 1, the purpose of this study is to examine the individual level effects of antecedent personal factors on health perceptions (perceived physical function and perceived pain interference) and how health perceptions affect health seeking behaviors. Ecological chronic care models have been proposed and are particularly useful for determining the social and environmental antecedents of chronic health problems for individuals and populations (Tacón, 2008). Others argue that illness is entirely socially constructed with theories that are effective for health systems (Martin & Peterson, 2009). In order to understand

individual level perceptions and how they are affected by antecedent personal factors, a model that focuses on individual level factors is more appropriate.

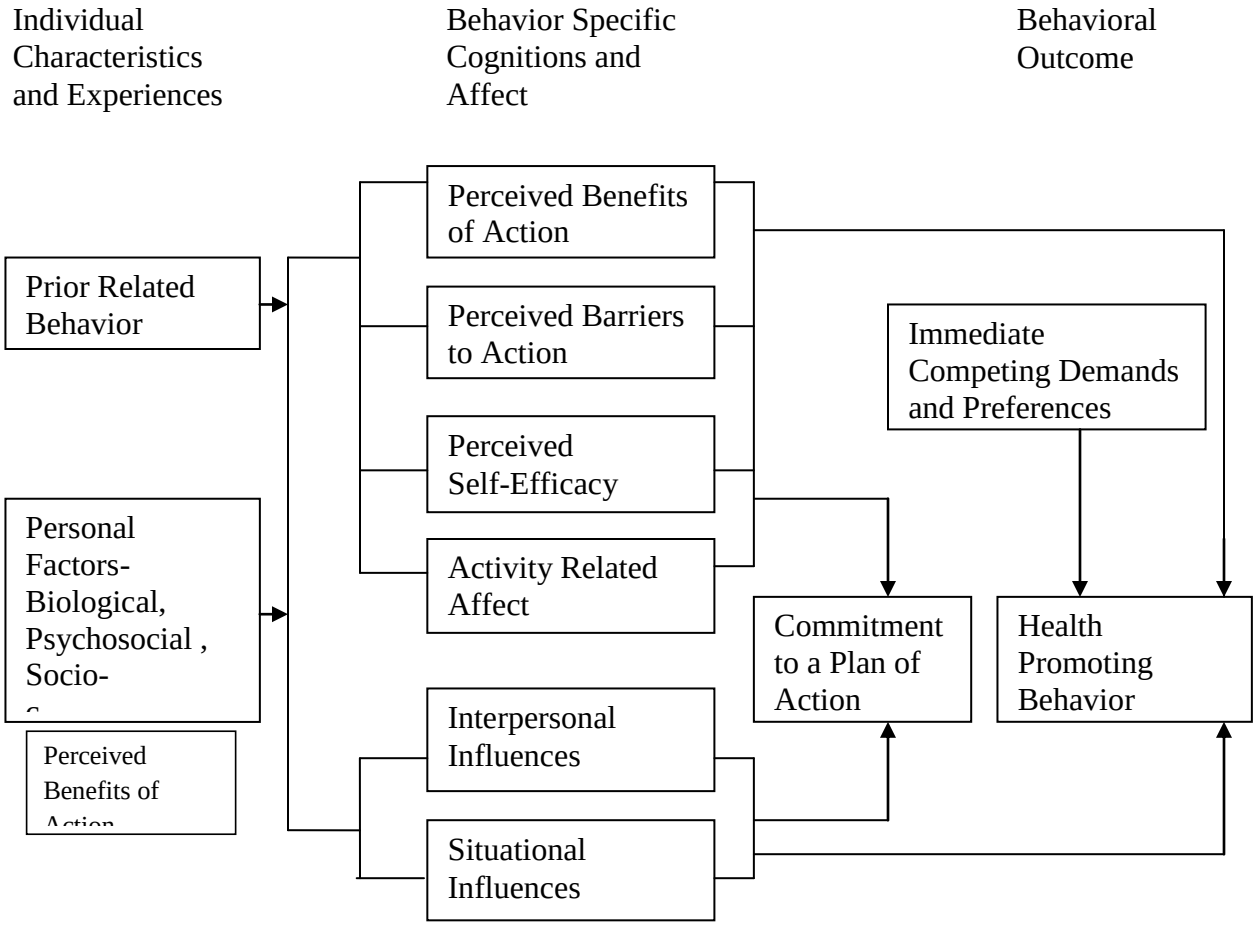
One chronic disease model that has received considerable attention is the chronic care model (Wagner, 1998). This model focuses on managing chronic disease at community and health systems levels through specifically enhancing patient self-management, care delivery, decision support and clinical systems that affect the relationship between the "informed and activated patient" and the "prepared and proactive care team" (Austin, 2011). The chronic care model could undoubtedly be relevant to the care of persons with lumbar degenerative spine conditions if the focus of the study were the care system issues related to chronic back problems. In this study, the research questions address individual level factors such personal factors, health perceptions and health seeking behaviors.

Another theory, the chronic illness trajectory theory (Corbin & Strauss, 1991) is based on grounded theory and focuses on trajectory mapping of chronic illnesses (Burton, 2000). This theory has undergone more recent updates to focus on health prevention and promotion behaviors sensitive to nursing intervention (Granger, Moser, Harrell, Sandelowski, & Ekman, 2007). The chronic illness trajectory theory bears several limitations for purposes of investigating antecedent personal factors, health perceptions and health seeking behaviors in lumbar degenerative spine conditions. Chronic illness trajectory theory does not clearly define the role of health perceptions and does not develop the role of health behaviors mitigating the consequences of chronic illness. After considering chronic care models, attention was turned to health promotion models.

A number of health promotion theories posit that perceptions are critical factors to engagement in health behaviors and ultimately can affect health related quality of life (Champion

& Skinner, 2008; Foster, et al., 2008; Pender, et al., 1988). The health promotion model (Figure 1) has demonstrated effectiveness in describing and predicting health promoting behaviors

Figure 1. Revise Health Promotion Model (Pender, 2006)



(Pender, et al., 1988) but was not designed explicitly for chronic conditions such as lumbar degenerative spine conditions. Secondly, the health promotion model does not address changes in perception and behavior over time.

The health related quality of life model (Ferrans, 2004; Wilson, 1995) describes the elements of the construct health related quality of life, but fails to account for how a person's behavior affects health related quality of life. Furthermore, the health related quality of life model fails to account for how health related quality of life changes over time.

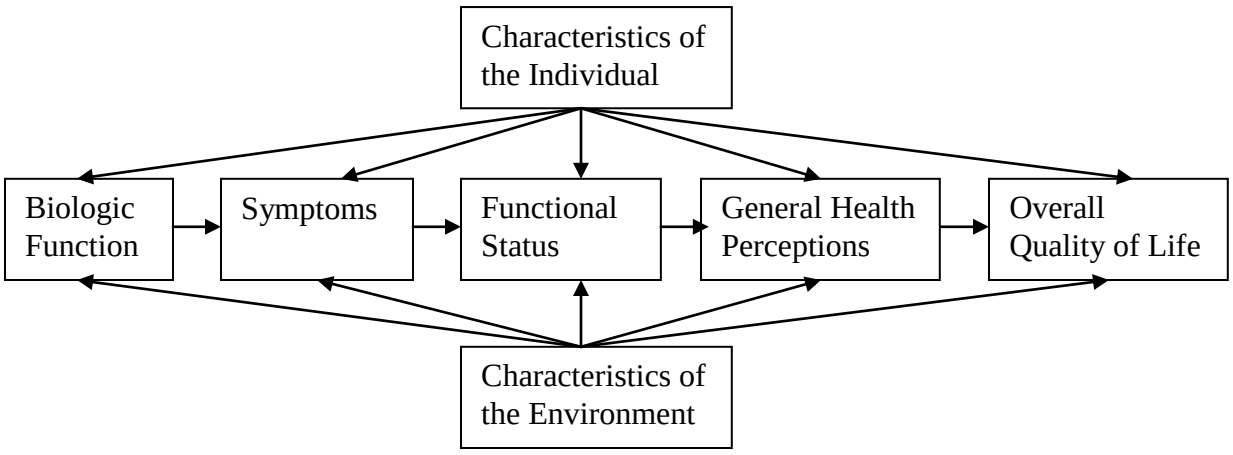
The next section identifies and describes the key concepts in the model used in this study and how the concepts come together to form a model for use in lumbar degenerative spine conditions.

Degenerative Spine Condition Model Development

In this section the development of the degenerative spine conditions model is described. First, the health related quality of life model is discussed, followed by the health promotion model. Finally, the model used for this study is described.

Health related quality of life model. Health related quality of life is a construct (Wilson, 1995) that is defined as the aspects of quality of life that are related to health (Ferrans, 2004). Wilson and Cleary (1995) developed a model (Figure 2) to understand the relationships between

Figure 2. Wilson and Cleary Model for Health Related Quality of Life (Wilson & Cleary, 1995).



the variables that constitute HRQoL. Within the HRQoL model (Figure 2), characteristics of the individual and characteristics of the environment act upon biological function, symptoms, functional status, general health perceptions and HRQoL. Physical functioning is one of four antecedent components of health related quality of life that exists within the construct of functional status. Thus, physical functioning is influenced by individual and environmental

characteristics and influences health related quality of life. Physical functioning has been studied in many disease states and has been identified as a key aspect of health related quality of life (NIH, 2009). Within the "functional status" category, several subcategories of functioning have been delineated: physical function, role function, psychological function and social function. Physical function, from a health related quality of life model perspective, was further clarified in the health related quality of life model update by Ferrans et al. (2005) to discard the negative "failure" or "inability" definitions and promote a definition based on maximum wellness or optimal functioning. Functional status, and therefore physical functioning, is influenced by symptom status such as pain. In the degenerative spine conditions population health perceptions have been associated with mobility outcomes and pain severity (Tang, 2007). The lumbar degenerative spine condition symptoms of pain sensitivity, anger and anxiety have been correlated with the functional domains and specifically physical functioning consistent with the Wilson and Cleary (Ferrans, 2004; Wilson, 1995) HRQoL model.

Health related quality of life is a broad topic that has far-reaching implications across clinical fields. In lumbar degenerative spine conditions, HRQoL has been a useful clinical outcome parameter because health perceptions (Block, 2003) and expectation have been shown to affect clinical outcomes such as physical function and pain status (Mannion, et al., 2009). The limitation of the health related quality of life model for purpose of this study is the failure of the health related quality of life model to clearly identify how patient behaviors relate to perceived physical functioning and perceived pain interference. Furthermore, the health related quality of life model does not identify ways that patients can influence their health status through health seeking behaviors that can contribute to HRQoL.

Health promotion model. The health promotion model (Pender, et al., 1988) was developed from social cognitive theory (Bandura, 1986) and the health belief model (Champion & Skinner, 2008; Rosenstock, 1960; Rosenstock, Strecher, & Becker, 1988) in order to understand the factors that predict health behaviors and create a framework for developing nursing interventions that affect health. The health promotion model (Figure 1) consists of three key areas: individual characteristics and experiences; behavioral-specific cognitions and affect; and behavioral outcomes. For purposes of this study, the health promotion model was utilized to more fully develop an understanding of how elements of health related quality of life (Figure 2) can be used to conceptualize the relationship between antecedent personal factors, perceived physical functioning and perceived pain interference, and to allow further conceptualization about their relationship to health seeking behaviors and health related quality of life. The health promotion model is seen in Figure 1(p. 15).

Health Perceptions in Degenerative Spine Conditions

Health promotion theories propose that patient perceptions regarding health are critical to engagement in health seeking behaviors and ultimately affect quality of life. Since physical functioning difficulty and activity interference due to pain are the primary personal experiences in lumbar degenerative spine conditions, a person's perception of his/her physical functioning and pain interference may affect health seeking behaviors such as participation in prescribed exercise regimens and medications use (Block, 2003; Haig, Tong, & Yamakawa, 2006; Tang, 2007). Health seeking behaviors are greatly influenced by a person's perception of his/her physical abilities and perceived pain interference, making perception a key variable influencing treatment outcomes and health related quality of life (Haig, Tong, & Yamakawa, 2006; Tang,

2007). In the next section, the model developed for this study is described including concepts and relationships among concepts.

Degenerative Spine Conditions Outcomes Model

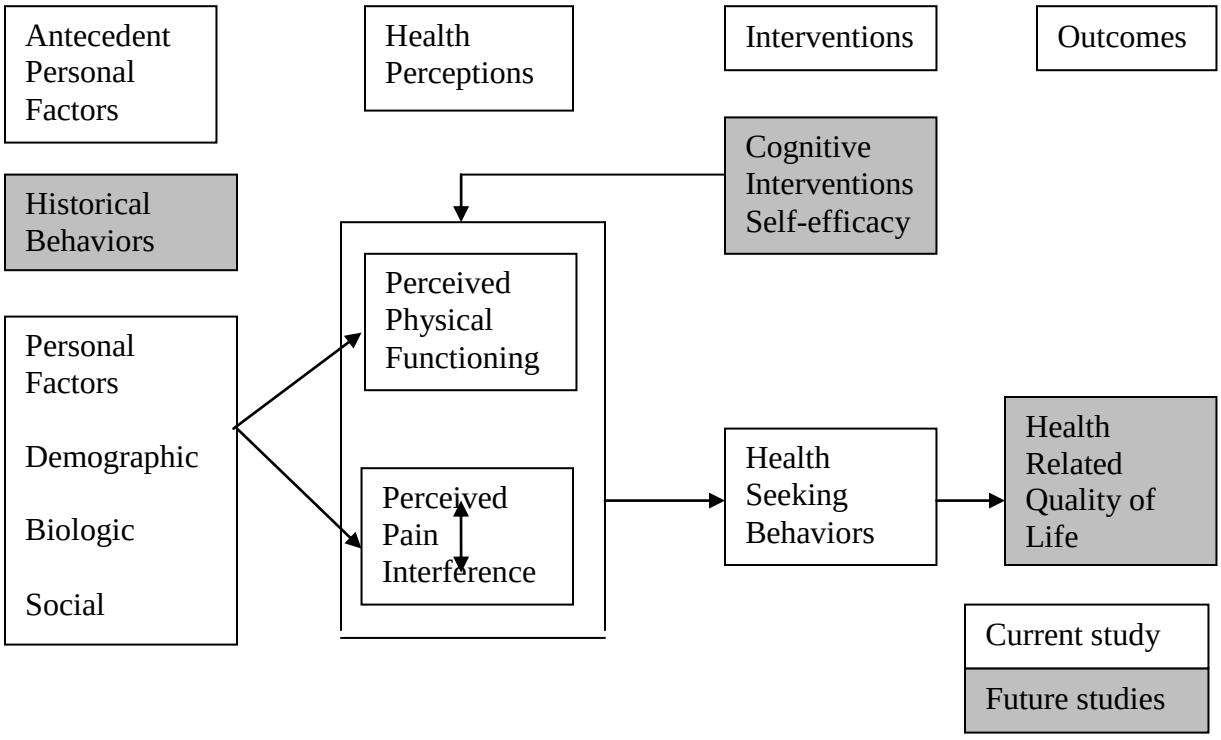
As has been discussed, the health related quality of life model (Ferrans, 2004; Wilson, 1995) and the health promotion model (Pender, et al., 2006; Pender, et al., 1988) inspired the development of the model for this study (Figure 3). In this section, each of the concepts of the model for this study is described along with the relationships among concepts.

Antecedent personal factors. The antecedent personal factors in the study model are organized around the predictors identified in the health promotion model (Pender, et al., 1988) and the construct health related quality of life (Ferrans, 2004; Wilson, 1995). Definitions from both models were utilized to develop the concepts within the proposed model. The first version of the health related quality of life model, (Wilson, 1995) does not describe "characteristics of the individual" but the subsequent model (Ferrans, 2004) describes characteristics of the individual, as demographic, psychological and biological factors that influence health. In the health promotion model, personal factors are categorized as biologic, sociocultural and psychological factors (Pender, et al., 2006). Using the theoretical considerations described above, the antecedent personal factors that influence health perceptions in the study model are described as personal factors-demographic, personal factors-biologic, and personal factors-social. Pender (p. 52) stresses that because many personal factors, whether they are demographic, biologic or sociocultural, are non-modifiable they should be selected carefully for theoretical relevance before being included in research studies (Pender, et al., 2006).

In the model used in this study, the antecedent personal factors are organized conceptually as demographic, biological, and social factors, to be consistent with the "individual

characteristics" of the health promotion model (Pender, et al., 2006) and the "characteristics of the individual" in the health related quality of life model (Ferrans, 2004; Wilson, 1995). In the parent models (Ferrans, 2004; Pender, et al., 2006; Wilson, 1995) biologic factors are those conditions affecting health that arise from the function of cells, organs, and organ systems. Social factors can be considered environmental factors (Ferrans, 2004) or influences of ocioeconomic status. Demographic personal factors are those factors such as age, sex/gender, racial, and ethnic heritage that can affect how persons practice health behaviors and interact with health systems (Pender, et al., 2006). As a class of variables, predictors are useful to understand antecedents of a particular concept or phenomenon (Barnum, 1998).

Figure 3. Theoretical framework for degenerative Spine Outcomes



In low back pain syndromes and lumbar degenerative spine conditions, individual or single predictor variables such as specific spine conditions (Zeller, Lynm, & Glass, 2009),

and pain interference are influenced through a complex process involving interactions of personal factors such as age, sex/gender, race/ethnicity, obesity (Vaidya, 2009), comorbidities, (Slover, Abdu, Hanscom, & Weinstein, 2006), and insurance status (van Duijn, 2004). Individual personal factors have been used extensively as individual elements to predict outcomes of episodes of care (Linton & Boersma, 2003; Linton & Hallden, 1998). The model used in the current study (Figure 4) proposes that cognitive appraisals of physical functioning and pain interference are influenced by demographic factors, such as age, sex/gender, and ethnicity; biologic factors, such as the specific spine diagnosis, body mass index (BMI), and other comorbidities; social factors, such as insurance status; and previous health behaviors such as physical activity experiences (Bandura, 1986; Dixon & Johnston, 2008; Foster, et al., 2008).

Health Perceptions. In lumbar degenerative spine conditions, health perceptions are a critically important from at least two perspectives. Theoretically, perceptions and specifically health perceptions are influenced by a number of personal, biologic and social factors and are important in influencing behaviors (Bandura, 1986; Dixon & Johnston, 2008; Foster, et al., 2008). Secondly, in lumbar degenerative spine conditions, health perceptions are important because they correlate better than traditional observational measures with issues important to patients such as physical functioning, work status, and pain relief (Mousavi, et al., 2006). The health perceptions selected for this study were perceived physical function and perceived pain interference and were chosen because the lumbar degenerative spine conditions are known to affect physical functioning and cause pain. The next two sections will discuss the concepts of perceived physical functioning and perceived pain interference.

***Perceived physical functioning*.** Perceived physical functioning can be conceptualized as the patient reported outcomes--that is the patient's perception of how he/she is physically

functioning. A person's negative perception of his/her physical functioning has been linked to many undesirable health outcomes such as poorer health related quality of life, increased risk for falls, fractures and disability, and increased health expenditures. Utilizing definitions and contexts of physical functioning that are relevant to the person has been identified as important to understanding the person's perception of his/her physical functioning (Tomey & Sowers, 2009). Patient reported outcomes can differ substantially from observational measures. An example of the importance of understanding differences between observational and patient reported outcomes is seen in a study of low back pain patients where observational measures such as spine mobility and trunk strength did not correlate significantly with issues important to patients such as symptom relief, physical function, and work status (Mousavi, et al., 2006).

Another method of conceptualizing physical functioning is seen in observational outcomes such as distance ambulated or demonstration of psychomotor skills. Measures of actual physical performance are most accurate when measured by clinicians or researchers and are called "performance based measures." Observational measures are distinctly different than the patient's perception of physical function (Smith, Domholdt, Coleman, del Aguila, & Boon, 2004). To address the incongruity between perceived and observed physical functioning in lumbar degenerative spine conditions, perceived physical functioning will be conceptually defined as a person's report of his/her ability to perform activities of varying function and intensity (Stewart, 1992).

Perceived pain interference. In lumbar degenerative spine conditions, varying degrees of back and leg pain often accompany losses in physical functioning (Hickey, 2003). For purposes of this study, perceived pain interference is defined as the person's perceived interference of pain in vocational, social/recreational, and family/marital functioning (Kerns, et

al., 1985). The definition of perceived pain interference was derived from the conceptual definition from the West Haven/Yale Multidisciplinary Pain Inventory in order to assess how pain affected and interfered with common activities and social relationships (Kerns, et al., 1985). As has been previously described, the thoughts, cognitions, and cognitive constructions surrounding difficulties in performing tasks can affect health care outcomes and health seeking behaviors (Dixon & Johnston, 2008; Guzman et al., 2007; Whiteneck, 2006).

Health Seeking Behaviors. Health seeking behaviors are defined as engagement in personal and prescribed behaviors intended to improve health status, mitigate the consequences of chronic conditions, or prevent health decline. The definition of health seeking behavior was modified from the definitions of health promoting behaviors (Pender, et al., 1988) and help seeking literature (SaintArnault, 2009) to recognize the role of health behaviors that not only improve conditions but also those that slow the rate of decline in chronic conditions. Health seeking behaviors are also sensitive to intervention as described in the health promotion model (Pender, et al., 2006). Interventions can be nurse led, such as promotion of patient self-efficacy for home exercise programs or patient level activities such as managing barriers to participation in health seeking behaviors (Frih, Fendri, Jellad, Boudoukhane, & Rejeb, 2009; Pender, et al., 2006).

In this study, the selected behaviors were those commonly identified behaviors that are known to influence the perceived physical functioning and perceived pain interference status in lumbar degenerative spine conditions. Behaviors such as participation in prescribed exercise regimens (Deutscher et al., 2009) and the use of medications to ameliorate pain and related symptoms (Crowe, Whitehead, Jo Gagan, Baxter, & Panckhurst, 2010) are associated with

improved health related quality of life in many types of musculoskeletal conditions (Deutscher, et al., 2009).

Relationship between health perceptions and health seeking behaviors. Limitations in physical functioning are common and increase with age. How these limitations are integrated into an individual's life is a complex process that involves the interaction between capability and environmental demands (Verbrugge & Jette, 1998). A model developed specifically to understand how persons adapt to changes in physical functioning hypothesizes that changes in behavior occur when there is incongruence between a person's perception of an activity, its relevance to his/her life situation, and the difficulty or interference factors that are encountered when performing the activity. For instance, a person could have substantial difficulty and pain when walking one mile, but if the ability to walk that distance did not have personal life relevance, it would not be perceived as a limitation in physical functioning (Tomey & Sowers, 2009).

In the health promotion model (Pender, et al., 2006), health perceptions are complex appraisals that can influence behaviors in multiple health situations. Additionally, perceptions are situation and context specific to a health condition in ways that can facilitate or impede health seeking behaviors (Pender, et al., 2006). In contrast to the current health promotion model, this study proposes that the definitions of health promotion can be extended from primary and secondary prevention described by Pender (1988; 2006) to include tertiary prevention (Wallace, 2010) such as the mitigation of the consequences of chronic diseases through health seeking behaviors.

Self-efficacy and cognitive interventions. The role of cognitive appraisal and perceptions is an essential component in optimizing physical functioning, improving perceived

pain interference, and improving health related quality of life. A consensus panel of spine care experts hypothesized that patient behaviors regarding spine related conditions are influenced by an interaction of physical, social, and cognitive factors (Guzman, et al., 2007). An example of how perceptions influence behaviors is seen in self-efficacy. Self-efficacy (Bandura, 1986, 1997) is a construct that describes a person's beliefs and cognitions about his or her abilities to successfully plan and execute behaviors. Self-efficacy has been used successfully in a number of studies that attempt to predict and describe behaviors. Self-efficacy will not be one of the concepts measured in the present study but the influence of self-efficacy and self-efficacy interventions on health perceptions, health seeking behaviors, and health outcomes will be examined in future research (Figure 3).

Although there were no studies that specifically studied self-efficacy in lumbar degenerative spine conditions, in patients experiencing other musculoskeletal pathologies, patient perceptions, expectations and self-efficacy beliefs about ability to function were responsible for variance in outcomes in patients undergoing total knee replacement surgery (Engel, Hamilton, Potter, & Zautra, 2004). In addition to degenerative joint disease, higher levels of self-efficacy improve self-care abilities in older adults (Callahan, 2006). In studies that used self-efficacy to predict outcomes in chronic conditions, self-efficacy enhancing interventions improved disease self-management in chronic diseases such as arthritis, heart disease and diabetes (Marks, Allegrante, & Lorig, 2005).

Health related quality of life. In the theoretical model used in this study, the outcome of health perceptions and health seeking behaviors is health related quality of life. There is substantial literature that describes how lumbar degenerative spine conditions can affect a patient's HRQoL (Block, 2003). In other chronic conditions, lower levels of disability

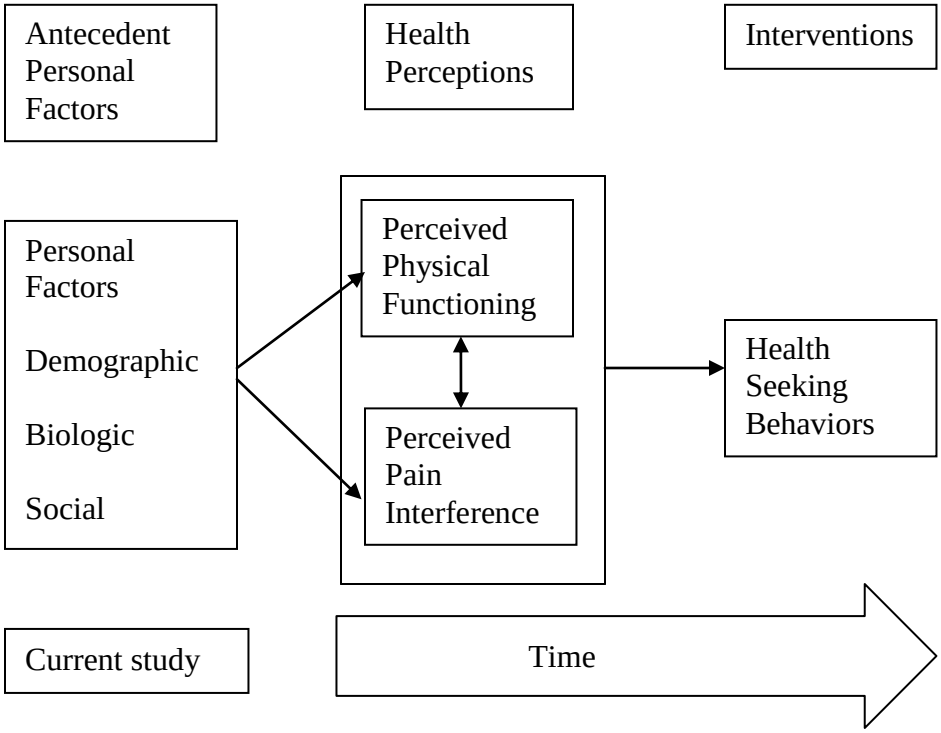
(Koroukian, Murray, & Madigan, 2006) and better self-care behaviors (Pavlou & Lachs, 2006) are associated with higher levels of HRQoL. Although HRQoL was not addressed in this study, it will be considered in future research.

Theoretical Model Summary

In summary, the theoretical model (Figure 3) focuses on how antecedent personal factors influence health perceptions, health seeking behaviors and ultimately HRQoL while Figure 4 shows only those elements of the theoretical model which are being utilized in this study. Health perceptions, specifically perception of physical function and perception of pain interference, influence health seeking behaviors which ultimately will affect a person's health related quality of life. The model proposes that health perceptions and their relationship to health-seeking behaviors may be influenced by self-efficacy and cognitive interventions. In degenerative spine conditions, antecedent personal factors--demographic, biological and social--are based on the predictive factors proposed by the health promotion model (Pender, et al., 2006; Pender, et al., 1988). Health perceptions are also derived from the health promotion model but are adapted based on the relevance to the situation-in this case, degenerative spine conditions (Tomey & Sowers, 2009). As cognitive constructs, a person's perception of his/her physical functioning and pain interference affect participation in health seeking behaviors to manage the symptoms of chronic lumbar degenerative spine conditions. Ultimately, how perceptions of physical functioning and pain interference affect health-seeking behaviors will in turn affect health related quality of life.

The present study will focus on the antecedent personal factors, health perceptions, and health-seeking behaviors (Figure 4). The model for the present study (Figure 4) proposes that perceived physical functioning and perceived pain interference influence engagement in health

Figure 4. Theoretical framework for current study of lumbar degenerative spine conditions



seeking behaviors. The diagram (Figure 4) of the model illustrates the proposed relationships between the antecedent personal factors, health perceptions (perceived physical functioning and perceived pain interference) and health seeking behaviors and is the final theoretical model that was used in this study.

Chapter 3 will present the state of the science in research regarding degenerative spine conditions as it relates to antecedent personal factors, perceived physical functioning and perceived pain interference and health-seeking behaviors.

CHAPTER 3: LITERATURE REVIEW

Ninety percent of persons over the age of 65 have some type of degenerative spine condition (Boden, Davis, Dina, Patronas, & Wiesel, 1990). Population estimates of outpatient visits for back problems were 61.7 million with 27.4 million of the visits being for care of chronic back problems (Licciardone, 2008). According to the National Institute of Neurological Disorders and Stroke (NINDS), lost work days due to lumbar spine conditions account for annual health care expenditures of 50 billion dollars and they are the leading causes of work related disability (NINDS, 2009). While degenerative spine conditions are becoming increasingly common in the United States, the treatment outcomes are inconsistent presumably because the degree or severity of degenerative disease by clinical diagnostic testing does not correlate well with the person's level of self-reported pain and physical functioning (Hicks, et al., 2009). Poor treatment outcomes in persons with lumbar degenerative spine conditions can lead to chronic pain and long term disability and affect health related quality of life (Caldwell, et al., 2009; Crisostomo et al., 2008; Deutscher, et al., 2009; Foster, et al., 2008; Guzman, et al., 2007; McGeary, 2003).

The purpose of this chapter is to present a review of the current literature and state of the science related to perceived physical functioning, perceived pain interference and health seeking behaviors in lumbar degenerative spine conditions. This literature review provided a foundation for this study. The literature review was conducted with the objective of improving the scientific understanding of the antecedents of health perceptions such as perceived physical functioning and perceived pain interference and how these perceptions influence health seeking behaviors in lumbar degenerative spine conditions.

Characteristics of the person, such as personal factors, biologic factors and social factors, may predict how the patient will ultimately perceive his/her physical functioning and pain interference. Exploring how these variables interact can provide a basis for predicting perceived physical functioning, perceived pain interference and health seeking behaviors. Understanding the relationships among biological, personal, and social antecedents of health perception and how they influence health seeking behaviors can contribute to developing nursing care process changes and improved patient treatment plans. Despite the rising prevalence of lumbar degenerative spine conditions (AAOS, 2008) and the conflicting reports about treatment responses (Block, 2003; Hicks, et al., 2009), nursing research of the factors that may influence treatment outcomes is limited.

The unique contribution of this study is to describe how personal, biological and social antecedents affect the critical perceptions and how perception affects engagement in health seeking behaviors. The role of nursing as patient advocates and educators can influence a person's health perceptions and participation in health seeking behaviors (Benner, Sutphen, Leonard, & Day, 2010; Pender, et al., 2006). Understanding the antecedents of health perceptions and the effect of health perceptions upon health seeking behaviors such as participation in prescribed exercise programs and pain amelioration measures can influence the Healthy People 2020 objectives of improving outcomes in chronic low back conditions (HHS, 2009).

This chapter will be organized by first discussing lumbar degenerative spine conditions as diagnostic categories, followed by the review of literature in health perceptions, health seeking behaviors and HRQoL. This chapter starts by describing lumbar degenerative spine conditions as a diagnostic group to provide clarity to the specific diagnostic conditions in question.

Secondly, health perceptions are discussed in general followed by more detailed literature synthesis regarding perceived physical functioning and perceived pain interference. Next, the literature regarding hypothesized antecedent personal factors is presented. In this section, the literature regarding demographic personal factors is presented first, followed by biologic personal factors, and finally social personal factors. Age, sex/gender, and race are the demographic personal factors that are presented. Degenerative spine conditions, body mass index, and comorbidities are the biologic personal factors. Lastly, the social personal factor is described as insurance status. Health seeking behaviors are discussed in the next section of the chapter, which is divided into prescribed exercise regimens and medication use. The final section of the chapter discusses HRQoL.

Degenerative Spine Conditions

Degenerative spine conditions, low back pain, and associated diseases are a group of related conditions causing pain, disability and difficulty with physical functioning of varying degrees (Licciardone, 2008). Lumbar spine disorders as a whole can be divided into degenerative disorders and 'back injury.' Back injury is traumatic and acute in nature, and includes lesser traumas such as sprain and strain (AAOS, 2008). Degenerative processes in the lumbar spine are the result of several dynamic processes. Intervertebral discs lose water and elasticity over time, resulting in a clinical syndrome of pain and motor deficit that appears to be acute but is the result of long term disc changes (Martin, et al., 2002). Mechanical forces and inflammatory changes in the lumbar spine can begin to occur early in adulthood, progress over time, and express themselves as changes in the bony endplate of the vertebral body and/or the facet joint. Long term inflammatory and mechanical changes in the lumbar spine lead to a variety of pathologies (AAOS, 2008). The major bony degenerative conditions are: spondylosis,

spondylolisthesis, spinal stenosis, and osteoarthritis. Spondylosis is the degeneration of the intervertebral bodies and/or disc spaces that result in nerve root or spinal cord compression. Spondylolisthesis is a condition where vertebral bodies slip forward and out of normal anatomic alignment resulting in compression of nerve roots and/or the spinal cord (AAOS, 2008; Burritt, 2003; Hickey, 2003). Spinal stenosis is a condition in which spinal nerves are compressed by bony growth that narrows the spinal canal due to inflammation and osteoarthritis (Zeller, et al., 2009). The discrete diagnostic categories have been described for clarity of definition for the purposes of this study. The next section will review the literature regarding health perceptions in general, followed by a discussion of specific health perceptions, perceived physical functioning and perceived pain interference, in lumbar degenerative spine conditions.

Health Perceptions

The literature regarding perceived physical functioning and perceived pain interference was reviewed for content that specifically focused on the health perceptions and how health perceptions influence health seeking behaviors. Health perceptions, the personal belief and appraisal of health status on a continuum of well to unwell or healthy to unhealthy (Macabasco-O'Connell, Crawford, Stotts, Stewart, & Froelicher, 2010) is a complex concept that has been measured in a number of chronic conditions. A large variety of health perception surveys were identified. In each section, the specific survey tool used is identified along with the study findings to allow for meaningful comparisons.

In chronic conditions, poor health perceptions have been associated with higher levels of morbidity and mortality in conditions such as congestive heart failure. This study demonstrated that objective health measures for chronic disease, such as New York Health Association Classification for congestive heart failure, are not directly associated with patient health

perceptions (Macabasco-O'Connell, et al., 2010) meaning that the severity of disease does not directly associate with how ill the person feels. For example, in this study, sixty percent of the heart failure patients fell in the worst levels of congestive heart failure but eighty percent of the patients perceived their health as poor or very poor (Macabasco-O'Connell, et al., 2010). This study (Macabasco-O'Connell, et al., 2010) was limited because health perceptions were measured in a general, rather than condition specific manner. Secondly, the effect of health perception upon behaviors such as self-care and adherence to therapy to prevent further decline in condition was not addressed.

Differences in health perceptions can affect health outcomes and individual factors such as age, race, ethnicity, and sex/gender can affect health perceptions (Hartweg & Isabelli-García, 2007; Macabasco-O'Connell, et al., 2010). In a study of 577 breast cancer survivors, women were assessed for a variety of factors including health perceptions, long term effects and HRQoL using the medical outcomes study (MOS) short form 36 (SF-36). This study demonstrated that women who perceived their health as poor could be experiencing the chronic effects of breast cancer therapy, suggesting that condition specific health perception measures may be more appropriate assessment tools (Ganz, Greendale, Petersen, Kahn, & Bower, 2003).

In lumbar degenerative spine conditions, health perceptions have been shown to influence health seeking behaviors. There is some evidence that persons with chronic back problems have lower levels of perceived health and that lower levels of perceived health negatively influence participation in treatment regimens for chronic back conditions (Park, Kang, & Park, 2006). In this study, 213 persons with chronic lumbar back conditions were assessed for health perceptions using a Korean version of the SF-36 and health behaviors via self-report. Overall, persons with

better health perceptions participated more in prescribed exercise ($r = 0.393$; $p < .001$) to improve their back conditions (Park, et al., 2006).

When considering health perceptions in lumbar degenerative spine conditions, the literature was reviewed with the purpose of determining whether generic or condition specific measures captured health perceptions most accurately. Since pain and motor deficit are the most common symptoms associated with lumbar degenerative spine conditions (Martin, et al., 2002), how these symptoms are perceived was the foundation for the health perception concept developed for this study. Within samples of people with lumbar degenerative spine conditions, health perceptions such as perceived physical function (using the SF-36) were substantially poorer for all types of lumbar degenerative spine conditions than in those without degenerative spine conditions (Block, 2003; Zanoli, 2006).

In a study that evaluated the effectiveness of health perception measures to detect changes in condition in persons with lumbar degenerative spine conditions ($n = 970$) symptom specific measures were considered preferable especially those for pain and function (Walsh, Hanscom, Lurie, & Weinstein, 2003). When evaluating studies of lumbar degenerative spine conditions, 14 patient self-report scales for measuring health perception were identified. Two tools, the MOS SF-36 and the Oswestry Disability Index (ODI) were used substantially more often than any other tools. When assessing the studies and systematic reviews for assessment of health perceptions in lumbar degenerative spine conditions, two themes emerged. First, the focus was on the domains of symptoms and functioning-specifically targeting pain and physical functioning (Davidson & Keating, 2002; Freburger, Carey, & Holmes, 2006a, 2006b; Grotle, Brox, & Vollestad, 2004; Walsh, et al., 2003). Secondly, there were several scales that were not

used frequently enough to be useful (Davidson, Keating, & Eyres, 2004; Suarez-Almazor, Kendall, Johnson, Skeith, & Vincent, 2000).

In lumbar degenerative spine conditions, health perceptions have been measured using a number of conceptual and operational definitions. Nine of twelve studies used the SF-36. The SF-36 is a 36-item health perception survey that assesses eight domains of general health-physical functioning, bodily pain, general health perception, vitality, social functioning, physical and emotional role limitations, and mental health (Stewart, 1992; Ware, 2004). The physical functioning subscale is a 10-item subscale measuring a person's perception of how health affects physical functioning. In general the SF-36 performed well in lumbar degenerative spine conditions. In a study of 970 patients with varying lumbar degenerative spine conditions, the SF-36 subscales for bodily pain and physical functioning had the best responsiveness to change when compared to the musculoskeletal outcomes data evaluation and management system (MODEMS) (Swiontkoski, Buckwalter, Keller, & Haralson, 1999) and the Oswestry Disability Index (Walsh, Hanscom, & Lurie, 2003). The SF-36 physical functioning subscale was found to be was responsive to change in patient condition for both improvement and deterioration of clinical condition (Davidson & Keating, 2002). One limitation of the SF-36 physical functioning subscale was that is not specific to the limitations of patients with back pain (Davidson & Keating, 2002).

When assessing the utility and appropriateness of each of the other health perception measures, it was problematic to find each was used very few times. For example, the EuroQoL 5D (Suarez-Almazor, et al., 2000) performed well in responsiveness to changes in patient conditions, but was used in only one study. The Health Utilities Index (HUI) is a promising generic health perceptions tool that actually performed better than the SF-36 physical functioning

subscale specifically in populations with back pathology but the HUI has not been used repeatedly to confirm its utility (Suarez-Almazor, et al., 2000). The other identified tools measured different concepts/constructs related to HRQoL such as pain (McGill pain questionnaire and Waddell back pain), disability (ODI and Quebec back pain questionnaire) and quality of life (World Health Organization Quality of Life Brief). One other measure of health perceptions was considered. The back specific SF-36 was developed by Davidson, Keating & Eyers, (2004). The back specific SF-36 performed well in initial psychometric testing, showing comparable reliability and improved responsiveness to change in patient condition when compared to the original version of the SF-36. It was studied in a small sample (n = 46) and repeated administrations were done only at baseline and 6 weeks. Although this tool shows promise, it is has not been adequately tested to allow broad utility with patients being treated conservatively for lumbar degenerative spine conditions.

Health perceptions are clearly influential in treatment outcomes in lumbar degenerative spine conditions. Problems with physical functioning and pain interference are some of the most prevalent experiences of persons with lumbar degenerative spine conditions. In the subsequent sections, the specific health perceptions that were chosen for this study are discussed. First, perceived physical functioning is discussed, followed by perceived pain interference.

Perceived physical functioning. Substantial numbers of studies were identified in which perceived physical functioning was used as an outcome measure, yet they failed to yield an understanding of how multiple personal-demographic, biologic and social factors can interact to influence perceived physical functioning. For purposes of this study, *perceived physical functioning* is defined as patient appraisal of his/her ability to perform a variety of physical activities of varying difficulty, intensity, and function (Stewart, 1992).

Perceptions of reduced physical functioning have been associated with increased symptoms and increased levels of comorbidity. In a sample of 195 persons over 60 years of age, general linear modeling was utilized to determine that pain and decreased muscle strength predicted 21 percent of the variance in perceived physical functioning (Whitson et al., 2009). Compromised physical functioning has been associated with poorer self-care abilities (Edwards, 2006). Physical functioning is known to decrease with age (Whitson, et al., 2009), yet the determinants of *perceived* physical function differ throughout the lifespan (Edwards, 2006). In persons experiencing chronic painful musculoskeletal conditions, perceptions were related to greater variance in physical functioning at younger adult ages, and higher levels of perceived pain interference were associated with more advanced ages (Edwards, 2006). Perceived physical functioning measures can be influenced by multiple factors such as social and demographic characteristics, and are distinctly different than observational measures (Wittink, Rogers, Sukiennik, & Carr, 2003). Conceptually, this distinction is important because health perceptions of physical function and the observed reality of ambulation or other functional activities may be entirely different (Pender, et al., 2006). In lumbar degenerative spine conditions, pain and interference in daily activities may accompany impairments of physical functioning (AAOS, 2008). Perceived pain interference as a health perception will be discussed in the next section.

Perceived pain interference. In lumbar degenerative spine conditions, a combination of back pain, leg pain, and varying degrees of difficulty with back and leg mobility are the prevailing patient experiences (Daffner, 2009; Zanoli, 2006). For purposes of this study *perceived pain interference* is defined as the perceived degree of interference of pain in vocational, social/recreational, and family/marital functioning (Kerns, et al., 1985).

Medical models, such as those that focus on structural spine problems (Hicks, et al., 2009) have not been effective in predicting the breadth of environmental, social and personal contributions to chronic progressive conditions (Whiteneck, 2006). This is especially true in conditions such as lumbar degenerative spine conditions. For example, in lumbar degenerative spine conditions, perception of physical functioning has been associated with severity of pain, sensitivity to pain stimuli, anger and anxiety (Block, 2003).. Women report higher levels of pain severity and higher levels of pain interference than men, even after controlling for psychological factors such as depression and anxiety (Stubbs et al., 2010). Additionally, prescribed exercise programs have been shown to reduce pain interference but the amount of change in perceived pain interference is distinctly different when considering patient level variables such as age, sex, and comorbidities (Wessels, Ewert, Limm, Rackwitz, & Stucki, 2007). .Although it is an interesting hypothesis to explore, the sample size (n = 162) was too small to determine how multiple types of prescribed exercise influenced pain interference.

In the current study, perception of physical functioning and perceived pain inference were hypothesized to have unique contributions to health seeking behaviors in lumbar degenerative spine conditions. Perceived pain interference has been associated with poor perceived physical functioning in workers' compensation cases (Baldwin, 2007). In older adults with non-work related spine conditions, perceived pain interference had a very weak association with perceived physical functioning (Edwards, 2006). Higher level of perceived pain interference and lower levels of perceived physical functioning have been implicated in poorer clinical outcomes such as participation in prescribed exercise (Foster, et al., 2008). The lack of clarity regarding the relationship between perceived pain interference and perceived physical functioning could be addressed by examining the unique contributions of personal, biological,

and social variables to the relationship between perceived pain interference and perceived physical functioning. In order to explore all of the elements of the theoretical framework, the next section explores the literature regarding the role of the construct self-efficacy in health perceptions and health seeking behaviors

Self-efficacy. In the theoretical framework in Chapter 2, it was theorized (Figure 3) that cognitive constructs such as self-efficacy could influence health perceptions. Self-efficacy is a construct that describes people's "judgments of their capabilities to organize and execute courses of action required to attain designated performances" (Bandura, 1986). Although self-efficacy was not examined in this research study, it does have relevance in lumbar degenerative spine conditions. The health seeking behaviors such as participation in home exercise regimens and medication use require appraisal, by the patient, of their ability to execute these behaviors.

No studies were identified that described the role of self-efficacy in lumbar degenerative spine conditions but there were a number of studies in closely related conditions. In undergoing total knee arthroplasty, better self-efficacy beliefs were responsible for improved outcomes such as distance ambulated and improved pain control. (Engel, et al., 2004). In other chronic conditions, self-efficacy enhancing strategies improved functional capacity and disease self-management in chronic diseases such as arthritis, diabetes, and heart disease (Marks, et al., 2005). In lumbar degenerative spine conditions, interventions that enhanced self-efficacy improved exercise adherence over standard education in patients with lumbar spondylosis treated surgically (Luszczynska, Gregajtys, & Abaraham, 2007). Self-efficacy interventions could improve outcomes in lumbar degenerative spine conditions treated conservatively. In the next section, the individual antecedent personal factors that are hypothesized to influence health perceptions such as perceived physical functioning and perceived pain interference are discussed.

Antecedent Personal Factors

In Chapter 2, it was theorized that the antecedents of perceived physical functioning and perceived pain interference could be identified from personal factors, biologic factors and social factors. The literature was reviewed keeping the proposed antecedent categories in mind. Nursing, medicine, psychology and physical therapy were used as focus areas for the literature search.

In order to stay consistent with the hypothesized theoretical framework, the definitions of personal biologic and social factors were derived from Pender's health promotion model (Pender, et al., 2006; Pender, et al., 1988) and the health related quality of life model (Ferrans, 2004; Wilson, 1995). In the first version of the health related quality of life model (Wilson, 1995) does not describe "characteristics of the individual, " but the subsequent model (Ferrans, 2004) describes characteristics of the individual, as demographic, psychological and biological factors that influence health. In the health promotion model, "personal factors" are differentiated as biologic, sociocultural, and psychological factors (Pender, et al., 2006). Using the theoretical considerations described, the antecedent personal factors of the proposed model are described as demographic personal factors, biologic personal factors, and social personal factors. In order to stay consistent with the health related quality of life model (Ferrans, 2004; Wilson, 1995) and the Health Promotion Model (Pender, et al., 2006; Pender, et al., 1988) demographic factors are defined as sex/gender, race/ethnicity, and age that have been shown to affect health status (Ferrans, 2004). Biologic factors, according to all authors, influencing the theoretical framework, are those conditions affecting health that arise from the functions of cells, organs and organ systems (Ferrans, 2004; Wilson, 1995). Sociocultural factors can be considered environmental factors (Ferrans, 2004) or influences of socioeconomic status.

Pender et al (2006, p. 52) stresses that since many personal factors, whether demographic, biologic or sociocultural, are non-modifiable and they should be selected carefully for theoretical relevance before being included in research studies (Pender, et al., 2006). For purposes of the current study, the demographic personal factors that were included are age, sex/gender, and race ethnicity. The biologic personal factors were body mass index, specific diagnostic category of lumbar degenerative spine condition and comorbidities. The social personal factor that was considered is insurance status. The remainder of this section will discuss each category of personal factors and provide rationale for the selection of the referents for each category.

Demographic personal factors. Individual factors influence perceived physical function and perceived pain interference in patients with lumbar degenerative spine conditions but how individual characteristics combine to affect perceived physical function and perceived pain interference is less well understood.

Age. Older persons are expected to have more degenerative spine conditions (Hicks, et al., 2009) than their younger counterparts, but no differences were found in the perception of physical functioning when persons over 65 with degenerative spine conditions were compared to those 50-64 with the same conditions (Glassman et al., 2007). In patients less than 65 years of age (range 26-60), older age was correlated with lower levels of physical functioning especially if the person was not employed (Bentsen, Hanestad, Rustøen, & Wahl, 2008). In persons older than age 65 with mobility problems, increased perceived pain interference and poor health perception predicted functional decline in the lower extremities (Rejeski, 2001). In a study regarding chronic painful musculoskeletal conditions, patient perceptions explained greater variance in physical functioning at younger adult ages, while higher levels of perceived pain

interference explained greater variance in perceived physical functioning at more advanced ages (Edwards, 2006). In the elderly, perceived pain interference is a major contributor to poor quality of life (Whitson, et al., 2009).

In summary, during the aging process, people experience increasing levels of degenerative spine disease and other comorbidities; if accompanied by lower levels of mobility and increases in pain older adults are at risk for poorer perceived physical functioning and increased perceived pain interference. Although there is evidence of age-related variance in health perceptions such as perceived physical function and perceived pain interference, how age influences the relationship between perceived physical functioning and perceived pain interference is less well understood. Additionally, how age interacts with the other antecedent personal factors has not been completely described.

Sex/Gender. Few studies examine the unique contributions of sex/gender upon perceived physical functioning and perceived pain interference. Among persons with work related chronic lumbar injuries, males were more likely (OR 1,4; $p = .008$) than females to return to work within 1 year after injury (McGeary, 2003). .The mean age of 42 for females and 47 for a male suggests typical role expectations of early middle aged females may affect disability and pain interference perceptions. Females are less likely to return to work, have more concerns about how changes in physical functioning affect family life, report increased pain intensity and report increased perceived pain interference (McGeary, 2003). Other studies (Juhakoski, Tenhonen, Anttonen, Kauppinen, & Arokoski, 2008; Lin, et al., 2006; Wand, McAuley, Marston, & De Souza, 2009) have suggested that gender differences in perceived physical function and perceived pain interference are either inconclusive or not present in lumbar degenerative spine conditions. This

presented an opportunity for this study to help clarify the influence of sex/gender in their effects on perceptions and health seeking behaviors in lumbar degenerative spine conditions.

Race/Ethnicity. When comparing persons with degenerative spine conditions by race and ethnicity, the evidence is unclear whether there are differences in perceived physical function or perceived pain interference (Lurie et al., 2008). In a study regarding self-reported health in persons with varying types of chronic conditions, black race was associated with greater compromises in physical function. Persons with white race were 3.7 times more likely to report better levels of all types of functioning (Spencer et al., 2009). Black adults are twice as likely to report limitations of self-care and instrumental activities of daily living when compared to all other races (Dey, 2006). What is more alarming, according to the Institute of Medicine (IOM), is that black adults will receive less vigorous physical therapy after a mobility impairing injury compared to other races (Smedley, Stith, & Nelson, 2003). In a chronic pain study, black participants had higher body mass index (M=31.6), and lower physical functioning when compared with white participants (Caldwell, et al., 2009). White persons were 3.7 times more likely to report better physical functioning and self-reported health than other races (Spencer, et al., 2009).

When specifically considering the racial differences in lumbar degenerative spine conditions, the investigators in the Spine Patient Outcomes Research Trial (SPORT) described in detail the difficulty they encountered in recruiting and randomizing persons based on race (Arega et al., 2006). Despite aggressive recruitment strategies to enhance diverse participation, they had less than 8 percent non-white participation (Arega, et al., 2006). It is difficult to make meaningful inferences regarding health perceptions or health care needs in general, with very low levels of racial and ethnic diversity like that seen in the SPORT trial.

In summary, the literature is limited regarding the effect of race on health perceptions in lumbar degenerative spine conditions. An additional challenge in evaluating the literature regarding race was that only one study (Arega, et al., 2006) specifically controlled for income level when evaluating the effect of race upon health perceptions. There is no specific evidence of racial/ethnicity related differences in perceived physical functioning and perceived disability in degenerative spine conditions, but the race and ethnicity differences noted in other chronic conditions support the need to consider this factor as a potential antecedent to these health perceptions. When considering these findings as a whole, the contributions of personal factors to perceptions of physical functioning and pain interference are clear, but the ways in which key personal factors interact with other factors has not been fully addressed.

Biologic personal factors. Much of the current medical literature focuses on physical functioning and pain interference as outcomes of surgically treated degenerative conditions. Within the confines of conservatively managed or non-operative degenerative spine conditions, the literature was analyzed regarding perceived physical functioning and perceived pain interference.

Lumbar Degenerative Spine Conditions. In persons with lumbar degenerative spine conditions, much of the literature focuses on specific pathologies. For example, persons with spinal stenosis and degenerative disc disease had substantially lower perceived physical functioning scores than those with other degenerative spine disorders (Zanoli, 2006). Additionally, Padua (2004) found that people with degenerative stenosis scored 12 points lower in physical functioning than the established normative scores on the SF-36 (Padua, 2004). Persons with spondylolisthesis had the highest level of perceived pain interference when compared to those with degenerative disc disease, spondylosis, stenosis and chronic low back

pain (Carreon, Glassman, & Howard, 2006). Nevertheless, no significant variance was seen in perceived physical functioning among the persons with the same lumbar degenerative spine conditions (Carreon, et al., 2006).

Despite these findings, what confuses the issue is that many persons who meet diagnostic criteria for degenerative conditions do not have overt impairment of physical function or complaints of pain (Haig, Tong, & Yamakawa, 2006). For example, a cohort of asymptomatic adults completed baseline and 3 year follow-up magnetic resonance imaging of the lumbar spine; in this study, 9 to 56 percent of the participants demonstrated radiologic evidence of degenerative spine changes in the absence of clinical symptoms (Jarvik, 2005). Among persons experiencing the identified lumbar degenerative spine conditions, severe lumbar stenosis and degenerative disc disease, patients consistently demonstrated lower levels of perceived physical functioning (Zanoli, 2006) while spondylolisthesis patients demonstrated higher levels of perceived pain interference (Carreon, et al., 2006).

The older people are, the more likely they are to experience lumbar degenerative spine conditions, especially stenosis and spondylolisthesis (AAOS, 2008). This indicates that separate analyses controlling for age and/or condition may be necessary to identify the unique contribution of each factor. A specific focus of the current study was to determine how the relationship between perceived physical functioning and perceived pain interference is affected by biologic factors such as category of lumbar degenerative spine condition.

Body mass index. Obesity, body mass index greater than 30 (CDC, 2009), has been associated with lower levels of perceived physical functioning across multiple disease states (Leon-Munoz et al., 2005). In lumbar degenerative spine conditions, the findings have been less clear. In a study comparing obese and non-obese persons (n = 209) with lumbar degenerative

spine conditions, the magnitude of improvement after treatment for both perceived physical function and perceived pain interference was similar for both groups (Djurasovic, 2008). Although the magnitude of change with treatment was the same for obese and non-obese people in this study (Djurasovic, 2008), the persons with obesity started treatment with lower perceived physical function and higher perceived pain interference and therefore still had lower perceived physical functioning and higher pain interference after treatment. Obesity has been implicated in contributing to some chronic pain conditions such as degenerative arthritis, can decrease HRQoL (Caldwell, et al., 2009) and is known to influence the pathological dynamics of degenerative musculoskeletal conditions (AAOS, 2008). Although the evidence regarding BMI and health perceptions in lumbar degenerative spine conditions is not entirely clear, there is sufficient evidence to include BMI as a biologic personal factor.

Comorbidities. Medical and psychological comorbidities have been shown to have a negative effect on perceived physical functioning in lumbar degenerative spine conditions at 6 months and one year after treatment (Slover, et al., 2006). Greater numbers of comorbid conditions are associated with lower levels of perceived physical functioning at baseline and after treatment in persons with spondylosis, spondylolisthesis, and herniated intervertebral disc (Slover, et al., 2006). More comorbidities are seen in persons with spinal stenosis and degenerative spondylolisthesis, presumably owing to the typically older age of those groups when compared to people with herniated intervertebral discs (Cummins, et al., 2006b). Similar to what was discussed regarding specific lumbar degenerative spine conditions and age, some relationships between these variables have already been established. In this study, the effect of the accumulation of multiple comorbidities upon perceived physical functioning and perceived disability in degenerative spine conditions was examined.

Social personal factors. In this section, the social personal factors are considered. Insurance status was identified as a social factor that would potentially influence the health perceptions, perceived physical functioning and perceived pain interference.

Insurance Status. Although insurance status would seem unrelated to either perceived physical functioning or perceived pain interference, lower levels of perceived physical functioning were associated with greater numbers of comorbid conditions and worker's compensation status (Slover, et al., 2006). In the period between 1999 and 2002, 22 percent of lost work hours were due to lumbar back complaints (Baldwin, 2007). Greater likelihood of return to work after receiving worker's compensation was predicted by perceptions of higher levels of physical function and lower levels of perceived disability, while a lower likelihood of return to work was found in persons reporting higher pain severity (Baldwin, 2007). In other studies, persons with spinal disorders that received workers compensation reported substantially lower physical functioning and physical composite scores than persons with other insurance types (Hee, 2001). Disease specific measures were better tools than generic measures for detecting change in condition and predicting return to work in persons with workers compensation insurance. There is ample evidence that persons with worker's compensation report lower levels of perceived physical functioning and higher levels of pain interference (Baldwin, 2007; Hee, 2001; Slover, et al., 2006) as well as some evidence that Medicaid patients may experience higher levels of perceived pain interference than persons with other insurance types (Cummins et al., 2006a).

When considering these findings regarding antecedent personal factors as a whole, the contributions of specific personal factors to health perceptions in some instances is clear. How key personal antecedent factors interact with other factors has not been fully addressed.

Specifically, this study explored how antecedent personal factors group together to influence perceived physical functioning, perceived pain interference and health seeking behaviors. The analysis section of Chapter 4 will discuss how individual personal factors were analyzed to determine the individual contribution of antecedent personal factors to perceived physical functioning and perceived pain interference.

Health Seeking Behaviors

The definition of health seeking behaviors in this study was previously defined as engagement in personal behaviors intended to improve health status, mitigate the consequences of chronic conditions or prevent health decline. Since the objective was to identify those behaviors that improve symptoms and slow the rate of decline in lumbar degenerative spine conditions, the literature was reviewed for behaviors that were consistently utilized in clinical practice and had demonstrated effectiveness in improving the clinical condition of the patient.

Health perceptions have been shown to influence health seeking behaviors in a number of chronic conditions. Improvements in health seeking behaviors have been demonstrated in care systems that use specific strategies such as engaging the person in decision making, intentional structured follow up and planned time with a care manager to influence health perceptions (Bodenheimer, 2005). In a cohort of heart failure patients (n = 387), key health seeking behaviors such as weighing themselves daily and reporting symptoms of worsening heart failure, were more frequently seen (p = .01) in those persons with better health perceptions (Baker et al., 2005a).

In persons with lumbar degenerative spine conditions, health perceptions have been associated with participation in various treatment activities. For example, in a study of Saudi women (n = 98) a higher level of perceived pain interference was associated with better

attendance at physical therapy appointments (r =.5; p < .05) (Al-Eisa, 2010). This study (Al-Eisa, 2010) and another study of 64 adults with chronic lumbar conditions, both demonstrated that a person's perceptions of the effectiveness of a behavior, such as prescribed exercise, in improving pain and functioning increases the likelihood that a person will participate in that behavior (Crowe, et al., 2010). The most common non-surgical treatment alternatives for lumbar degenerative spine conditions are prescribed exercise programs and medication use to reduce pain and related symptoms (Deutscher, et al., 2009). In the theoretical framework, health perceptions, perceived physical functioning and perceived pain interference were hypothesized to be influential in the patient's participation in care interventions such as prescribed exercise and the use of medications. In the next 2 sections, prescribed exercise regimens and medication used will be discussed followed by a discussion on patient responses to health seeking behaviors.

Prescribed exercise. Behaviors such as participation in prescribed exercise regimens are associated with improved HRQoL in many types of musculoskeletal conditions (Deutscher, et al., 2009), and perceptions of perceived pain interference and physical functioning influence the participation in prescribed exercise programs. In a study conducted in Israel between 2002 and 2006 (n = 22,019), perceived physical functioning and perceived pain interference was improved in persons that participated in physical therapy visits and completed their home therapy regimens in multiple types of musculoskeletal disorders (Deutscher, et al., 2009). One limitation of this study is that home participation in exercise regimens was a self-report measure that was subject to social desirability response bias.

Older persons with lumbar degenerative spine conditions participate in prescribed exercise as a way to ameliorate pain depending upon how well it improved the pain experience and whether or not aggravation of pain or interference with functioning occurred (Mailloux,

Finno, & Rainville, 2006). The variance in perceived physical functioning and perceived pain interference was studied in 169 patients that were randomized to several different types of prescribed exercise programs. Although perceived physical functioning and perceived pain interference improved in all groups, there were systematic differences in improvement based on personal factors such as age, sex/gender, and comorbidities (Stubbs, et al., 2010; Wessels, et al., 2007). Other types of insurance were not considered in those studies, but perceived pain interference and perception of poor physical functioning were related to lower levels of health seeking behaviors, such as participation in home exercises, in worker's compensation cases (Reme, Hagen, & Eriksen, 2009). Whether individuals covered by other types of insurance exhibit similar differences has not been studied. Since prescribed exercise is one of the most frequent treatment regimens for persons with lumbar degenerative spine conditions, understanding how health perceptions influence participation in prescribed exercise can contribute to understanding of the drivers of patient behaviors.

Medication use. The second health seeking behavior identified was the use of medication by patients. Higher levels of physical functioning and lower levels of pain related disability are reported in persons who have their chronic musculoskeletal pain controlled with opiates compared to those who do not use opiates as part of their chronic pain management (Soin, Cheng, Brown, Moufawad, & Mekhail, 2008). In contradiction, other studies have shown that withdrawal of opiate pain medications may result in improved physical functioning and decreased levels of disability (Crisostomo, et al., 2008). In a study of 158 patients with multiple medical problems, perceived need and perceived severity of disease influenced whether patients filled prescriptions and took medications (McHorney & Gadkari, 2010). Although this study

was not conducted in persons with lumbar degenerative spine conditions, it does highlight the multiple individual factors that may influence medication use.

In adults with lumbar degenerative spine conditions, perception of pain interference influenced patient participation in medication use (McCarberg & Barkin, 2001). How perceived physical functioning and perceived pain interference influence specific health seeking behaviors such as participation in prescribed exercise regimens and pain medication use has not been directly investigated.

Patient responses. One of the focuses of this study is how perceived physical functioning and perceived pain interference change over the time of treatment. As was previously reported, persons who participate in both physical therapy appointments and home exercise programs experience improvements in both perceived physical functioning and perceived pain interference (Deutscher, et al., 2009). The degree to which patients respond to treatment interventions is less clear which may be, in part, related to difficulty in discerning the difference between the effect of prescribed exercise and medication use. Both perceived physical functioning and perceived pain interference, as measured by the SF-36 physical functioning subscale and ODI, showed significant improvement after 6 months treatment at a multidisciplinary spine center (Artus, van der Windt, Jordan, & Hay, 2010; Baird, Worral, Haslam, & Haslam, 2008). One of the difficulties in determining patient responses to treatment in lumbar degenerative spine conditions is the lack of standardization in time frames. Time frames for patient responses are further discussed in Chapter 4 with the survey instruments.

Health Related Quality of Life.

Health related quality of life (HRQoL) is a construct that refers to the aspects of quality of life that are related to health (Wilson, 1995). In the theoretical model used for this study

(Figure 3), HRQoL was the final outcome. Although HRQoL was not examined in the present study, it is important to understand its role in lumbar degenerative spine conditions as it related to health perception and health seeking behaviors. HRQoL will be examined in future studies.

Health perceptions have been shown to be instrumental in influencing HRQoL in persons with lumbar degenerative spine condition treated surgically for their conditions (Block, 2003). A person's negative perception of his/her physical functioning has been linked to many undesirable health outcomes such as poorer HRQoL; increased risk for falls; fractures and disability; and increased health expenditures (Tomey & Sowers, 2009). Health seeking behaviors in lumbar degenerative spine conditions can be greatly influenced by a person's perception of his/her physical abilities and pain interference making health perceptions a key variable influencing health related quality of life (HRQoL) and treatment outcomes (Haig, Tong, Yamakawa, et al., 2006; Tang, 2007). This has been especially true in conditions such as lumbar degenerative spine conditions where patient perceptions have been related to health outcomes such as participation in health seeking behaviors and health related quality of life (Dixon & Johnston, 2008).

Summary

In summary, there are many studies in the available literature that examine the influence of single antecedent personal factors on perceived physical function and perceived pain interference. The findings of these studies support the selection of the hypothesized antecedent personal factors. There are inconsistent results regarding the role of some factors such as age, sex/gender, and BMI, however, other factors such as higher levels of comorbidity and insurance coverage by worker's compensations are clearly related to lower levels or of perceived physical function and greater perceived pain interference. Few studies have been done to clearly

document the role of race and ethnicity upon perceived physical functioning and perceived pain interference. This study presented an opportunity to understand the complex relationship of antecedent personal factors upon health perceptions using multivariate analysis. Furthermore, how perceptions influence key health seeking behaviors in lumbar degenerative spine conditions has not been well described.

CHAPTER 4: METHODS

This study used a repeated measures descriptive design to determine the influence of antecedent personal factors on perceived physical functioning, perceived pain interference and health seeking behaviors in patients with lumbar degenerative spine conditions. Demographic and clinical data were obtained from a medical chart audit combined with an established health outcomes data base. At the site where this study was conducted baseline data is collected at the patient's first visit as part of routine clinical care. Since 2007, perceived physical functioning and perceived pain interference measures have been collected as a routine part of care at entry into treatment, and are repeated at 12 weeks. A repeated measures design was used to determine changes in perceived physical functioning and perceived pain interference over the time of treatment. The data were collected from a multidisciplinary outpatient spine treatment center at an urban community medical center.

The purpose of this chapter is to provide a detailed methodological description of the study. This chapter is organized to describe the design, sample and setting, operational definitions, procedures, protection of human subjects and analysis. The sample and setting section includes a description of the setting, sample size, inclusion criteria and exclusion criteria. The operational definition section includes operational definitions of each of the antecedent personal factors (demographic, biologic and social), health perceptions (perceived physical function and perceived pain interference), and health seeking behaviors (prescribed exercise regimens and medication use). The next section describes the procedures that were used while conducting this study. After the procedures section, the methods that were used to protect human subjects is described. This chapter finishes with a description of the analytic procedures used to answer the research questions.

Design

Within the descriptive research design, the antecedents of perceived physical functioning and perceived pain interference, and their effects upon health seeking behaviors were analyzed using the theoretical framework discussed in chapter 2. In review, the research questions for this study were:

- How do antecedent personal factors, (a) demographic, (b) biologic, and (c) social, affect health perceptions such as perceived physical functioning and perceived pain interference at start of treatment and 12 weeks of treatment?
    - How do health perceptions vary between entry and 12 weeks of treatment?
- How do the health perceptions, (a) perceived physical functioning and (b) perceived pain interference at the start of treatment affect health seeking behaviors at 12 weeks of treatment?
- How do the antecedent personal factors influence health seeking behaviors when considering the relationship between perceived physical functioning and perceived pain interference?

In order to answer these questions, the study was conducted at an outpatient spine clinic in an urban community health system after institutional review board (IRB) approval was received from the study site. The IRB at Michigan State University accepted the study site IRB (IRB#11-335R). The next sections will describe the sample and setting proposed for this study.

Setting

The participating institution, which is an urban community hospital, has an outpatient neuroscience clinic that provides care for 6 distinct neuroscience populations. The spine center cares for non-surgically treated spine patients in a multidisciplinary care model. Of the 6

neuroscience clinics, only the Spine Center was involved in this study. The participating medical center cares for approximately 200 persons with non-surgical degenerative spine patients per month. A written letter of agreement was obtained as part of the submission of this proposal to the National Institutes of Health (NIH) for funding through the Ruth L. Kirschstein Nursing Research Service Award (NRSA). Confirmation of continued interest in pursuing this study was verified prior to submitting an IRB application to the study site.

Sample

The sample for this study was obtained from patients who had completed at least 12 weeks of non-surgical treatment for lumbar degenerative spine conditions. Information regarding the distributions of gender and race/ethnicity for the clinic were not available so estimates of a representative sample were developed from US census data. Estimates of planned enrollment were based on the population estimates of Grand Rapids, Michigan and Kent County Michigan. Kent County has a racial distribution that is 86% White, 9.3% Black, 2.1% Asian with the remainder of the racial categories less than 1% (US Census Bureau, 2009). The city of Grand Rapids, Michigan has a racial distribution that is 67% White; 20% Black; and 1.2% Asian. In Kent County, 9.5% of persons report Latino ethnicity and in the city of Grand Rapids, persons report Latino ethnicity at a rate of 13.1% (US Census Bureau). The planned enrollment is displayed in Table 1. For analysis purposes, the 'other' category was collapsed due to insufficient numbers and race was categorized as 'white,' 'black' and 'non-white.' The actual enrollment numbers are presented in Chapter 5. The original plan was to oversample to improve representation of diverse populations. During the IRB approval process, the method was changed to retrospective record review, and the decision was made to sample all available charts on site regardless of race/ethnicity. The consequences of this decision on the diversity of the

sample are further discussed in Chapter 6 under limitations. The determination of sample size is discussed in a subsequent section.

Table 1.

Estimates of Planned Enrollment.

	Sex/Gender		
Ethnic Category	Males	Females	**Total**
Hispanic	10	10	20 (15.4%)
Non Hispanic	55	55	110 (84.6%)
Ethnic Category Total	65	65	130 (100%)
Racial Category			
White	52	52	104 (80%)
Black or African American	10	10	20 (15.4%)
Other	3	3	6 (4%)
Racial Category Total	55	55	130 (100%)

Inclusion criteria. In order to be included in this study, the patient had to be diagnosed with lumbar degenerative spine conditions such as spondylosis, spondylolisthesis, lumbar spinal stenosis, degenerative disc disease, and herniated lumbar disc using the criteria of the American Association of Orthopedic Surgeons (AAOS). Procedures used for confirming diagnosis are discussed in the procedures section. This time frame was selected because it gives the patient the opportunity to complete physical therapy appointments and provider follow up (Deutscher, 2009). Potential subjects needed to have completed 12 weeks of non-operative conservative spine treatment by a physician or neuroscience nurse practitioner with a specialty in spine

rehabilitation and the ability to diagnose degenerative spine conditions.

Patients must have been referred for physical therapy visits. Patients must be able to read, write, hear and understand English because the health perception instruments were written in English. Symptomatic lumbar degenerative conditions rarely occur in adults under age 21 years, therefore only adults older than 21 years were considered for this study (Boden, et al., 1990).

Exclusion criteria. Patients were excluded if they required urgent surgery for trauma or urgent/emergent spinal symptoms. A patient history of previous back surgery was not considered an exclusion criteria but it was counted as a comorbid condition. Since participation in prescribed exercise is a key variable of this study, patients who did not have physical therapy ordered were excluded. Patients with major neurologic comorbidities such as Parkinson's disease, amyotrophic lateral sclerosis or multiple sclerosis were also excluded because these patients would be expected to require greater rehabilitation. As discussed above, patients under the age of 21 years were excluded.

Sample size. A minimum sample of 130 patients was obtained from the population of patients who had completed 12 weeks of non-operative care for lumbar degenerative spine conditions. The data were obtained from the records of the described multidisciplinary spine clinic in an urban community hospital. Since both multivariate regression analysis and structural equation modeling were used, power analysis was conducted for both analysis types.

For multivariate regression analysis, power analysis was conducted based on a power of .80 and medium effect size of .30. Power is defined as the ability of a statistical test to detect relationships, or the probability of committing a type II error subtracted from one (Vogt, 2005). Generally, a power level of 0.8 is considered acceptable (Trochim & Donnelly, 2007; Vogt,

2005) and therefore was utilized in this study for determination of sample size. Effect size, the magnitude or size of the relationship, can be expressed by Cohen criteria of Cohen's *d* (Shadish, Cook, & Campbell, 2002; Trochim & Donnelly, 2007; Vogt, 2005) and is expressed as the standard small $p = 0.10$, medium $p = 0.30$ or large $p = 0.50$ (Faul, Erdfelder, Lang, & Buchner, 2007). For purposes of this study a medium effect, $p=.30$ was used. Using G*Power statistical software (Faul, 2007), the minimum sample size for multivariate regression was calculated as 55.

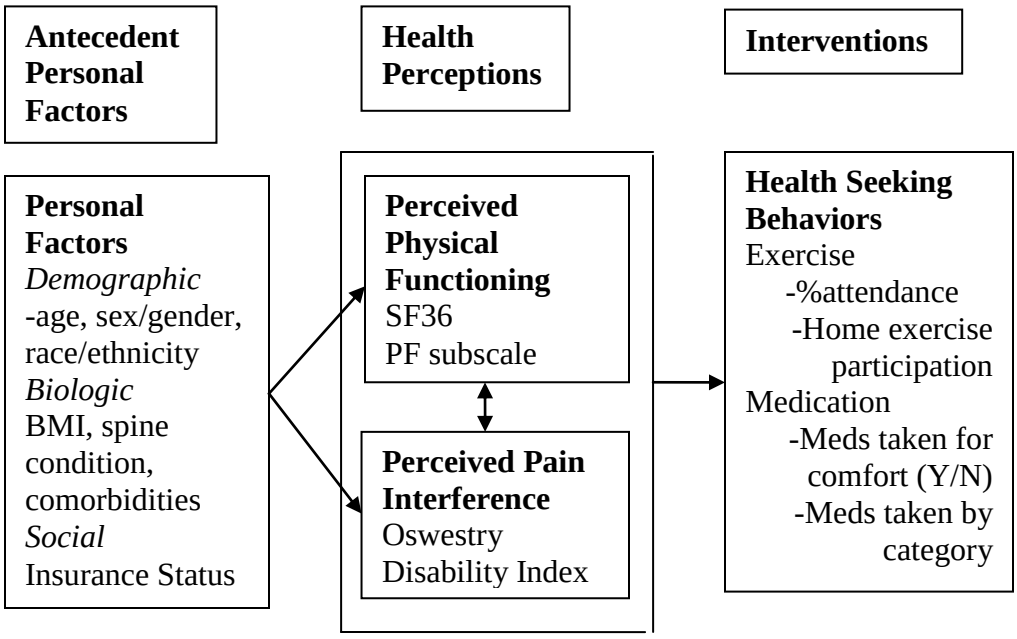
The other planned analysis was structural equation modeling (SEM). For SEM, sample size estimation is not an exact science and depends on multiple considerations (Kline, 2005). The quality of the data such as normality and missing data can affect the sample size needed for meaningful inferences (Raykov & Marcoulides, 2006). In general, SEM analysis should have a minimum sample size of 100 unless the model is very simple (Kline, 2005). Since the structural equation model was planned using only manifest variables and did not use latent variables, the structure can be considered relatively simple. Lastly, other authors have suggested that SEM sample sizes can be estimated by using a factor of 10 cases per variable of measurement (Raykov & Marcoulides, 2006) meaning in the case of this study, the model would require a sample size of 130. Given the issues that have been presented, the plan for this study was to collect data from a minimum of 130 patients. The next section will discuss the operational definitions of each variable in the proposed study.

Operational Definitions

Operational definitions provide the researcher a method for making theoretical concepts measureable for use in empirical research (Stommel & Wills, 2004). The next sections describe the proposed operational definitions used in this study. Figure 5 provides a visual representation of how the operational definitions of concepts fit within the theoretical model (Figure 4).

Antecedent personal factors. Based on the conceptual model and literature review of lumbar degenerative spine conditions, antecedent personal factors were grouped into three categories: demographic, biologic, and social. Demographic personal factors included: age, sex/gender, and race/ethnicity. Biologic personal factors included: body mass index, spinal condition, and comorbidities. Insurance status was the sole social personal factor. All of the personal factors were identified in the literature as potential factors that may influence and/or interact to affect perceived physical functioning, perceived pain interference and health seeking behaviors.

Figure 5. Study framework for lumbar degenerative spine conditions with empirical referents



Demographic antecedent personal factors. Age was obtained from the medical record as the patient's age in years on admission to the study. Likewise, sex/gender was obtained from medical record audit as a categorical variable. Race and ethnicity categories were collected from patient's self-report on admission to the clinic . Race and ethnicity were collected in the format

of the medical center's established categories which are White, Black, or Race/Other. At the study site, ethnicity is collected to identify those persons who identify with Hispanic ethnicity.

Biologic antecedent personal factors. In this study setting, height and weight are collected as actual measurements on the first clinic visit. The data were retrieved during chart review and were converted into body mass index (BMI) using the Centers for Disease Control (CDC) formula for adults: weight (lbs) / [height (inches)] ^{2} x 703 (CDC, 2009). Comorbidity was operationally defined as a count of other chronic health conditions in addition to the primary spinal disease. The comorbid conditions were determined from the patient's medical record and measured as a simple count of disease states. Osteoarthritis was not included as a comorbid condition in addition to spondylosis and stenosis since those conditions are directly related to degenerative osteoarthritis and would be collinear in analysis (Hickey, 2003; Kline, 2005).

Degenerative spinal disease condition was classified as those most common degenerative conditions that bring the patient to the clinic: spondylosis, spinal stenosis, herniated lumbar disc, spondylolisthesis and degenerative disc disease. The category of lumbar degenerative spine condition was obtained from the medical record based on the 9th version of the International Classifications of Disease Codes (ICD-9) for each degenerative condition. The ICD codes were developed to code and classify morbidity data from clinical records (CDC, 2010). It is acknowledged that persons have more than one spinal diagnosis. The primary degenerative spinal condition was used.

Social Antecedent Personal Factor. Insurance status was operationally defined as the person's insurance carriers as identified on the patient's chart. The insurance status was classified as commercial, Medicare, Medicaid, self-pay, and worker's compensation. Study

subjects may have more than one insurance type but only primary insurance information was collected.

Health perceptions. The operational definitions of health perceptions are organized around the concepts of perceived physical functioning and perceived pain interference. In this section, the operationalization of perceived physical functioning and perceived pain interference are described as well as the measurement relationships between these variables.

Perceived Physical Functioning. The physical functioning subscale of the Medical Outcomes Survey (MOS) Short Form 36 (SF-36) was used to measure perceived physical functioning. The SF-36 is a 36-item self-report health perception survey that assesses eight domains of general health: (a) physical functioning, (b) bodily pain, (c) general health perception, (d) vitality, (e) social functioning, (f) physical and (g) emotional role limitations, and (h) mental health (Ware, 2004). The questions asked in the physical functioning subscale specifically refer to the person's perception of function. The SF-36 has a separate two-item subscale for bodily pain (Ware, 2004). Although the SF-36 has been extensively used, it has been criticized in the literature for lack of sensitivity to the functioning defects common to low back disorders (Davidson & Keating, 2002; Davidson, et al., 2004).

The response format for the SF-36 physical functioning subscale is a three level Likert type response format designed to determine how a person's health affects his/her physical functioning. Response categories are "yes, limited a lot," "yes, limited a little," and "no, not limited at all" (Ware, 2004). Previously, perceived physical functioning was defined as a patient's appraisal of his/her ability to perform a variety of physical activities of varying difficulty, intensity, and function (Stewart, 1992). From the patient responses, norm based scoring is used with a score range of 0 to 100.

The eight domains of the SF-36 are divided into two categories-physical and mental health. The SF-36 was originally developed in 1989 and has had several revisions, including the SF-12, SF-6D, and SF-36 version 2, and the Arthritis Specific Health Index (Walters, 2003 ; Ware, 2004). The SF-36 has been used in almost 5000 studies, in a wide range of chronic diseases including back pain, asthma, spine care, multiple sclerosis, cancer, cardiovascular disease, depression, and musculoskeletal disease (Ware, 2004). The second version of the SF-36 was developed to shorten, simplify, and allow for better translation capacity for the tool. Some changes were made to the role functioning, mental health and vitality scales. No changes were made to the physical functioning scale (Ware, 2004).

All of the subscales of the SF-36 have demonstrated evidence of reliability and validity. The physical functioning subscale has a test-retest coefficient of reliability of 0.93. The ceiling effect was 18.7 percent and the floor effect was 0.5 percent (McHorney, 1992). Each of the eight subscales demonstrated internal consistency reliability coefficients greater than .80, except for social functioning, which had a internal consistency reliability coefficient (Cronbach's α) of 0.76 (Ware, 2004). Item discriminate validity values in the physical functioning subscale range from 0.41 for the bathing item to 0.78 for limitations of vigorous activities due to health (Ware, 1998). The extensive use of the physical functioning subscale of the SF-36 allows the investigator many opportunities to compare findings with other research on persons experiencing lumbar degenerative spine conditions, as well as other chronic conditions.

A number of investigators have described the use of the SF-36 physical functioning subscale in lumbar degenerative spine conditions. Zanoli, Jonsson and Stromquist (2006) assessed the variations in SF-36 scores in patients with degenerative lumbar spine disorders. Patients with degenerative spine conditions were expected to, and did demonstrate lower

physical functioning scores, confirming expected lower total SF-36 scores for degenerative conditions than the normative data given in the SF-36 manual for low back pain patients (Ware, 1994). Persons with lumbar degenerative spine conditions had an average SF-36 physical functioning score between 30 to 45 depending on specific spine pathology when compared to nonspecific low back pain (M = 70) and normative data (M = 85) (Zanoli, 2006). When using the SF-36 in patients with lumbar degenerative spine conditions, one study (Glassman et al., 2006) validated the work of Ware (1994) in the normative data of the SF-36 manual. This study found that the minimally important clinical difference for the physical functioning subscale is an increase of 5.42 points.

The SF-36 was used in a comparison of surgical and non-surgical care of patients with lumbar degenerative spine conditions (Thomas et al., 2007). In that study, the normative data from Ware (2004) regarding timing of SF-36 assessment every 12 weeks was substantiated in the spine conditions as a clinically meaningful time frame for observing changes in scores. Two groups of patients, one receiving surgical spine intervention and one receiving conservative non-surgical therapy, completed the SF-36 at baseline and every 3 months for one year. The physical functioning scores did not vary significantly between groups. The physical functioning scores improved 16.3 points over a year for the nonsurgical group and 18.5 points for the surgical group. For the current study, the timing of perceived physical function assessments is discussed further in subsequent sections.

Perceived pain interference. The Oswestry disability index (Fairbank & Prysent, 2000) was developed specifically to address problems associated with low back pathology including personal care, sitting, standing, walking, lifting and sexual activity. In the development of the Oswestry disability index (ODI), the International Classification of Function (ICF) definition of

disability was used. The ODI was chosen to represent the concept *perceived pain interference* rather than the bodily pain subscale of the SF-36 for two reasons. First, the SF-36 bodily pain subscale is comprised of only 2 questions. One question is about pain magnitude and the other is regarding pain interference. As previously stated, the ODI describes perceived pain interference in relation to activities known to be affected by lumbar degenerative spine conditions.

The original ODI definitions were developed from disablement, which is described as a process in which physical pathology leads to impaired function which in turn results in disability or restriction of behaviors necessary to execute basic activities and roles (Jette, 1998; Whiteneck, 2006). Disability is defined as the perceptions or cognitive constructions related to difficulties experienced in any of the domains of mobility, self-care, domestic life, or social life. This definition of the concept of disability was derived from the World Health Organization (WHO) disability model.

The ODI is a 10-item scale, with six levels of response using Likert type scoring. Each question asks the patient how pain interferes with different elements of his/her life (Fairbank, 2000). Although the scale was originally developed from a disability perspective, *all* of the questions posed to the patient ask about how pain interferes with specific activities. For example, regarding sitting, patients are asked to choose from the following statements regarding sitting:

I can sit in any chair as long as I like.
I can only sit in my favorite chair as long as I like.
Pain prevents me from sitting for more than 1 hour.
Pain prevents me from sitting for more than 1/2 hour.
Pain prevents me from sitting for more than 10 minutes.
Pain prevents me from sitting at all.

Each of the questions asks the patient to choose an item that most closely describes how the person perceives that pain interferes with specific activities. The first question asks about

pain intensity. The remaining questions ask about how pain interferes with personal care, lifting, walking, sitting, standing, sleeping, social life, traveling, and employment/homemaking. Because the question format clearly asks how a person perceives that pain interferes with activities of daily life, the definition for perceived pain interference was adopted for use in this study. Perceived pain interference is defined as the perceived interference of pain in vocational, social/recreational, and family/marital functioning (Kerns, et al., 1985). The ODI is scored as percentage of interference in the previously described activities that ranges from zero to one hundred. Higher scores indicate higher levels of pain interference.

One study (Grotle, et al., 2004) compared instruments used in studies of patients with low back pathology. One of the most common tools that offered evidence of reliability and validity was the ODI. The ODI was originally tested in 1976 and has subsequently gone through two revisions (Fairbank & Prysent, 2000). Like the SF-36, the test went through its most recent revision to improve sensitivity in high functioning patients because of a ceiling effect in that part of the sample. Test-retest reliability was 0.99 at 24 hours, 0.91 at 4 days and 0.83 at one week. The internal consistency was tested using Cronbach's alpha. Most recent testing demonstrated excellent internal consistency which was 0.87 to 0.89 (Davidson, et al., 2004; Fairbank & Prysent, 2000). Convergent construct validity was established based on several well-known indexes that measure how pain interferes with patient activities. The ODI has a convergent correlation with the Quebec Pain Scale of 0.80 and 0.82 with the Roland Morris Questionnaire. No studies were identified that addressed discriminant validity in the ODI (Firch, 2002; Fritz, 2001).

The content of the ODI makes it a suitable tool to determine the level of perceived pain interference that a person may experience from lumbar degenerative spine conditions. The

repeated uses of the ODI make it suitable for comparisons among different types of lumbar degenerative spine conditions. In the ODI, minimally important difference was tested at four points in the original testing of the instrument (Glassman, et al., 2006; Meade, Dyer, & Browne, 1990). More recently, the minimally important difference for ODI was determined to be a change of ten points (Glassman, et al., 2006; Hagg, Fritzell, & Nordwall, 2003). The next section describes the relationship between the SF-36 physical functioning subscale and the Oswestry Disability Index in order to facilitate understanding of the relationship between the measurement properties of perceived physical functioning and perceived pain interference.

The relationship between health perception variables. When evaluating the similarities and differences between the measures of perceived physical functioning and perceived pain interference, there are a number of issues to consider. First, because perceived physical functioning is being measured with the physical functioning *subscale* of the SF-36, many of the studies comparing the two tools, compare the physical composite score of the SF-36 to the ODI. Along with the ten items of the physical functioning subscale, the 3 item social functioning subscale, 2 item bodily pain subscale and 5 item general health subscale are also part of the physical composite subscale (Ware, 2004). That being said, 5 studies were identified that compared the psychometric properties of the physical functioning subscale of the SF-36 and the Oswestry Disability Index.

In a study comparing outcome measurements for low back pain and related conditions the relationship of perceived physical functioning and perceived pain interference is highlighted (Resnick & Dobrykowski, 2005). Researchers and clinicians are encouraged to select instruments that distinctly measure function specifically and how pain interferes with function. Secondly, overlap between the concepts perceived physical functioning and perceived pain

interference are distinctly different but related (Resnick & Dobrykowski, 2005) in that perceived pain can influence function and perceived functioning can influence pain. That being said, in evaluation of the use of the SF-36 physical functioning subscale for persons with lumbar degenerative spine conditions, the Pearson correlation has been reported as r = -.607 in one study (Monticone et al., 2009) and as high as r = -.66 in another (Mousavi, et al., 2006) indicating a substantial relationship between the concepts perceived physical function and perceived pain interference. The inverse relationship of the scores is because in the SF-36 physical functioning subscale higher scores indicate higher levels of functioning (Ware, 2004) whereas in the ODI a higher score indicates a higher level (Fairbank & Prysent, 2000) of perceived pain interference. Although the perceived physical functioning and pain interference are related to each other, in some lumbar spine patients, such as those with failed back surgery, improved physical function does not strongly correlate with lower levels of pain interference (Manca, Eldabe, Buchser, Kumar, & Taylor, 2010).

One study suggests that disease condition is context specific related to perceived physical functioning and pain. In a study of 300 cancer and non-cancer patients with chronic pain, there was increased pain interference in the cancer patients as compared to non-cancer patients (Hølen, Lydersen, Klepstad, Loge, & Kaasa, 2008). In another painful condition, persons who sustained traumatic pelvic and acetabular fractures (n = 90) were followed for a period of four years post trauma. Perceived physical functioning and perceived pain interference revealed a similar relationship (r = -0.72) as was found in the previously discussed lumbar degenerative spine studies. Similar findings were seen in a study of 180 community dwelling adults with multiple sclerosis. Lower perceived physical functioning was related to higher levels of pain interference (Ehde, Osborne, Hanley, Jensen, & Kraft, 2006). Although in many conditions, including

lumbar degenerative spine conditions, lower levels of perceived physical function are related to higher levels of perceived pain interference, the relationship is not straightforward nor clearly described.

In the construction of the back specific SF-36 (Davidson, et al., 2004) the items of the SF-36 physical functioning subscale, ODI and the Quebec Back Pain Disability Scale were used. The analysis done in that study is useful in understanding the similarities and differences between the scales. In the item analysis of the study (Davidson, et al., 2004) the questions of the ODI specifically queried regarding the role of pain interference. Another difference between the scales is seen in item content, where 6 of 10 items of the ODI asked about completely different activities than the SF-36 physical functioning subscale. A comparison of specific measurement properties, internal consistency reliability, intraclass correlation, minimum detectable change and effect size for the SF-36 physical functioning subscale and the Oswestry Disability Index (Davidson & Keating, 2002; Davidson, et al., 2004; Fairbank & Prysent, 2000; Monticone, et al., 2009) can be seen in Table 3.

Timing of health perception assessments. In this study, health perceptions were measured at entry into treatment and after 12 weeks of treatment. In assessing the timing of assessment of health perceptions, limited evidence beyond expert opinion was available. All studies reviewed used a baseline assessment, no matter which measurement instrument was used. The timing of assessments varied. Some studies offered baseline with one repeated measurement at 6 weeks, or 12 weeks. Others (Campbell, et al., 2006) had more vague references to baseline and follow up for "at least one year" (p.816). None of the studies offered rationale for the timing of assessments. For purposes of this study, health perceptions were measured at entry into

treatment (baseline) and 12 weeks of treatment to allow for detection of meaningful changes in scores due to treatment.

Table 2.

Measurement properties of the SF-36 Physical Functioning Subscale and Oswestry Disability Index.

Measurement	SF-36 Physical functioning subscale	Oswestry Disability Index
Cronbach's α	0.89	0.84
Intraclass Correlation Coefficient	0.91 (0.76-0.97)	0.92 (0.79-0.97)
Minimum Detectable Difference	16 (9-27)	10.5 (6-17)
Effect Size	0.41 (0.23-0.46)	0.30 (0.21-0.39)

Note: values in parentheses are 95% confidence intervals

In a study evaluating outcome measures for low back pain and related conditions, (Davidson & Keating, 2002) the physical composite score of the SF-36 and the Oswestry Disability Index were compared at entry into physical therapy and repeated at 6 weeks. The authors claim that the SF-36 and the Oswestry Disability index show similar and acceptable responsiveness. Although the authors (Davidson & Keating, 2002) attempted to overcome the controversy about differing methods of measuring responsiveness by using standardized response means, receiver operating characteristics and minimal detectable change, they chose a time frame of 6 weeks that other authors (Wand, et al., 2009) have described as problematic in detecting change. Wand et al (2009) criticized this time frame due to the issues of follow up treatment appointments such as physical therapy and favor the 12 week time frame for evaluating change.

In this study, perceived physical functioning was measured with the SF-36 physical functioning subscale and perceived pain interference was measured with the ODI. Health perceptions were measured at entry into treatment and repeated at 12 weeks.

Health seeking behaviors. In this section, the operational definitions for prescribed health seeking behaviors are defined and discussed. Health seeking behaviors include prescribed exercise regimens and medication use.

***Prescribed exercise regimens*.** In persons with lumbar degenerative spine conditions, exercise regimens are typically prescribed for the patient in the form of physical therapy appointments (May, 2007). Two measures of prescribed exercise were utilized in this study. First, participation in prescribed exercise regimens was operationalized as the proportion physical therapy visits that the patient attended. Secondly, participation was measured by the patient's report of how often they are performing their home exercise program.

At each physical therapy visit, the therapist evaluates the patient's participation in home exercise. It is documented using the question "How often are you doing your home exercise program?" Patient responses were collected and coded based on patient response. The responses were categorized as 'high participation' and 'low participation' to create a dichotomous variable for analysis. During data collection, however, the patient responses were collected verbatim from the physical therapy note and listed in the data spread sheet.. Once these were collected, the principal investigator read through them assessing for descriptors of the level of participation in home exercises. As was hypothesized, patients were easily identified as "high participation" or "low participation." Examples of high participation are statements such as "patient states are doing home exercises daily" or "patient feels that daily exercises are very helpful." An example of low participation is "I really haven't been doing them because they

make my pain worse." Unfortunately, there was a high level of missing data with this variable. This is discussed more fully in Chapter 5.

Medication use. The use of medication was operationalized in two ways. First, medication use was operationally defined as whether or not the patient was using medication to improve his/her condition. The question "Do you use medication to treat your pain?" (yes/no) was used to obtain this information. Secondly, medication use was operationalized as which categories of medication the patient is taking that will improve their pain and related symptoms. seen in Table 3.

This information was obtained from the medication list and the question on the physical therapy notes that states "Which medications are you taking that improve your pain?" Medications were categorized as opiates, over the counter, non-steroidal anti-inflammatory and anti-epileptic medications. Each category was given a yes/no score for each patient. A total number of medications each patient used to treat his/her lumbar degenerative spine condition was also developed.

Summary of Variables. A summary of the variables and the places where the data were found in the patient record can be seen in Table 3.

Data collection. The data for this study were collected from a combination of retrospective medical record audit from the paper chart and electronic medical record (EMR) and was accompanied by an electronic data base maintained by the clinic. Electronic data and medical record audit data were kept in a password protected spreadsheet on an encrypted external hard drive. All data for this study were part of the routine care of patients at this clinic Upon admission to the clinic, the following data are collected as part of the usual care by the business office coordinator or medical assistant: age, sex/gender, insurance status, height, and weight.

The patient is mailed the spine clinic admission assessment, SF-36 and ODI as part of routine care prior to the first appointment. If the patient does not bring the paperwork to the visit

Table 3.

Variables Used in this Study

Variable	Time Collected*	Variable Type	Instrument Used to Measure
Antecedent Personal Factors			
Demographic			
Age	T1	Continuous	Chart Face Sheet
Sex/Gender	T1	Categorical	Chart Face Sheet
Race/Ethnicity	T1	Categorical	Chart Face Sheet
Biologic			
BMI	T1	Continuous	Intake Questionnaire
Comorbidity	T1	Continuous	Health History
Spinal Disease Condition	T1	Categorical	Visit Encounter Record
Social			
Insurance Status	T1	Categorical	Chart Face Sheet
Health Perceptions			
Perceived Physical Functioning	T1 T2	Continuous	SF-36-PF Subscale
Pain Interference	T1 T2	Continuous	Oswestry Disability Index
Health Seeking Behaviors			
Prescribed Exercise			
Physical Therapy Attendance	T2	Categorical	Physical Therapy Notes
Home Exercise Participation	T2	Categorical	Physical Therapy Notes
Medication Use			
Medication Used	T1 T2	Categorical	Medication Form/PT notes
Medication Category	T1 T2	Categorical	PT Notes

*T1= entry into treatment T2=12 weeks of treatment .

the business office coordinator gives the patient an additional set of paperwork to fill out in the waiting room. The spine clinic admission assessment contains information about comorbidity.

Spinal Disease Condition was obtained from the diagnostic codes on the provider visit notes. Follow up SF-36 and ODI data are currently collected at 12 weeks after the initial visit as a routine part of care. The surveys are mailed out. If not returned within 10 days, a follow up call is placed to the patient.

Quality control and data management.. In order to maintain quality in data collection, code and procedure manuals were developed that included the operational definitions for data collection for each variable. Maintenance of confidentiality of protected health information (PHI) was the primary quality and data management issue. All electronic data were kept in a password protected encrypted electronic file on a secure external hard drive. Data collection was the sole responsibility of the primary investigator to avoid issues with interrater reliability when doing chart audits. In order to assure stability of data collection the data was collected twice for every 10^{th} patient. The data abstractions were compared for stability. Of the 30 charts assessed for stability, 28 of 30 were identical (.93). Errors in the remaining two charts were reviewed and found to be typographical data entry errors.

Protection of Human Subjects

The human subjects in this research study are persons who have received services at the outpatient spine center at an urban community hospital. Institutional review board (IRB) approval was obtained January 28, 2011 from Saint Mary's Health Care. Michigan State University (MSU) has a cooperative agreement with the study site for human subjects protection monitoring. Data for this research study were obtained by the principal investigator after IRB approval. The database files were uploaded to a password protected encrypted external hard drive. The data were obtained by retrospective review from the paper clinic chart, the health system's EMR and a de-identified database from the clinic that tracks patient outcomes. The

database specifically houses the SF-36 and ODI scores. Each patient was assigned a study number.

The risk to human subjects primarily existed in the necessity to maintain the strictest patient confidentiality. No new information was collected beyond the data that is collected in the course of clinical care. Patients were not expected to directly benefit from this study. Potential benefits to future patients arise from the findings of this study and the ability of practitioners to identify patients that are likely have poor perceived physical functioning and higher levels of pain interference and how they associate with health seeking behaviors. The results may improve the ability of practitioners to identify patients at risk for poor health outcomes so they can intensify interventions and coordinate referrals. Patients may ultimately benefit from contributing to the scientific knowledge base that supports future research such as contributing to the development of cognitive behavioral interventions, identification of patients at risk for poor treatment outcomes such as lower levels of perceived physical functioning and higher levels of pain interference. They may also contribute to the understanding of antecedents of health perceptions and health seeking behaviors in lumbar degenerative spine conditions.

Data Analysis

In this study, the objective was to use a repeated measures descriptive design to determine how antecedent personal factors influence health perceptions and health seeking behaviors. Health perception measures were obtained from a clinic data base of patients that completed the SF-36 and ODI at entry into treatment and at 12 weeks. The remainder of the study data was obtained from chart review. PASW (ver. 18) was used for the statistical analysis of research questions 1 and 2. Lisrel (Joreskog & Sorbom, 2006) was used for structural equation modeling in research question number 3. Multiple independent variables were assessed

for their effect on the dependent variables through a series of regression analyses and structural equation modeling. Two-tailed tests with a significance level of 0.05 were conducted.

In order to prepare the data for analysis, the data were first cleaned. The data required extensive cleaning. The medical center has had difficulty obtaining the personnel necessary to maintain the database, causing numerous gaps in data. The consort diagram (Figure 7) in Chapter 5 describes the case selection in detail. After cleaning, the data were assessed for normality and patterns of missing data.

Prior to statistical analysis, the health seeking behavior information about home exercise participation was analyzed for content. Patient self-report to the question "How often are you participating in your home exercises" was dichotomized as high participation and low participation. Patient responses were evaluated and coded by reading and rereading the responses, then developing coding definitions based on the theoretical framework. Notes were kept in the spreadsheet to improve consistency in coding. The method has been previously described by qualitative researchers (Fereday & Muir-Cochrane, 2006; Holloway, 2005).

Analysis plan for research questions. Before addressing the specific research questions, descriptive statistics were obtained for the antecedent personal factors, health perceptions and health seeking behaviors. For the continuous variables, range, mean, and standard deviation were calculated. For the categorical variables, frequencies and percentages were calculated. Table 3 provides a list of the level of measurement of each variable and indicates which variables are continuous, and which are categorical.

Research question 1. The first research question sought to examine how the antecedent personal factors affect perceived physical functioning and perceived pain interference in lumbar degenerative spine conditions at entry into treatment and at 12 weeks of treatment. The sub-

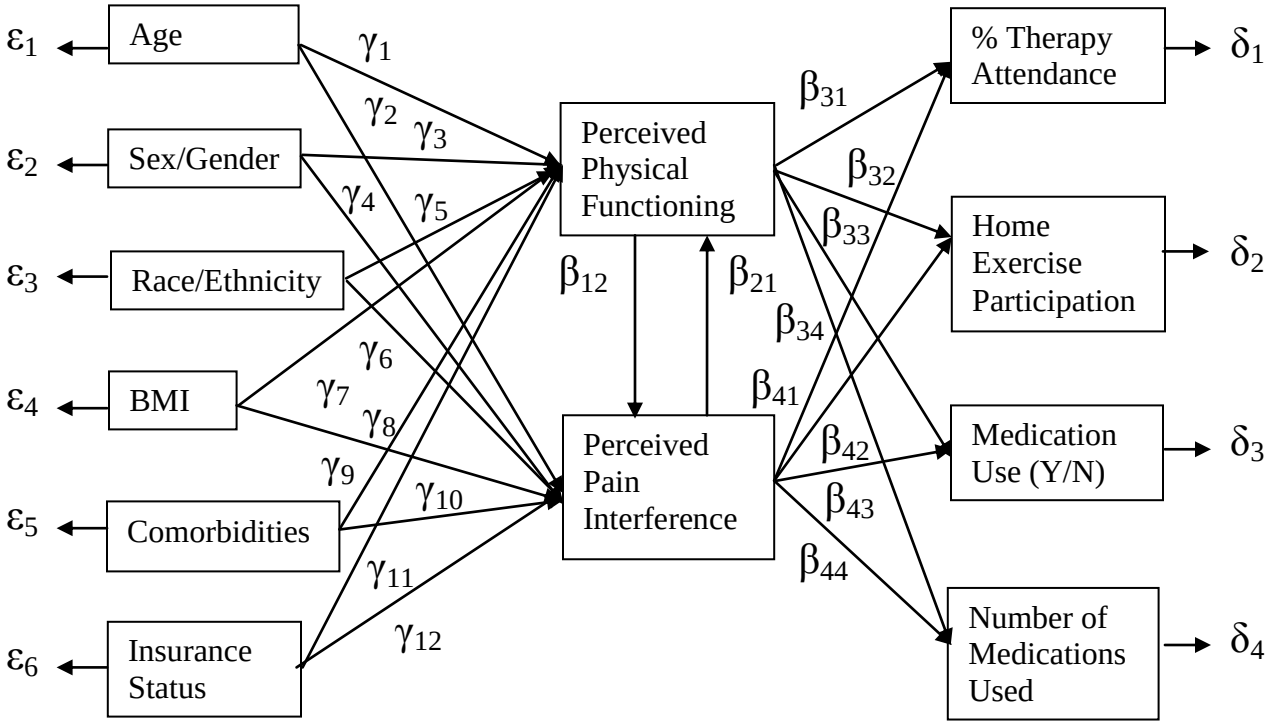
questions sought to determine how perceived physical functioning and perceived pain interference change from entry to 12 weeks of treatment. First, general linear modeling was used to determine which of the antecedent personal factors were associated with perceived physical functioning. Secondly, general linear modeling was used to determine which of the antecedent personal factors were associated with perceived pain interference.

The first equation included age, sex, race/ethnicity, body mass index, spinal condition, comorbidities and insurance status as the independent variables and perceived physical functioning as the dependent variable. Then the same antecedent personal factors-age, sex, race/ethnicity, body mass index, spinal condition, comorbidities and insurance status, were used as independent variables with perceived pain interference as the dependent variable. The second part of this research question required using multiple analysis of covariance (MANCOVA) to determine whether variance in perceived physical functioning and perceived pain interference exists between entry into treatment and at 12 weeks.

***Research question 2*.** The second research question sought to explore how perceived physical functioning and perceived pain interference at the start of treatment influenced health seeking behaviors at 12 weeks of treatment in lumbar degenerative spine conditions. Logistic regression was used to determine if the health perceptions, perceived physical function, and perceived pain interference at entry into treatment influenced health seeking behaviors at 12 weeks of treatment. First, perceived physical functioning and perceived pain interference were used as the independent variables and health seeking behaviors at 12 weeks were used as the dependent variables. Since there were four measures of health seeking behavior, each measure was examined in a separate regression model.

Research question 3. The third research question sought to examine how the antecedent personal factors influence health seeking behavior while considering the relationship between

Figure 6. Structural equation model for research question 3.



perceived physical functioning and perceived pain interference. Lisrel software (Joreskog & Sorbom, 2006)was used to develop a structural equation model based on the proposed model seen in Figure 6.

Summary

The purpose of this study was to contribute to the science by developing an understanding of how antecedent personal factors influence health perceptions, and how health perceptions, in turn, influence health seeking behaviors in lumbar degenerative spine conditions. Lumbar degenerative spine conditions are increasingly prevalent but study models that focus on only skeletal pathology have not yielded accurate predictions of health outcomes (Hicks, 2009). Little nursing research has been done to understand how biological, personal and social factors

group together to predict perceived physical functioning and perceived pain interference in person with lumbar degenerative spine conditions. The relationship of health perceptions to health seeking behaviors in lumbar degenerative spine conditions is largely unexplored despite the increased prevalence of these common musculoskeletal disorders (Hicks, 2009). Findings from this research can inform interdisciplinary research teams aimed at developing and testing interventions that modify cognitive and affective barriers to participation in health seeking behaviors for persons with lumbar degenerative spine conditions.

CHAPTER 5: RESULTS

The purpose of this study was to determine how antecedent personal factors influence health perceptions, how health perceptions influence health seeking behaviors, and how antecedent factors influence health seeking behaviors in persons with lumbar degenerative spine conditions. In the previously described theoretical model, the antecedent factors were identified as demographic, biologic, and social. The theoretical framework for this study can be seen in Figure 4 and the theoretical framework with empirical referents can be seen in figure 5. Health perceptions were identified as perceived physical functioning and perceived pain interference. Health seeking behaviors were identified as participation in prescribed exercises and medication use. In this chapter, the analyses used to answer the research questions are presented. This study answered the following research questions.

Research Question 1

The first research question sought to determine how antecedent personal factors: (a) demographic, (b) biologic, and (c) social, affect health perceptions such as perceived physical function and perceived pain interference at start of treatment, and 12 weeks of treatment. The demographic personal factors were age, sex/gender, and race/ethnicity. The biologic personal factors were body mass index (BMI), lumbar degenerative spine condition, and comorbidity. The social personal factor was insurance status.

Subquestion 1. A subquestion to research question 1 was also answered. The subquestion sought to determine how health perceptions varied between entry to treatment and 12 weeks of treatment.

Research Question 2

The second research question sought to determine how health perceptions, (a) perceived physical function, and (b) perceived pain interference, at the start of treatment influence health seeking behaviors at 12 weeks of treatment.

Research Question 3

The final research question sought to determine how the antecedent personal factors influenced health seeking behaviors when considering the relationship between perceived physical functioning and pain interference.

Data Management

In order to obtain a sample that was appropriate for this study, several steps occurred. The data were obtained from two sources: an outcome database for spine patients and a medical record audit. First, the database was assessed for potential patients, and then the medical record audit was conducted. Inclusion and exclusion criteria were assessed at two points: during the database assessment and during the medical record audit.

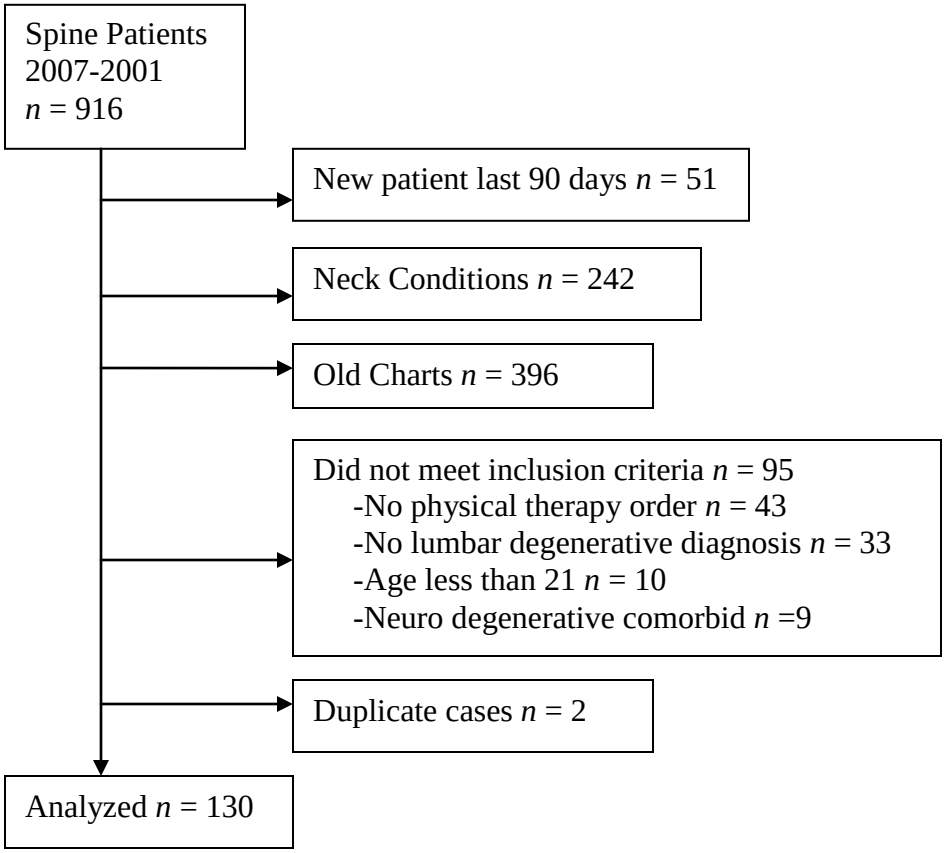
Sample determination from the database. In the spine clinic, 916 patients were cared for between September 2007 and 2011. First, any new patients from the previous 90 days were eliminated from eligibility because they had not completed 12 weeks of conservative therapy (n = 51). Next, the data set was examined for other reasons that persons did not meet inclusion criteria. Twenty-eight percent (n =242) of the data set represented patients that were seen for degenerative *neck* conditions so those patients were excluded.

Sample determination from the medical record audit. When preparing for medical record review, medical records staff indicated that obtaining charts for patients prior to April 2009 would result in substantial cost and work burden; therefore, only the medical records of

patients seen after April 2009 were audited in this study. The remaining number of charts available for audit was 227. The minimum sample size for this study was determined to be 130 therefore a medical record sample of 227 was deemed adequate. The rationale for sample size determination was discussed in Chapter 4. During the medical record audit, an additional 95 patients were excluded. Patients were excluded for: no physical therapy order (*n* = 43); diagnosis other than lumbar degenerative spine condition (*n* = 33); age less than 21 years (*n* = 10); and presence of a comorbid neurodegenerative condition (*n* = 9). There were also 2 duplicate cases

Final sample determination. The final sample size for this study was 130 based on the inclusion and exclusion criteria and time frame of care in the clinic. This sample size was deemed to be adequate based on a power of .8 and a medium effect size of .3. Figure 7 outlines.

Figure 7. Determination of Sample Size by Consort Criteria



the manner in which the final sample was obtained. In the next section, the descriptive analysis of the data is presented.

Descriptive Analysis of the Sample

Prior to embarking on the analysis of the research question, descriptive analysis was performed on the data. The descriptive analysis was performed in accordance with the theoretical model. First antecedent personal factors were analyzed, followed by health perceptions and health seeking behaviors.

Antecedent personal factors. As described in the theoretical model, the antecedent personal factors were subdivided into 3 categories: demographic, biologic and social. The demographic personal factors were age, sex/gender, and race/ethnicity.

Demographic personal factors. In the study the age of the patients ranged from 21 to 91 (M = 54.2; SD = 14.7). The sample was comprised of 79 females (60.8%) and 51 males (39.2%). The race and ethnicity statistics reveal that the sample comprised of 88.5 % white persons (*n* = 115), 6.2 % black persons (*n* = 8) and 2.3 % other races and ethnicities (*n* = 3).

Biologic personal factors. In this study, the biologic personal factors were body mass index (BMI), count of comorbidities, and diagnosis of a degenerative spine condition. Body mass index was calculated using the Center for Disease Control formula for determining body mass index (CDC, 2009) equal to weight in pounds/height in inches^2 x 703. For this sample, the body mass index ranged from 19.4 to 56.1 (M = 30.7; SD = 7.37).

The sample consisted of individuals with 4 types of lumbar degenerative spine conditions. Persons with herniated disc (*n* = 42; 32.3%) and degenerative disc disease (DDD) (*n* = 42; 32.3%) represented the majority of the sample. The remainder of the sample consisted of persons with spondylolisthesis (*n* = 15; 11.5%), stenosis (*n* = 23; 9.2%), and other (*n* = 15;

11.5%). The other category consisted of persons that met the criteria for lumbar degenerative spine condition but conflicting documentation made accurately classifying the patient condition

Table 4.

Descriptive statistics for antecedent personal factors

Age		M	(SD)
		54.2	(14.7)
Sex/Gender		*n*	(%)
	Male	51	(39.2)
	Female	79	(60.8)
	Missing	0	(0.0)
Race/Ethnicity		*n*	(%)
	White	115	(88.5)
	Other	11	(8.5)
	Missing	4	(3.1)
Body Mass Index		M	(SD)
		30.7	(7.4)
Spine Condition		*n*	(%)
	Herniated Disc	42	(32.3)
	DDD	42	(32.3)
	Spondylolisthesis	15	(11.5)
	Stenosis	12	(9.2)
	Other	15	(11.5)
	Missing	4	(3.1)
Comorbidities		M	(SD)
		2.7	(2.2)
Insurance Status		*n*	(%)
	Commercial	71	(54.0)
	Medicare	35	(26.9)
	Medicaid	16	(12.3)
	Self-Pay	6	(4.0)
	Missing	2	(1.5)

uncertain. The comorbidities were measured as a count of comorbid conditions in addition to the spine condition. The count of comorbidities for the sample ranged from 0 to 10 while the mean number of comorbidities was 2.7 (SD = 2.2).

Social personal factors. Insurance status was the social personal factor. Persons with commercial insurance represented the majority of the sample (*n* = 71; 54.0%), followed by Medicare (*n* = 35; 26.9%), Medicaid (*n* = 16; 12.6%) and self-pay (*n* = 6; 4.6%). A summary of the descriptive statistics can be seen in Table 4.

Health perceptions. The health perception variables in this study are perceived physical function and perceived pain interference. Perceived physical functioning was measured by the 10 item physical functioning subscale of the SF-36. Perceived pain interference was measured using the Oswestry disability index. Both scales have a minimum score of 0 and a maximum score of 100. They were both measured at entry into treatment and 12 weeks of treatment.

Perceived physical functioning. The mean perceived physical functioning score for persons in this study at entry into treatment was 61.41 (SD = 18.03; range 33 to 100). After 12 weeks of treatment for lumbar degenerative spine conditions, the mean perceived physical functioning score increased to 68.71 (SD = 19.22; range 33 to 100). Survey answers that indicated higher levels of perceived physical function and lower scores indicated lower levels of perceived physical functioning.

Perceived pain interference. The mean perceived pain interference was 48.57 (SD = 17.81; range 6 to 98) at start of treatment. After completing 12 weeks of treatment for lumbar degenerative spine conditions the mean perceived pain interference score decreased to 38.59 (SD = 22.41; range 0 to 88). Lower scores indicate lower levels of perceived pain interference and higher scores indicate higher levels of pain interference in daily activities.

Reliability of health perception scales. Before analyzing the research questions, internal consistency reliability of the health perception data was assessed using Cronbach's alpha. Cronbach's alpha is an assessment of reliability that estimates how much of the variance in scale items are accounted for by a single factor (Vogt, 2005). At the start of treatment, the internal consistency reliability for perceived physical functioning was .910 and at 12 weeks of treatment the internal consistency reliability was .927. Other authors have found similar internal consistency reliability values with Cronbach α values between .860 and .890 (Davidson & Keating, 2002; Davidson, et al., 2004; Fairbank & Prysent, 2000; Monticone, et al., 2009).

Unfortunately, the clinic reports only the summary score for the ODI. Internal consistency reliability could not be calculated for the ODI because the scores for individual items were not available. In the next section, the health seeking behaviors used in this study are discussed.

Health seeking behaviors. In this study, health seeking behaviors were participation in physical therapy and medication use. There were two variables serving as indictors for each behavior. For participation in physical therapy, the variables were the percentage of ordered physical therapy appointments attended by the patient and the degree to which the person participated in the prescribed home exercise program were the measures of the concept. Medication use was measured by the patient's self-report of whether medication was used to alleviate symptoms of lumbar degenerative spine conditions, and by the categories of medications used by the patient.

Prescribed exercise regimens. As was previously indicated, prescribed exercise was measured in two ways; as physical therapy attendance and participation in home exercise. A person's physical therapy attendance was calculated as the percentage of the ordered physical

therapy visits that were attended. In this study, the minimum attendance score was 0 % and the maximum of 100 %. The mean physical therapy attendance percentage was 79.6 (SD = 36.4).

The second measure of participation in prescribed exercise regimens was self-report of participation in home exercises. Patients responses were categorized as "high participation" and "low participation" as discussed in Chapter 4. In this study 54 persons (41.5%) were in the high participation group, and 59 persons (45.4%) were in the low participation group. In 17 cases (13.1%), either the number of visits ordered or the number of visits attended was not recorded in the medical record. A summary of the descriptive statistics for prescribed exercise behaviors can be seen in Table 5.

Medication use. In this study, data regarding all medication that patients used to ameliorate the symptoms of lumbar degenerative spine conditions were collected and analyzed. The types of medications used that the patient was using was collected. The Data were analyzed in 3 ways. First, whether or not the patient was using medication to control the effects of lumbar degenerative spine conditions, then, the categories of medications were assessed. Finally, a count of the number of categories of medications the patient was using was created. In this study, the medication categories that were considered were opiate, non-opiate, muscle relaxants, non-steriodal anti-inflammatory drugs (NSAIDS), and anti-epileptic drugs (AEDS).

There were 99 persons (76.2%) who used medication to attempt to influence the consequences of lumbar degenerative spine conditions and 28 (21.4%) did not. In 3 cases (2.3%) there was conflicting evidence regarding whether the patient was using medications or not; therefore, those cases were left as missing data.

Medications were then analyzed by drug class. Not surprisingly, the most frequent drug class was opiates (n = 48; 36.9%) and was represented by drugs such as oxycodone and

hydrocodone. Opiates were followed closely by non-steriodal anti-inflammatory drugs (NSAIDS) such as ibuprofen, naproxyn and celecoxib (*n* = 47; 36.2%). Muscle relaxants were the next most common pharmaceutical agent used by patients (*n* = 16; 12.6%). Typical muscle

Table 5.

Descriptive statistics for Health Seeking Behaviors

Percent Physical Therapy Appointments Attended	M	(SD)
	79.6	(36.4)
Home Exercise Participation	*n*	(%)
High	51	(39.2)
Low	79	(60.8)
Missing	0	(0.0)
Medication Use	*n*	(%)
Yes	99	(75.2)
No	28	(21.5)
Missing	3	(2.3)
Medication Category*	*n*	(%)
Opiates	48	(36.9)
Misc. Analgesics	13	(10.0)
Muscle Relaxants	16	(12.9)
NSAIDS	47	(36.2)
Anti-Epileptics	14	(10.8)
Steroids	3	(2.3)
Number of Medications	*n*	(%)
0	28	(21.5)
1	54	(41.5)
2	33	(25.4)
3	6	(4.6)
4	2	(1.5)
5	1	(0.8)
Missing	3	(2.3)

*Total for medication category is greater than 100% because many patients were on more than one medication

relaxants that were used by the patients in this sample were cyclobenzaprine, metaxalone, and methocarbamol. Anti-epileptic drugs (AEDs), such as gabapentin and pregabalin were also used by patients in this sample as adjuvant therapy in pain management (*n* = 14; 10.8%). Another class of drugs, the miscellaneous analgesics, is related to, but different from, opiates and includes such drugs as propoxyphene and tramadol. In this sample, the miscellaneous analgesics represented 10 percent (*n* =13) of the sample. Lastly, a few patients receive catabolic steroid medications such as methylprednisolone and prednisone (*n* = 3; 2.3%). Many patients (32.2%) were taking more than one agent to influence the effects of lumbar degenerative spine conditions. A summary of the descriptive statistics for health seeking behaviors can be seen in Table 5.

Missing Data Analysis

Before attempting to answer the research questions, the patterns and amounts of missing data were explored. Missing data occurred from several sources, including when patients did not return surveys, when there were too few staff to send out surveys at the 12 week follow up, when data were left undocumented in the clinic and when various data elements were contradictory. The purpose of the missing data analysis was to determine patterns of missingness that would alter the analysis and study results (McKnight, McKnight, Sidani, & Figueredo, 2007). The Oswestry Disability Index (ODI) and SF-36 at entry into treatment accounted for the majority of missing data. Table 6 displays the distribution of missing data points. Missing data is expressed as number of missing data points and percent of total sample (*n* = 130).

Most of the variables were found to have less than 5 percent missing data. Since there was greater than 20 % missing data for perceived physical function at the start of treatment and the ODI index at 12 weeks, the decision was made to impute values for these variables.

Maximum likelihood estimation was used to impute values for SF-36 physical functioning subscale and the ODI at start of treatment and 12 weeks of treatment. Maximum likelihood estimation is a method of estimating missing values through the creation of subsets of cases that are similar to those with missing values (Kline, 2005; McKnight, et al., 2007). Amos 17 (SPSS, 2009) was used to impute values for the SF-36 physical functioning subscale and the ODI.

Table 6.

Description of missing data

	n	(%)
Age	2	(1.5%)
Sex/Gender	0	(0.0%)
Race/Ethnicity	0	(0.0%)
BMI	5	(3.8%)
Spine Condition	0	(0.0%)
Comorbidities	4	(3.1%)
Insurance Status	0	(0.0%)
PF Start of Treatment	31	(23.8%)
PF 12 weeks	6	(4.6%)
ODI Start of Treatment	4	(3.1%)
ODI 12 weeks	31	(23.8%)
Participation In PT	0	(0.0%)
Home Exercises	17	(13.1%)
Medication Use	0	(0.0%)
Medication Category	6	(4.6%)

Summary

The data for this study were obtained in retrospective chart review. The final sample included 130 patients. In the next section, the analysis completed for each research question will be addressed.

Research Question Results

Research question 1. The first research question and sub-question sought to determine the influences of the antecedent personal factors on physical functioning at the beginning of

treatment and at 12 weeks. The general linear model was employed to develop 4 models using PASW version 17 software (SPSS, 2009). In the general linear model the antecedent personal factors, age, sex/gender, race/ethnicity, BMI, spine condition, comorbidities, and insurance status were used as the independent variables in all models. Separate models were developed for the SF-36 physical functioning subscale at the start of treatment and 12 weeks as the dependent variable. Then, the antecedent personal factors were used as the independent variable and the ODI was used as the dependent variable at entry into treatment and 12 weeks.

Prior to starting treatment, perceived physical functioning was assessed using the physical functioning subscale of the SF-36. This 10 item scale has a minimum score of 0 and a maximum score of 100. Higher scores indicate that a person perceives their physical functioning to be higher or better (Ware, 2004). The ODI is also scored from 0 to 100 but in this case, higher numbers indicate higher levels of perceived pain interference in daily activities (Fairbank & Prysent, 2000).

Influences of antecedent personal factors on perceived physical function at the start of treatment. Using the general linear model, the categorical independent variables were sex/gender, race/ethnicity, spine condition and insurance status. The continuous variables were age, body mass index and number of comorbidities. The dependent variable was the physical functioning subscale of the SF-36. In the final model, only sex/gender was a significant predictor of perceived physical functioning ($F = 2.21$, $p = .014$). The model accounted for 21.0 percent of the variance ($R^2 = .21$). A summary of the model statistics can be seen in Table 7. In this table, only sex/gender is significant in predicting perceived physical functioning. On average, females scored 9.4 points lower ($p = .014$) in perceived physical functioning (CI 1.70, 14.48) than males.

Table 7.

Model for antecedent personal factors influencing perceived physical functioning at entry in treatment.

Parameter	B	Std. Error	Sig	95% Confidence Interval	
				Lower Bound	Upper Bound
Intercept	101.6				
Age	-.180	.146	.221	-.469	.110
Sex/Gender			.014	1.70	14.48
Male	8.09	3.22			
Female*					
Race/Ethnicity	-14.39	9.49	.132	-33.20	4.42
White	-11.45	10.95	.298	-33.16	10.26
Black					
Other*					
BMI	-.275	-1.30	.196	-.694	.144
Comorbidities	-.303	.772	.695	-1.83	1.23
Spine Condition					
Herniated Disc	-9.62	5.46	.081	-20.44	1.21
Deg. Disc Disease	-7.20	5.60	.202	-18.30	3.91
Stenosis	-8.45	7.00	.230	-22.32	5.42
Spondylolisthesis	-10.87	6.27	.086	-23.29	1.55
Other*					
Insurance Status	-4.26	.15	.339	-.47	.11
Medicare	-9.63	.77	.071	-1.83	1.23
Medicaid	-14.16	.21	.057	-.69	.14
Self-Pay					
Commercial*					

*reference category

Table 8.

Model for antecedent personal factors influence upon perceived pain interference at entry in treatment.

Parameter	B	Std. Error	Sig	95% Confidence Interval	
				Lower Bound	Upper Bound
Intercept	44.54				
Age	.037	.159	.818	-.278	.352
Sex/Gender					
Male	-.577	3.51	.870	-7.54	6.38
Female*					
Race/Ethnicity					
White	10.29	4.83	.322	-10.20	30.78
Black	6.93	11.93	.562	-16.72	30.59
Other*					
BMI	.148	.230	.521	-.308	.605
Comorbidities	.583	.841	.490	-1.08	2.25
Spine Condition					
Herniated Disc					
Deg. Disc Disease	-.400	5.95	.947	-12.19	11.39
Stenosis	.101	6.10	.987	-12.00	12.20
Spondylolisthesis	8.43	7.62	.271	-6.68	23.55
Other*	5.11	6.83	.456	-8.42	18.64
Insurance Status					11.64
Medicare	2.06	4.83	.427	-7.52	28.31
Medicaid	16.92	5.75	.004	5.53	28.24
Self-Pay	12.34	8.02	.127	-3.57	
Commercial*					

*reference category

Influences of antecedent personal factors on perceived pain interference at start of treatment. The general linear model was used to determine how the antecedent personal factors,

age sex/gender, race/ethnicity, BMI, spine condition, count of comorbidities, and insurance status influence perceived pain interference. Insurance status was the only significant factor (F=12.04; p = .001) that predicted perceived physical functioning at start of treatment when considering pain interference at the start of treatment. Table 8 provides a summary of the entire model describing the antecedent personal factors influence on perceived pain interference at start of treatment.

To further understand the differences among insurance types for perceived pain interference, further analysis was conducted. Bonferroni correction was done to adjust for multiple comparisons. On average, persons with Medicaid insurance had a higher mean perceived pain interference (CI 5.53, 28.31) score than persons who self-pay (1.96 points), Medicare (14.44 points) and commercial insurance (18.59 points). Table 9 displays the mean differences between insurance types in pain interference at start of treatment. Persons with

Table 9.

Comparison of mean differences in perceived pain interference at start of treatment among insurance types.

Insurance type M (SD)	Medicare	Medicaid	Commercial	Self-Pay
Medicare 48.5(16.0)		-14.86 (p = .183)	2.06 (p =.999)	-10.72 (p = .846)
Medicaid 63.1(13.8)			16.92 (p = .024)*	4.59 (p = .996)
Commercial 44.5(17.9)				-12.34 (p = .558)
Self-Pay 61.2(10.5)				

*significant at .05 level with Bonferroni correction for multiple comparisons

Table 10.

Initial model for the influence of antecedent personal factors on perceived physical function at 12 weeks of treatment.

Parameter	B	Std. Error	Sig	95% Confidence Interval	
				Lower Bound	Upper Bound
Intercept	96.82				
Age	-.244	.155	.117	-.551	.062
Sex/Gender					
Male	5.61	3.41	.103	-1.16	12.38
Female*					
Race/Ethnicity			.706	-16.12	23.73
White	3.80	10.05	.714	-18.74	27.25
Black	4.26	11.60			
Other*					
BMI	-.328	.224	.146	-.771	.116
Comorbidities	-1.61	.818	.052	-3.29	.014
Spine Condition					
Herniated Disc	-2.14	5.78	.712	-13.61	9.32
Deg. Disc Disease	-3.37	5.94	.571	-15.14	8.39
Stenosis	.170	7.41	.982	-14.52	14.86
Spondylolisthesis	-.800	6.64	.904	-13.96	12.36
Other*					
Insurance Status	-.134	4.70	.997	-9.50	9.18
Medicare	-20.35	5.59	<.001	-31.44	-9.73
Medicaid	-26.18	7.80	.001	-42.64	-10.71
Self-Pay					
Commercial*					

R^2 = .339 (Adjusted R^2 = .260) *reference category

Medicaid insurance had significantly higher perceived pain interference than those with commercial insurances. There were large differences between other insurance types, such as the 14.8 point higher scores that persons with Medicaid insurance had, than those persons with Medicare. Although the mean difference between Medicare and Medicaid appears quite large, it is not significant after corrections for multiple comparisons.

Influences of antecedent personal factors on perceived physical functioning at 12 weeks of treatment. After 12 weeks of conservative non-operative treatment for lumbar spine conditions, patients were reassessed for perceived physical functioning and perceived pain interference using the SF-36 physical functioning subscale and the ODI index as a routine part of care. The general linear model was used to determine how the antecedent personal factors, age, sex/gender, race/ethnicity, BMI, spine condition, count of comorbidities, and insurance status influenced the health perceptions, perceived physical functioning and perceived pain interference. The initial model for perceived physical functioning accounted for 26.0 percent of the variance (R^2 = .260) and included only insurance status (F = 4.26; p < .001) as a significant. predictor of perceived physical functioning. A summary of the model of antecedent personal factor influences on perceived physical functioning can be seen in Table 10. In an attempt to find a better model fit, general linear modeling was performed using only insurance status and count of comorbidities. The final model for influences of antecedent personal factors on perceived physical functioning at 12 weeks of treatment included insurance status and count of comorbidities (F = 11.97; *p* <.001) and accounted for 28.5% of the variance (R^2 =.285). The final model also reduced the difference between the R^2 and adjusted R^2. In the first model, the R^2 was .339 and adjusted R^2 was .260. In the final model, the R^2 was .285 with an adjusted R^2

of .261. Value similarity between the R^2 and adjusted R^2 are one method of determining that the model fit is acceptable (Field, 2005; Vogt, 2005) A summary of the final model can be seen in Table 11.

Table 11.

Final model for the influence of antecedent personal factors on perceived physical functioning at 12 weeks of treatment.

Parameter	B	Std. Error	Sig	95% Confidence Interval	
				Lower Bound	Upper Bound
Intercept	79.95				
Comorbidities	-2.26	.744	.003	-3.73	-.787
Insurance Status					
Medicare	-4.86	3.73	.195	-12.25	2.52
Medicaid	-19.02	4.94	<.001	-28.81	-9.23
Self-Pay	-20.83	7.15	.004	-34.98	-6.68
Commercial*					

R^2 = .285 (Adjusted R^2 = .261) *reference category

Influences of antecedent personal factors on perceived pain interference at 12 weeks of treatment. When attempting to determine which antecedent personal factors were influential in perceived pain interference, several steps were employed because the initial model was not significant. In the first step (Table 12), any variables with *t* values -/+ 1.00 were retained in attempt to develop a significant model. The models were reduced at each step and in the final step, and in the final model, only insurance status remained as a significant influence on perceived pain interference. The stepwise method in model development can be seen in Tables 12 through 14. In the second step, age, sex, and spine condition were removed resulting in a

better model (Table 13). Since there were no significant parameters, those with the lowest *t* value were removed until one or more parameter became significant. Although the final model was significant (Table 14), it only accounted for a modest 4.9 percent of the variance ($R^2 = .049$).

Table 12.

Initial model for the influence of antecedent personal factors upon perceived pain interference at 12 weeks of treatment.

Step	R^2	F	Sig	Parameter	B	Std. Error	*t*	Sig
1	.069	1.69	.072	Intercept	-4.20			
				Age	.071	.279	.367	.715
				Sex/Gender				
				Male	.619	4.26	.145	.885
				Female*				
				Race				
				White	15.50	12.55	1.24	.219
				Black	21.15	14.48	1.46	.147
				Other*				
				BMI	.423	.279	1.52	.133
				Comorbidity	1.41	1.02	1.38	.171
				Spine Condition				
				Herniated Disc	-.821	7.22	-.114	.910
				Deg. Disc Dis.	4.79	7.41	.646	.520
				Stenosis	-1.52	9.25	-.165	.870
				Spondylolisthesis	1.54	8.28	.186	.852
				Other*				
				Insurance Status				
				Medicare	-2.86	5.87	-.488	.627
				Medicaid	12.85	6.97	1.84	.068
				Self-Pay	13.34	9.74	1.37	.174
				Commercial*				

*reference category

Table 13.

Second model for influences of antecedent personal factors on perceived pain interference at 12 weeks of treatment.

Step	R^2	F	Sig.	Parameter	B	Std. Error	*t*	Sig
2	.102	2.97	.007	Intercept				
				Race				
				White	15.87	12.04	1.32	.190
				Black	24.39	13.90	1.75	.082
				Other*				
				BMI	.456	.259	1.76	.081
				Comorbidity	1.46	.259	1.76	.081
				Insurance Status				
				Medicare	-2.72	4.71	.578	.565
				Medicaid	10.93	6.19	1.77	.080
				Self-Pay	11.35	1.28	1.28	.203
				Commercial*				

*reference category

In order to determine how the antecedent personal factors influence perceived pain interference functioning over time, repeated measures general linear modeling was used. The perceived physical functioning data at baseline and 12 weeks were used for within subject effect and the antecedent personal factors, age, sex/gender, race/ethnicity, BMI, spine conditions, count of comorbidities, and insurance status, were used as factors for between subject effects. The assumption of sphericity was assessed with a non-significant Mauchly's test, indicating the assumption of sphericity is not violated (Field, 2005; Vogt, 2005). When analyzing the within subject effects, there was no significant difference in the mean perceived physical functioning score comparing entry into treatment to 12 weeks of treatment ($F = 0.030, 1; p = .863$).

Table 14.

Final Model for the influence of antecedent personal factors on perceived pain interference at 12 weeks of treatment

	R^2	F	Sig.	Parameter	B	Std. Error	*t*	Sig
Final	.049	2.64	.037	Intercept	32.94			
				Insurance Status				
				Medicare	-.078	4.35	.018	.986
				Medicaid	15.66	5.78	2.70	.008
				Self-Pay	16.23	8.87	1.83	.070
				Commercial*				

Influence of antecedent personal factors on perceived pain interference over time. In order to determine how the antecedent personal factors influence perceived physical functioning over time, the repeated measures general linear model was used again to determine which of the antecedent personal factors influenced perceived physical functioning over time.

When analyzing the within subject effect there was a significant difference in the mean perceived pain interference score (F = 3.23, 3; p = .009). On average the mean perceived pain interference score improved (decreased) by 14.9 points from start of treatment to 12 weeks. Similar to the previous regression models, persons using Medicaid for reimbursement had on average a 16.97 point higher pain interference score than those reimbursed through commercial insurances (CI = 4.19, 29.74). Persons with Medicaid insurance improved from entry into treatment to 12 weeks, to a similar degree as persons with other insurance types. There was no interaction effect between insurance type and number of comorbidities when analyzing the change in perceived pain interference over time.

Research question 1. In research question number 1, a number of general linear models were developed to determine how the antecedent personal factors influenced the health perceptions, perceived physical functioning and perceived pain interference at start of treatment and 12 weeks into treatment. At the start of treatment, on average, women experienced lower levels of perceived physical functioning than men and persons with Medicaid insurance had higher levels of perceived pain interference than those persons covered by other insurance types. After 12 weeks of conservative treatment for lumbar degenerative spine conditions, persons with Medicaid insurance and those with higher levels of comorbidities experienced lower levels of perceived physical functioning. Persons with Medicaid insurance also experienced higher levels of perceived pain interference than those covered by other insurance types after 12 weeks of treatment.

Attempts were made to develop a model that explained how antecedent personal factors influences changes in the health perceptions, perceived physical functioning and perceived pain interference over the 12 week time period. Although, no significant model was developed, the analysis revealed that perceived pain interference significantly improved during the 12 week treatment period. In the next section, research question 2 explores how health perceptions influence health seeking behaviors. The health seeking behaviors are medication use and participation in prescribed exercise regimens.

Research question 2. This research question seeks to determine the effect that the health perceptions, perceived physical functioning and perceived pain interference have upon health seeking behaviors. The health seeking behaviors that were studied were divided into two categories: medication use and prescribed exercise participation. In this section, the results of a

series of four regression analyses are reported. Both logistic regression and general linear modeling were used, depending on the nature of the dependent variables.

Influences of health perceptions on medication use. Medication use includes two variables. One categorizes whether the patient does or does not take medications to influence the effects of lumbar degenerative spine conditions. The second medication variable is a count of the number of medication categories the patient used.

Influences of health perceptions perceived physical functioning and perceived pain interference on medication use at 12 weeks. In order to determine the influence of perceived physical functioning and perceived pain interference on whether or not patients used medications, logistic regression was performed. A backward, stepwise method was used to determine the best model. Perceived pain interference was the only factor that influenced pain medication use ($X^2 = 4.48$; $df = 8$; $p = .028$). Perceived physical functioning was not significant in the model. The Wald statistic was 4.51 ($p = .034$) and the exp(B) was .971 (CI .931, .998). The R^2 was calculated ($R^2 = .106$) by dividing the model X^2 by the -2Log likelihood (Field, 2005; Tamhane & Dunlop, 2000) accounting for just over 10 percent of the variance in whether persons take medications for lumber degenerative spine conditions. Higher levels of perceived pain interference were associated with increased likelihood that the patient was taking medications ($p = .028$) to ameliorate the symptoms of lumbar degenerative spine conditions.

Influence of health perceptions, perceived physical functioning and perceived pain interference on medication categories. Medications used to influence the effects of lumbar degenerative spine conditions were previously defined as muscle relaxants, non-opiate pain relievers, non-steroidal anti-inflammatory drugs, opiates, antiepileptics, and catabolic steroids. The numbers of medications on the patient's medication lists were counted. The descriptive

statistics regarding medications can be seen in Table 5 (p. 87) where both total numbers of medications and medications by individual categories are reported.

The general linear model was used to determine the effect of health perceptions, perceived physical functioning and perceived pain interference on the number of medications used. The polytomous universal model (PLUM) is a type of general linear modeling that is used for ordinal data or linear data with limited response levels (Field, 2005; Tamhane & Dunlop, 2000). Table 15 describes the model that was developed. Lower scores for perceived physical functioning predicted higher numbers of medication categories. The model explained 15.8 percent of the variance (R^2 = .158). Persons with lower levels of perceived physical functioning

Table 15.

Model for health perceptions predicting number of medications used.

Parameter	B	Std. Error	Sig	95% Confidence Interval	
				Lower Bound	Upper Bound
Intercept	1.85				
Perceived Physical Function	-.012	.005	.034	-.023	-.001
Perceived Pain Interference	.001	.005	.790	-.009	.012

used on average, higher numbers of medications. Persons using zero medication had a mean perceived physical functioning score of 69.46 (SD = 16.53), while those with 3 or more medication had a mean perceived physical functioning score of 46.30 (SD = 11.72). Table 16 displays the perceived physical functioning scores by number of medications used. In the next

section, the role of health perceptions, perceived physical functioning and perceived pain interference will be explored as potential predictors of participation in home exercise regimens.

Influences of health perceptions on prescribed exercise regimens. In this study, prescribed exercise regimens were operationalized 2 ways. The first is the percentage of physical therapy visits that the person attended. The second is the person's participation

Table 16.

Mean perceived physical functioning scored by number of medications used.

	Perceived physical functioning scores	
Number of medications used	*M*	(SD)
0	69.46	(16.53)
1	58.33	(14.44)
2	63.13	(16.94)
3+	46.30	(11.72)

in home therapy, which was categorized as high participation or low participation. The effect of the health perceptions, perceived physical functioning, and perceived pain interference upon prescribed exercise was examined.

Influence of health perceptions perceived physical function and perceived pain interference on physical therapy attendance. Physical therapy attendance was calculated as percentage of physical therapy visits attended of those ordered. The percentages were used as a continuous dependent variable. Neither perceived physical function (F = .598, 1; p =.441) or perceived pain interference (F= 2.13, 1 p = .147) were significant predictors of attendance at physical therapy appointments.

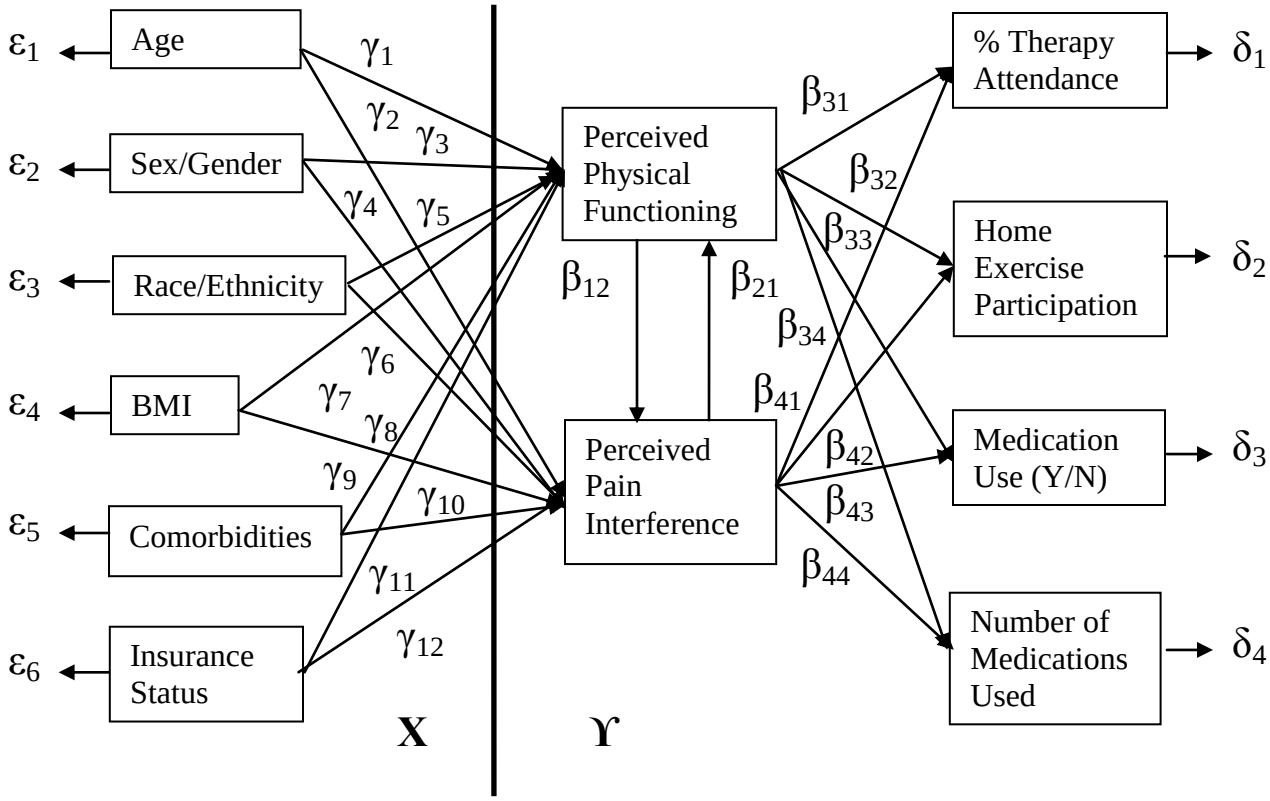
Influence of health perceptions perceived physical functioning and perceived pain interference on home exercise regimens. Patient participation was categorized as either high or low based on the patient's description of his/her participation in the home exercise regimen.

Logistic regression was used to determine if perceived physical function and/or perceived pain interference was associated with participation in home exercises. Neither perceived physical functioning nor perceived pain interference predicted the degree to which patients participated in home exercise regiments (X^2 =2.91, df = 1; p = .538).

Summary of research question 2. Logistic regression and general linear modeling were used to determine the effects of health perceptions on health seeking behaviors. In summary, higher levels of perceived pain interference were associated with an increased likelihood that patients used medications, but lower levels of perceived physical functioning were associated with higher *numbers* medications used. Neither of the health perceptions, perceived physical functioning nor perceived pain interference was associated with participation in either of the prescribed exercise regimen variables. In the next research question, structural equation modeling is used to assess the influences of antecedent personal factors upon health perceptions and how they in turn, influence health seeking behaviors.

Research question 3. The third, and final, research question in this study sought to determine how the antecedent personal factors influence health seeking behaviors when considering the relationship between perceived physical functioning and perceived pain interference. Structural equation modeling (SEM) was used because SEM has the ability to assess multiple variable relationships in a model using the principles of traditional statistical methods such as analysis of variance, linear modeling and regression while addressing the measurement error that is frequent in clinical research (Kline, 2005; Raykov & Marcoulides, 2006).

Figure 8. Measurement model for research question 3.



The model for structural equation model analysis was previously described in Chapter 4 (Figure 6). Figure 8 depicts the measurement model that was developed from the theoretical framework. In order to perform structural equation modeling, first the data has to be assessed for appropriateness for analysis. In structural equation modeling, all categorical variables must be binary categorical, ordinal or continuous (Skrondal & Rabe-Hesketh, 2005). First, race was categorized as "white" and 'non-white." Insurance was categorized as "Medicare and commercial" and "Medicaid and self-pay." In the previously described models, Medicaid and self-pay patients were shown to have lower levels of perceived physical functioning and higher pain interference. They also have the commonality of having higher financial burden in health care. Lastly, lumbar degenerative spine condition was considered for recategorization. The decision was made to eliminate if from the model because spine condition category was not

significant in any of the models tested previously. Additionally, there was no reasonable clinical or research method to reduce the number of categories. SEM requires that there are no missing values in the data; therefore, maximum likelihood estimation was used to estimate the small number of missing values in categories such as race/ethnicity, insurance status, and medication use. Testing of the model was completed using Lisrel© 8.8 Student Version (Joreskog & Sorbom, 2006). Prior to attempting to achieve model fit, covariances were analyzed for error. The final variables for the model were age, sex, race/ethnicity, BMI, count of comorbidities, insurance status, perceived physical functioning, perceived pain interference, participation in physical therapy, home exercise participation, use of medications, and number of medications used. A manifest variable model was tested; the model had no latent variables.

Table 17.

Transformation of variables for use in structural equation modeling.

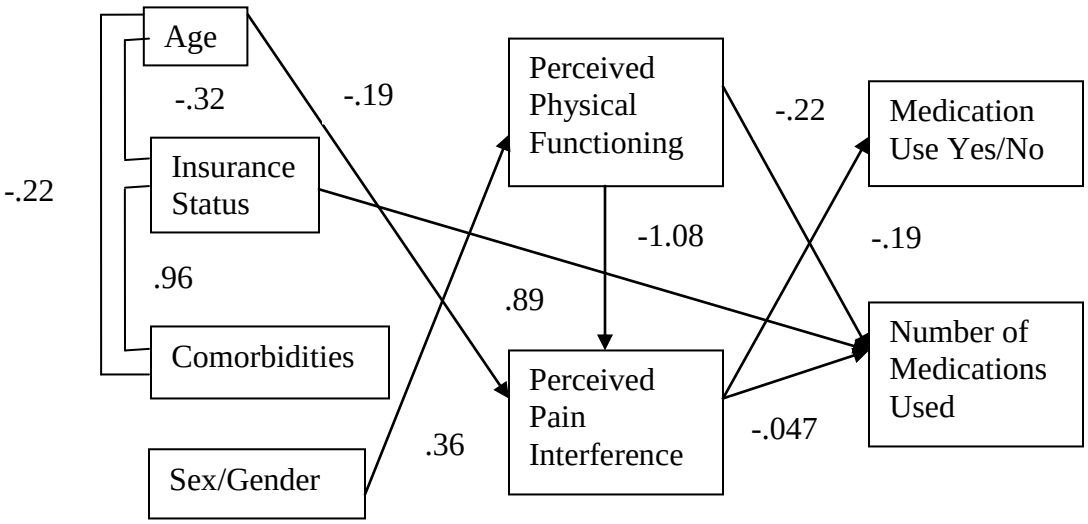
Previous Categories	*n* (%)	New Category	*n* (%)
Race/Ethnicity			
White	115(88.5)	White	115(88.5)
Black	8(6.2)	Non-White	11(8.5)
Asian	3(2.3)		
Insurance Status			
Medicare (MCR)	35(26.9)	MCR/	106(82.8)
Commercial	71(54.6)	Commercial	
Medicaid(MCD)	16(12.3)	MCD/Self-Pay	22(17.2)
Self-Pay	6(4.6)		

While the initial model converged, it did not reveal an acceptable solution (X^2 = 523; df = 30; $p < .001$; RMSEA = .19). Model fitting parameters including parameter estimated, modification indices, and goodness-of-fit test were used to create the final model. Specifically, constrained parameters between insurance status and medication categories were freed. This

change resulted in a model that converged with satisfactory goodness of fit statistics (X^2 =34.90; p = .17; RMSEA = .045; CI 0.0, 0.087).

In the final model the significant paths were the effect of age upon perceived pain interference (t = -2.53), the effect of sex/gender (t = -2.39) upon perceived physical functioning. Three factors influenced number of medications: insurance status (t = 17.53), perceived physical functioning (t = -2.05) and perceived pain interference (t = -2.55). Perceived pain interference also influenced whether or not persons took medications (t = -2.22). The final Comparative Fit Index for the model was .98. The model with significant paths can be seen in Figure 8.

Figure 9. Path coefficients for research question number 3.



In order to interpret the standardized path coefficients, the paths were considered in order of the theoretical framework Figure 4 (p. 27). Standardized path coefficients are expressed as regression coefficients, z-scores, or standard deviation units (Kline, 2005; Vogt, 2005). To interpret the magnitude of the relationships between variables, Cohen's criteria (1988) was used. As "small effect" was assigned to values less than .01, "medium effect" was assigned to values

of .3 and a “large effect” was considered for values greater than .5 (Kline, 2005).

When looking at the significant relationships between antecedent predictive factors, age, insurance status and comorbidities consideration was given to significant paths and the directions of the paths. Health perception data was collected at entry into treatment and heath seeking behavior data was collected at 12 weeks. The path directions were consistent with the data collected. Persons with Medicaid insurance and those who self-pay for their care are likely to be younger. Persons with Medicaid insurance and those who self-pay are more likely to have more cormorbid conditions. The beta weights for each path can be seen in Figure 9.

This model demonstrates a number of relationships that were previously discussed in the models developed in research questions 1 and 2. In the antecedent personal factors portion of the model, the effect of sex/gender on perceived physical functioning is seen. Like the results seen in the regression models previously discussed, female sex/gender was related to lower levels of perceived physical functioning at start of therapy. Persons with Medicaid insurance and those that self-pay for care use fewer medications to ameliorate their symptoms of lumbar degenerative spine conditions. Higher age was associated with lower levels of perceived pain interference. The new influences in this model that were not seen in the regression models are the effect of age on perceived pain interference and the effect of insurance status directly upon the number of medications used.

When considering the relationship between perceived physical functioning and perceived pain interference, analysis revealed that as perceived physical functioning increased, perceived pain interference decreased. As the perceived physical functioning score increased by 18 points, the perceived pain interference score decreased by 19 points. The opposite relationship, the

effect of perceived pain interference upon perceived physical functioning, was not a significant path.

In this model, increased levels of perceived physical functioning at start of treatment were related to lower levels of numbers of medication used at 12 weeks of treatment. As perceived pain interference increased, patients less likely to be taking medications for symptoms of lumbar degenerative spine conditions. Similarly, as perceived pain interference increased, the patients were likely to be receiving lower numbers of medication. It should be noted that the associations between perceived physical functioning and medication use are relatively weak.

It was the intent of this study analysis to increase the understanding of the relationship between perceived physical functioning and perceived pain interference. The implications of these findings are further discussed in Chapter 6.

Summary

The purpose of this chapter was to describe the results of the research questions in this study. In the next chapter, the results will be discussed further including the strengths, limitations, implications for further research, implications for practice and health policy considerations.

CHAPTER 6: DISCUSSION

Persons with lumbar degenerative spine conditions can experience difficulty with physical functioning and pain that interferes with daily activities (AAOS, 2008; Licciardone, 2008). How people perceive their chronic conditions has been shown to affect health outcomes (Macabasco-O'Connell, et al., 2010). In lumbar degenerative spine conditions, negative cognitions can influence health perceptions (Schmidt, et al., 2010). If patients fare poorly in treatment for lumbar degenerative spine conditions, the result can be chronic pain, long term disability, and poorer health related quality of life (Caldwell, et al., 2009; Crisostomo, et al., 2008; Deutscher, et al., 2009; Foster, et al., 2008; Guzman, et al., 2007; McGeary, 2003).

In lumbar degenerative spine conditions health seeking behaviors are affected by how a person perceives his/her physical functioning and how much interference in daily activities is perceived as due to pain (Schmidt, et al., 2010; Stubbs, et al., 2010). The degree to which persons participate in behaviors designed to ameliorate the effect of a lumbar degenerative spine condition are dependent on their health perceptions (Mailloux, et al., 2006; McCarberg & Barkin, 2001).

The purpose of this research was to examine how antecedent personal factors influence health perceptions and how health perceptions, in turn, influence health seeking behaviors in people with lumbar degenerative spine conditions. In this study, the previously describe theoretical framework (Figure 4) was used to guide this study. This chapter provides a summary of the research findings. First, the main findings of the study are presented. Next, a detailed discussion of each research question is presented within the context of the current literature. The results discussion will be followed by a discussion of the limitations of this study, followed by

discussion of the research, nursing and policy implications. Finally, a summary and conclusions of the study are presented.

Main Research Study Findings

In this study, perceived physical functioning and perceived pain interference at entry into treatment and 12 weeks of treatment were influenced by several of the antecedent personal factors. Table 18 shows a summary of the research findings. Women had significantly lower

Table 18.

Summary of research findings

Research question 1	
	Women had significantly lower perceived physical functioning at entry into treatment compared to men. Persons with Medicaid insurance had significantly higher perceived pain interference at entry into treatment and at 12 weeks of treatment. Persons with Medicaid insurance and higher numbers of comorbidities had lower perceived physical functioning at 12 weeks of treatment.
Research question 2	
	Higher perceived pain interference predicted whether or not persons used medications to ameliorate symptoms. Lower perceived physical functioning predicted higher number of medications used to ameliorate symptoms. Neither health perception predicted participation in home exercise regimens.
Research question 3	
	Females experienced lower levels of perceived physical functioning. Persons with Medicaid insurance used lower numbers of medications but are more likely to be using opiates. Increased age was associated with lower perceived pain interference. As perceived physical functioning increased, perceived pain interference decreased. Higher levels of perceived physical functioning at the start of treatment were associated with lower numbers of medications used at 12 weeks of treatment. Persons with increased perceived pain interference were less likely to be taking medications and were taking fewer numbers of medications.

perceived physical functioning at entry into treatment than men. Persons with Medicaid insurance had significantly higher perceived pain interference at both the start of treatment and 12 weeks. At 12 weeks of treatment, higher numbers of comorbidities and Medicaid insurance coverage significantly predicted lower levels of perceived physical functioning. Persons with higher levels of perceived pain interference used medications less frequently to treat their symptoms, and lower perceived physical functioning predicted a higher number of medications used.

When considering the relationships among the variables of the entire model, using structural equation modeling, older age was associated with lower levels of perceived pain interference and female sex/gender as associated with lower levels of perceived physical functioning. The number of medications a person was taking was influenced by 3 factors: perceived physical functioning, perceived pain interference and insurance status. Increased age was also found to be related to perceived pain interference. A higher level of perceived physical functioning was associated with lower levels of perceived pain interference. Prescribed exercise participation was not significantly predicted by either of the health perceptions, perceived physical functioning or perceived pain interference. The theoretical model (Figure 4) was supported in the structural equation modeling (Figure 8). Each identified category of antecedent personal factors, personal, biologic and social, were represented as influences upon health perceptions. A relationship between perceived physical functioning and perceive pain interference was also significant. Lastly the structural equation model (Figure 8) revealed a relationship between health perceptions and health seeking behaviors in both of the medication use categories.

Summary of Research Question 1

The first research questions asked: How do antecedent person factors, (a) demographic, (b) biologic, (c) social, influence health perceptions such as perceived physical functioning and perceived pain interference at start of treatment and 12 weeks of treatment? Research question 1 had a sub question which was: How do health perceptions vary from entry into treatment to 12 weeks of treatment? The discussion of this research question will be divided into 5 separate sections: 1) influences of antecedent personal factors on perceived physical functioning at start of treatment; 2) influences of antecedent personal factors on perceived pain interference at the start of treatment; 3) influences of antecedent personal factors on perceived physical functioning at 12 weeks; 4) influences of antecedent personal factors perceived physical functioning at 12 weeks; and 5) effect of time upon perceive physical functioning and perceived pain interference between entry into treatment and 12 weeks.

Influences of antecedent personal factors on perceived physical functioning at start of treatment. In this study, only sex/gender influenced perceived physical functioning at entry into treatment. A summary of the findings of this portion of the research question can be seen in Table 8. The mean perceived physical functioning scores for males was 66.25 (SD = 17.0) and for females was 57.59 (SD = 15.03). The mean difference between male and female was 9.26 points (t =3.23; df = 126; p = .002; CI 3.59, 14.93).

The current literature regarding the effect of sex/gender on perceived physical functioning suggests that females have lower levels of perceived physical functioning than males in work related chronic lumbar injuries (McGeary, 2003). Although insurance information was collected for every person in this study, no worker's compensation cases were identified, eliminating the ability to determine the effect of lower levels of perceived physical functioning

seen in worker's compensation. This study suggests that women have lower levels of perceived physical functioning regardless of insurance status.

Other studies (Juhakoski, et al., 2008; Lin, et al., 2006; Wand, et al., 2009) have suggested that gender differences in perceived physical function are either inconclusive or not present in lumbar degenerative spine conditions. Normative data regarding persons receiving physical therapy for musculoskeletal conditions suggests that men (M = 47) have lower levels of perceived physical functioning than females (M = 54) when using the SF-36 to measure perceived physical functioning (Mossberg & McFarland, 1995). Age is another issue that can influence perceived physical functioning. In normative data of persons with the same mean age as this study the mean perceived physical functioning score was 79 as compared to 91 for persons 18 to 24 years of age (Guyatt, Feeney, & Patirck, 1993; Jenkinson, Coulter, & Wright, 1993). This study suggests that females with lumbar degenerative spine conditions, regardless of other potentially mitigating factors, do perceive lower levels of physical functioning at the start of treatment than males.

In order to determine whether there were systematic differences between the men and women in this study, each of the other antecedent personal factors-age, race/ethnicity BMI, spine condition, comorbidities and insurance status were evaluated using either an independent samples t-test or Chi-Square analysis. It was found that in this sample, females had significantly (t = -2.93; p = .004) more comorbidities and were older (t = -2.42; p = .016) than males. Males on average had a mean number of comorbidities that was 1.16 less than females. The mean count of comorbidities for males was 2.02 (SD = 1.8) and 3.18 (SD = 2.36) for females. Males on average were 6.37 years younger than the females with the mean age for males being 50.3 years (SD = 14.6) and 56.7 for females (SD = 14.2).

The age and comorbidity differences by sex/gender are important because older age is associated with lower levels of perceived physical functioning (Bentsen, et al., 2008). Additionally, comorbidities have been shown to have a negative effect on perceived physical functioning in lumbar degenerative spine conditions (Slover, et al., 2006). This study suggests that females, especially those with increased numbers of comorbidities and older age, have lower levels of perceived physical functioning at the start of treatment for lumbar degenerative spine conditions.

Influences of antecedent personal factors on perceived pain interference at start of treatment. In this study, insurance status was the only variable that influenced perceived pain interference at the start of treatment. A summary of the model findings for this portion of the research question are found in Table 9 in Chapter 5. Within the insurance types (commercial, Medicare, Medicaid and self-pay), patients were assessed for other systematic differences that could explain the higher level of pain interference that was seen in the persons with Medicaid insurance. The only other difference that was seen was in persons with Medicare. Persons with Medicare insurance had a mean age of 69.3 (SD = 10.1) as compared to a mean age of 43.4 (SD = 10.7) for Medicaid insurance, 42.1 (SD = 14.6) and commercial insurance 49.8 (SD = 11.0). Since typically persons become eligible for Medicare insurance after the age of 62, it is not surprising that the Medicare insurance subset is substantially older. When assessing the pairwise comparisons of comorbidity, persons with Medicaid had significantly higher levels of comorbidity than all other insurance types (F = 10.8, 3; p = <.001). On average, persons treated for lumbar degenerative spine conditions with Medicaid had 2.53 more comorbid conditions than those with commercial insurance (CI -.404, -1.64). Considering that the number of comorbidities rises as a person ages (Hicks, et al., 2009), it would be expected that persons with

Medicare insurance would have more comorbidities than those with Medicaid. On average persons with Medicare had 0.76 fewer comorbid conditions than those with Medicaid (p = .009). None of the other antecedent personal factors-sex/gender, race/ethnicity, BMI, or spine condition-were significantly associated with insurance status.

A problematic higher level of pain interference in people covered by worker's compensation insurance is well documented among those with lumbar degenerative spine conditions (Baldwin, 2007; Hee, 2001; Slover, et al., 2006). Among those who are covered with other insurance types, higher levels of pain interference are not as well documented. According to the Institute of Medicine, (Smedley, et al., 2003), persons with Medicaid tend to be referred for treatment later in the disease trajectory of chronic conditions. Persons with Medicaid insurance are also much more likely to have difficulty with access to specialty providers (O'Neill & Kuder, 2005). Furthermore, in more recent studies regarding chronic low back conditions, persons with Medicaid insurance received less aggressive pain management with opiate medications and less intensive physical therapy (Nampiaparampil, Nampiaparampil, & Harden, 2009). However, it is difficult to elicit whether or not the authors are writing about persons suffering from nonspecific musculoskeletal low back pain or lumbar degenerative spine conditions. Although higher levels of perceived pain interference has been associated with worker's compensation insurance, the association of Medicaid insurance with higher levels of pain interference in people with lumbar degenerative spine conditions is a novel finding of this study. In the next two sections of this discussion, the factors that influence perceived physical functioning and pain interference after the patients have received 12 weeks of conservative, non-operative treatment for lumbar degenerative spine conditions are addressed. The implications of these findings are that persons with Medicaid must be carefully screened and received

meticulous assessment of the role of perceived pain interference in daily activities. In this study, persons with Medicaid insurance had significantly higher numbers of chronic comorbid conditions to manage in addition to a lumbar degenerative spine condition. Managing multiple comorbidities requires priority setting in numerous patient populations (Schoenberg, Leach, & Edwards, 2009). Managing a lumbar degenerative spine condition in the face of other multiple comorbidities is a daunting task. Consider, for example, the person who has hypertension, heart disease, diabetes and a lumbar degenerative spine condition. Part of the care for all four conditions would be to increase physical activity such as walking. In many lumbar degenerative spine conditions, walking causes increased symptoms such as back and leg pain causing difficulty in prioritizing self-management of these conditions. Nurses can help patients problem solve and prioritize management of multiple comorbidities (Chen, Tsai, & Chou, 2011).

Influences of antecedent personal factors on perceived physical functioning at 12 weeks of treatment. At the completion of 12 weeks of treatment, perceived physical functioning was again assessed using the MOS SF-36. In a model that included the antecedent personal factors; age, sex/gender, race/ethnicity, BMI, spine condition, comorbidities, and insurance status, Medicaid and higher levels of comorbidity accounted for 26 percent of the variance in perceived physical functioning ($F = 4.26, 13; p = <.001$). In the discussion of perceived physical functioning at start of treatment, sex/gender was a significant influence upon perceived physical functioning but after treatment lower levels of physical functioning were no longer related to female sex/gender. Insurance status, specifically Medicaid insurance and higher levels of comorbidity were associated with lower levels of perceived physical functioning after 12 weeks of treatment.

Increased numbers of comorbidities have been shown to have a negative effect on perceived physical functioning in persons with lumbar degenerative spine conditions (Slover, et al., 2006). Although this study did not detect a difference among individuals with varied spine conditions, more numerous comorbidities were associated with lower levels of perceived physical functioning after 12 weeks of treatment in persons with spondylosis, spondylolisthesis and herniated disc but not with degenerative disc disease and spinal stenosis (Slover, et al., 2006).

At least one study has identified that there tend to be more comorbidities in persons with spinal stenosis and spondylolisthesis due to the fact that those conditions tend to occur more at older ages (Cummins, et al., 2006b). In this study, persons with stenosis were older than all other types with a mean age of 63.3 (SD= 12.8) as compared to spondylolisthesis (M = 51.4; SD = 12.8), herniated disc (M = 51.9; SD = 16.2), degenerative disc disease (M = 55.5; SD = 14.9) and other (M = 50.1; SD = 12.8). Even though the persons with stenosis in this study were substantially older than the persons with spondylolisthesis, the persons with spondylolisthesis had on average 3.4 comorbid conditions (SD = 1.9) while those persons with stenosis had, on average, 2.8 comorbid conditions (SD = 1.7). In the persons with other lumbar degenerative spine conditions, those with radiculopathies had 2.2 comorbid conditions (SD = 2.3) and those with degenerative disc disease had 2.24 comorbid conditions (SD = 1.8). The implications of this report, for purposes of the present study, is that there were no significant differences in perceived physical functioning among degenerative spine conditions regardless of the age or number of comorbidities seemingly in conflict with other studies.

Influences of antecedent personal factors on perceived pain interference at 12 weeks of treatment. After 12 weeks of treatment, insurance status was the sole antecedent personal factor

associated with perceived pain interference. Specifically, persons with Medicaid, on average experienced higher levels of perceived pain interference after 12 weeks of treatment ($F = 2.97, 7$; $p = .007$) than persons with other types of insurance. On average persons with Medicaid insurance had perceived pain interference scores that were 16.2 points higher than persons with Medicare, 12.9 points higher than commercial insurance and approximately equal (-.49 points) to persons who self-pay their health care.

In the discussion regarding start of treatment, persons with Medicaid insurance have poorer access to specialty providers, tend to present later in the course of chronic diseases (Smedley, et al., 2003), and receive less aggressive pain management strategies (Nampiaparampil, et al., 2009). Although persons with Medicaid insurance improved in perceived pain interference over the course of 12 weeks of treatment, they still experienced significantly higher perceived pain interference than any other insurance type. The changes in perceived physical functioning and perceived pain interference over time are discussed in the next section.

Influences of antecedent personal factors on health perceptions over time. The subquestion of this research question sought to determine how perceived physical functioning and perceived pain interference varied between start of treatment and 12 weeks of treatment when considering the antecedent personal factors. Again, insurance status was the only personal antecedent personal factor that influenced either of the health perceptions over time. Insurance status, specifically Medicaid, influenced perceived pain interference ($F = 2.23, 3$; $p = .009$). Persons with Medicaid improved in perceived physical functioning on average by 14.9 points. The minimally clinically important difference for the ODI has been established at 10 points (Copay et al.; Davidson, et al., 2004). Although persons with Medicaid insurance improve

almost 1.5 times the minimally important difference, their perceived pain interference scores are still far higher than their counterparts with other insurance coverage at 12 weeks of treatment. This finding strengthens the previous discussion that there are systematic differences in perceptions of pain interference in persons with Medicaid insurance.

Changes in perceived physical functioning over 12 weeks of treatment. Perceived physical functioning improved on average by 7.92 points from start of treatment (M = 60.94; SD = 16.4) and at 12 weeks (M = 68.86; SD = 19.0) using the paired *t*-test (t = -4.92; $p < .001$; CI 4.73, 11.11). The minimally important difference for the SF-36 physical functioning subscale has been established as 5.42 points (Ware, 2004) by some authors and 16 points by others (Davidson, et al., 2004; Monticone, et al., 2009) but the value of 5 points is most frequently used (Ware, 2004; Zanoli, 2006). Although there were no antecedent personal factors that were specifically associated with improvements in perceived physical functioning, the patients did experience improvement similar to that which is seen in other studies that documented changes in perceived physical functioning over time (May, 2007; Zanoli, 2006). The people in this sample received treatment that is commonly prescribed in persons with lumbar degenerative spine conditions.

Changes in perceived pain interference over 12 weeks of treatment. Perceived pain interference also improved during the course of treatment. The mean improvement (decrease) in perceived pain interference was 13.2 points from the start of treatment (M = 48.8; SD = 21.4) to 12 weeks of treatment (M = 35.6; SD = 17.7) and significant using the paired *t*-test (t = 6.98; p <.001; CI 9.45, 16.93). For the Oswestry disability index, the minimally important difference has been established as 10 points (Fairbank & Prysent, 2000; Monticone, et al., 2009).

Conclusions research question 1. In this question, female sex/gender, Medicaid insurance and higher comorbidities were associated with lower levels of perceived physical functioning. Persons with Medicaid insurance status experienced higher levels of pain interference at both start of treatment and after 12 weeks of treatment however they did improve over the course of treatment. Although much attention has been paid to the poor perceived physical functioning and high levels of perceived pain interference, in persons with worker's compensation insurance, the findings of research question 1 suggest that those with Medicaid may have as much, if not more, difficulty with perceived physical functioning and perceived pain interference. Clinicians need to closely monitor persons with Medicaid insurance for issues with perceived physical functioning and perceived pain interference, particularly if they are associated with a high number of comorbidities or female sex/gender. There is evidence that persons with Medicaid insurance may present later in the course of many chronic conditions (Smedley, et al., 2003). Further research is needed to determine whether this generalization regarding chronic conditions holds true for lumbar degenerative spine conditions. A summary of the findings of research question one are seen in Table 19. In the next question the role of health perceptions in influencing health seeking behaviors in lumbar degenerative spine conditions will be explored.

Table 19.

Summary of findings in research question 1.

Antecedent personal factor	Health Perception Influenced	Time Frame
Female Sex/Gender	Lower Perceived Physical Functioning	Start of Treatment
Medicaid Insurance	Higher Perceived Pain Interference	Start of Treatment
Higher Comorbidities	Lower Perceived Physical Functioning	12 weeks of Treatment
Medicaid Insurance	Lower Perceived Physical Functioning	12 weeks of Treatment
Medicaid Insurance	Higher Perceived Pain Interference	12 weeks of Treatment

Summary of Research Question 2

This research question sought to determine how health perceptions-perceived physical functioning and perceived pain interference- at start of treatment influence health seeking behaviors at 12 weeks of treatment. The health seeking behaviors in this study are medication use and prescribed exercise regimens.

Influences of health perceptions on medication use. In this study, medication use was conceptualized in 2 ways. First, whether or not the patient took medications to ameliorate their symptoms was assessed. In this study, 75.2 % of the persons took medications and 21.5 % did not (3.3% missing). Secondly, the number of medications the patient was taking was assessed. In this study, the number of medications ranged from 0 to 5 (M = 1.3; SD = .95).

Influences of health perceptions on medication use. Increased levels of perceived pain interference were associated with increased likelihood that the patient was taking medications to improve the symptoms of lumbar degenerative spine conditions. Perceived physical functioning was not a significant predictor of medication use. It is difficult to ascertain in this study how patient access to medications is related to prescriber practice patterns. In the clinic in which this study was conducted, steroids were the only drug type that was prescribed at the clinic. All other prescriptions for pain and associated symptoms were obtained by the patient's primary care practitioner or pain clinic. Although some studies have suggested that prescriber habits can negatively influence perceived pain interference (Lowdermilk, Panus, & Kalbfleisch, 1999; Nampiaparampil, et al., 2009) in this study, the persons that were not taking medications on average had lower levels of perceived pain interference (M = 43.26; SD = 15.7) than those that were taking medications (M = 50.8; SD = 17.98) even though the difference was not significant

(p =.363). This could be related to either under reporting of medications used, or, the patient simply did not perceive that they needed mediation to alleviate symptoms.

Influences of health perception on the number of medications used. Perceived pain interference predicted whether or not a person takes medications for lumbar degenerative spine conditions but perceived physical functioning predicted how *many* medications the patient was taking. Substantial numbers of studies were identified that addressed drug use by class (Crisostomo, et al., 2008; McCarberg & Barkin, 2001; Soin, et al., 2008; Sullivan et al., 2010) and health perceptions, but surprisingly none were identified that addressed polypharmacy in people with lumbar degenerative spine conditions.

In this study, general linear modeling was used to determine the relationship between perceived physical functioning and the numbers of medication used. Increased numbers of medications was significantly associated with lower levels of perceived physical functioning (F = 6.25, 3; p = .001). Table 20 displays the change in mean perceived physical functioning a Table 20.

Change in perceived physical functioning between number of medications

Number of Medications	**0**	**1**	**2**	**3+**
	Mean change (sig)	**Mean change (sig)**	**Mean change (sig)**	**Mean change (sig)**
0	-			
1	11.3(.05)	-		
2	ns	ns	-	
3+	23.2(.001)	ns	16.9(.026)	-

pairwise comparison of different numbers of medications used. For example when 0 medications is compared to 3 or more medications there is a 23.2 point difference in mean perceived physical functioning; on average, persons with 0 medications had perceived physical

functioning scores that were 23.3 points higher than those with 3 or more medications. This study contributes to nursing science by providing evidence that as mean perceived physical functioning decreases the likelihood of being on multiple medications increases.

Persons using 3 or more medications to treat their lumbar degenerative spine condition had substantially lower perceived physical functioning than those using no medications, indicating that either the medications are not effective for issues of functioning, or the medications are the reasons for poorer functioning. Opiates, AED's and muscle relaxants can all have substantial central nervous system effects that could influence functioning (Chou, 2010). Another, essentially unexplored but possible explanation is that persons with low levels of perceived physical functioning may be more persistent in seeking treatment resulting in higher numbers of medications used. In the next section, how health perceptions influence prescribed exercise regimens is explored.

Influences of health perceptions on prescribed exercise regimens. Prescribed exercise regimens were measured in two ways in this study. Prescribed exercise regimens were defined as the percentage of physical therapy appointments that the patient attends. Secondly, the degree to which patients participate in their home exercises was assessed.

Influences of health perceptions on the percent physical therapy attendance. In this study, neither perceived physical functioning nor perceived pain interference were related to the patient's participation in physical therapy. In a study that compared persons with mechanical low back pain to those with lumbar degenerative spine conditions, better attendance at physical therapy appointment was associated with higher levels of perceived pain interference (r = .5; p 05) and whether or not the person felt he or she was improving (r = 0,7; p = .001) during the course of therapy (Al-Eisa, 2010). In this study, none of antecedent personal factors-age,

sex/gender, race/ethnicity, BMI, spine condition, comorbidity or insurance status was related to attendance at physical therapy (F = .908, 18: p =.575). Unlike the Al-Eisa study (2010), in this study, the patients were seen at multiple community therapy sites instead of one single practice, which could account for the differences in findings. It is possible that the failure to identify a relationship with physical therapy attendance is related to the *number* of physical therapy visits rather than the percentage of total ordered visits. In this study data regarding the total number or dose of physical therapy visits was not collected. This issues is further discussed in the study limitations,

Influences of health perceptions on home exercise participation. In this study, no relationship was found between health perceptions and home exercise participation. In other studies (Medina-Mirapeix, Escolar-Reina, Gascon-Canovas, Montilla-Herrador, & Collins, 2009), factors such as age, sex/gender and spine condition have been associated with differing levels of home exercise participation. One issue that has been well described regarding home exercise participation is difficulty in obtaining an accurate assessment of home exercise participation (Frih, et al., 2009; Medina-Mirapeix et al., 2006). As with all self-report measures, social desirability response bias is a possibility. Interestingly, the issue of accuracy of self-report is rarely discussed in the physical therapy literature. Using an objective measure such as an Actigraph (ActigraphLLC, 2010) could clarify the actual activity levels of persons with lumbar degenerative spine conditions. The actigraph is a small monitor worn around the waist that measures the frequency and intensity of physical activity. It could help clarify and quantify the degree to which persons with lumbar degenerative spine conditions participate in home exercise regimens.

Summary of Research Question 3.

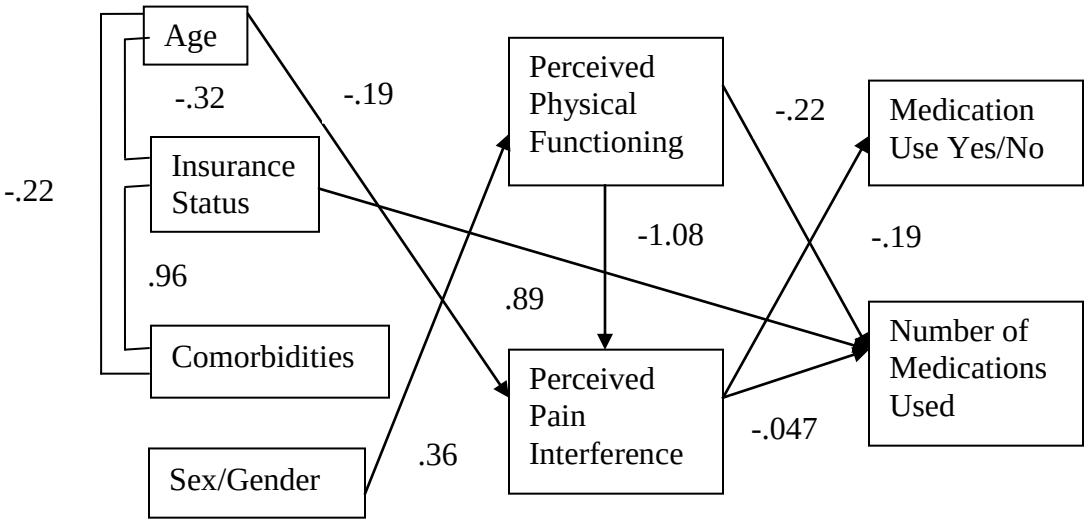
The third and final research question in this study sought to determine how the antecedent personal factors influence health seeking behaviors when considering the relationship between perceived physical functioning and perceived pain interference. The next section will discuss the structural equation model that was presented in Chapter 5.

Discussion of structural equation model. In the structural equation model (Figure 8) eight significant paths were identified in the model. Most were consistent with the general linear modeling and logistic regressions that have been previously discussed. For example, in research question 1, the results demonstrated that persons with female sex/gender had lower levels of perceived physical functioning at the start of treatment. In question 1, perceived pain interference was related to both whether or not a person took medications and how many medications they took to ameliorate the symptoms of lumbar degenerative spine conditions. Also in research question 1, lower levels of perceived physical functioning were related to higher numbers of medications used. The relationships between age, insurance status and comorbidities were also discussed in research question 1. Persons with Medicare insurance are typically over the age of 62 and as people age, the number of comorbid condition increases (Cummins, et al., 2006b; Juhakoski, et al., 2008).

The new elements of discovery in this model are the relationship between age and pain interference and the relationship between perceived pain interference and number of medications used. In this study, as age increased perceived pain interference decreased (r = -0.19). Persons over the age of 65 with degenerative lumbar spine conditions tend to have higher perceived pain interference than those with other degenerative musculoskeletal conditions (Morone et al., 2009). As people age, the incidence and severity of lumbar degenerative spine condition increases but

the level of perceived pain interference has not been directly related (Hicks, et al., 2009). In other chronic conditions, the changing perceptions and expectations in physical condition as a person ages have been related to changes in perceived physical functioning, pain expectations and health related quality of life (vandeWeil, Geerts, & Hoekstra-Weebers, 2008). This issue has not been specifically addressed in lumbar degenerative spine conditions but this study suggests that a relationship may exist.

Figure 9. Path coefficients for research question number 3.



. The relationship between perceived pain interference and number of medications used is a relatively weak (r = -.047) but significant path indicating that as perceived pain interference increases, the number of medications decreases. In assessing this measure, it is important not to jump to the immediate conclusion that this finding is a function of the under-treatment of pain. Medication management for lumbar degenerative spine conditions can be very complicated owing to the complex nature of the inflammatory, degenerative and neuropathic processes that interact in lumbar degenerative spine conditions (AAOS, 2008). Despite years of education across health care disciplines regarding the personal and perceptual nature of the pain experience

(Block, 2003; Mularski et al., 2006), adequate pain management has remained problematic in acute and chronic conditions. A number of provider and patient level issues exist. Providers may have be reluctant to prescribe medication due to fear of misuse of medications, particularly opiates (Sullivan, et al., 2010). In a study of patients that evaluated medication misuse in persons receiving chronic opiate therapy in chronic non-cancer pain, misuse was between 6 and 24 percent in commercially insured patients and between 3 and 20 percent in persons with Medicaid insurance (Sullivan, et al., 2010). Safely decreasing the perceived interference and effect of pain in lumbar degenerative spine conditions is the goal of the consensus statement of the American Pain Society (Chou, 2010). In this study, the low level of association between perceived pain interference and number of medication has more practical clinical implications than research implications. Further research is necessary to understand the elements in this relationship such as provider level and patient level factors. In the next section, limitations of this will be discussed.

In the discussion of this model, it is necessary to discuss the paths that were *not* found to be significant. Like the modeling in research question 2, the paths between health perceptions and prescribed exercise variables were not significant. Either the paths are truly not significant, which would not be well received by the professional physical therapists caring for these patients, or there could have been measurement issues that influenced the findings. As was previously described, the patients in this study were seen at multiple physical therapy sites. Some had as many as 15 physical therapy visits and others had 2 ordered. If a patient attended 2 of 15 visits, they would have 28 % compliance. If the person attended 2 of 2 visits, they would have a 100 % compliance rate. Both patients received the same dose but have different compliance. Although this method was used fairly extensively in the physical therapy literature

(Deutscher, et al., 2009; Freburger, et al., 2006a; Rossignol et al., 2000), it may require that all patients are seen at the same clinic and have a fairly similar number of ordered visits.

Using SEM to evaluate the theoretical model. One purpose of using SEM in analyzing research question 3 is this method's ability to test theoretical relationships. In this study, an adaptation of the health promotion model (Pender, et al., 2006) and health related quality of life model (Wilson, 1995) was tested. For a first time use of a model, it is considered a success that most of the main elements of the theoretical framework were found to be significant in path analysis. At least one indicator from each of the categories of antecedent personal factors had a significant path influencing health perceptions. Age and sex/gender represented the demographic personal factors. Comorbidities represented the biologic personal factors and insurance status represented the social personal factors. The health perceptions, perceived physical functioning and perceived pain interference were both predicted by antecedent personal factors. More research is needed to determine why perceived pain interference was influenced by more factors than perceived physical functioning. The health perceptions did influence the health seeking behaviors related to the use of medications but not prescribed exercises. A surprising finding of this study was the lack of clarity regarding the relationship between perceived physical functioning and perceived pain interference. The model demonstrated that as perceived physical functioning decreased, perceived pain interference increased but the opposite relationship was not significant. Further research is needed to clearly understand the relationship between perceived physical functioning and perceived pain interference in lumbar degenerative spine conditions.

This study was not designed to address all of the relationships hypothesized in the larger theoretical framework (Figure 3). In this study, only the relationships between antecedent

personal factors, health perceptions and health seeking behaviors were addressed (Figure 4). The elements of the structural equation modeling that were significant, age, sex, comorbidities, insurance status, perceived physical functioning, perceived pain interference and medication use, are shown in Figure 8. This model shows promise in demonstrating that there is a relationship between antecedent personal factors and health perceptions. The relationship between health perceptions and health seeking behaviors was not as well documented in this study. Medication used was clearly influenced by the health perceptions but participation in prescribed exercise regimens was not significant. The final outcome of the theoretical framework in Figure 3 was HRQoL and further research is necessary to determine if HRQoL is influenced by antecedent personal factors, health perceptions and health seeking behaviors as described in the theoretical framework.

Study Limitations

Some of the major limitations of this study are associated with the data. The proportion of missing data for health perception data was approximately 20 percent. Although maximum likelihood estimation is better than other method for estimating missing data (Kline, 2005), a lower level of missing data would be preferred. Maximum likelihood estimation is preferred because it uses multiple data points to impute the missing values rather than some of the simpler methods such as series mean or random assignment (Kline, 2005) It is unknown how that factor influenced the outcome of the study. Additionally, in this research, there were few persons of diverse racial and ethnic backgrounds, relatively few persons with Medicaid insurance and no worker's compensation data, limiting the generalizability of this study.

Secondly, the data regarding home exercise regimens was difficult to assess accurately. There was large variance between patients in the number of physical therapy visits ordered even

if patients had the same lumbar degenerative spine condition. One patient may have attended 4 of 12 sessions (33%) and another attended 4 of 4 (100%) yet their physical therapy "dose" is the same. This method of operationalizing physical therapy visits has been used in a number of studies (Al-Eisa, 2010; Mailloux, et al., 2006; Medina-Mirapeix, et al., 2009; Soin, et al., 2008). None of these studies addressed the variance in appointment prescriptions. This could potentially be overcome by doing both a "dose" measure such as number of visits and proportion of attendance.

Participation in home exercise regimens was difficult to accurately abstract. Although the well-known qualitative method for content analysis was strictly adhered to (Holloway, 2005), simply asking questions regarding adherence to home exercise regimens has the potential to induce social desirability response bias. It is unknown whether this affected this study. Future studies could be improved by considering changes in the measurement structure of home exercise. For example, total dose of physical therapy appointments may be a more accurate measurement.

Lastly, there were an additional 396 charts that could have been audited. In this study there was a sufficient number of subjects to meet the requirement for power and effect size (n =130). Many of the significant findings were associated with the persons with Medicaid insurance. This subsample was only 12.3 percent of the sample (n =16). It is unknown if this affected the results of the study. This issue will be addressed further in the "Implications for further research" section.

Implications for Nursing Practice

As nurses, the ability to create relevant and individualized plans of care is an important professional responsibility. Although gross generalizations of populations in clinical care are

certainly not appropriate, understanding the factors that put patients at risk for poor outcomes in lumbar degenerative spine conditions can help nurses to develop an individualized plan of care for patients. In this study, three factors were associated with poorer perceived physical functioning and/or higher levels of perceived pain interference-female sex/gender, Medicaid insurance, and higher levels of comorbidity.

In this study, perceived physical function was assessed using a number of task related activities such as "walking a block" and "climbing stairs." Evaluation of the patient's environment and unique barriers can decrease the patient's frustration and increase their functioning (Hickey, 2003) in patients with lumbar degenerative spine conditions. In female patients, careful evaluation of daily activities and function can help patients identify problem areas and assistive resources.

In persons with Medicaid insurance, careful assessment of patient access issues is necessary since these patients are at risk for being referred later in the process of their condition (Nampiaparampil, et al., 2009). Persons with Medicaid insurance are also more likely to have increased numbers of comorbid conditions therefore careful assessment of medications and effectiveness for the individual is needed. Increasing comorbidity also increases the risk of polypharmacy. There is evidence that in persons with chronic pain conditions and multiple comorbidities, better pain outcomes can be achieved through care management lead by professional registered nurses (Baker et al., 2005b; Chen, et al., 2011; Crowe, et al., 2010). The American Pain Society guidelines can help to address the need for comprehensive multimodality methods to treat ongoing pain concerns (Chou, 2010). The multimodality guidelines include the use of physical therapy home exercise regimens, "rational guidelines for polypharmacy" (p. 601) and the educational and psychological needs of patients (Chou, 2010). Nursing practice is in the

position to assess for specific problems in persons with lumbar degenerative spine conditions. At a systems level they can assess for reimbursement specific patterns of referral where patients may be referred late for care or prematurely discharged from physical therapy care. The advocacy role of nursing needs to include assessment and intervention in situations where patients are either being undertreated for pain, or do not have timely access to care.

Implications for Research

The findings of this study lead to several opportunities for further research. The participating spine clinic has 396 remaining charts that can be audited to strengthen the statistical analysis. The researcher will return to the clinic and attempt to audit the remaining charts while the IRB is still in effect (expires 1/2012).

A person's eligibility for Medicaid is fraught with social and economic issues. The strength of association between Medicaid insurance and lower levels of perceived physical functioning and higher levels of pain interference is one of the main outcomes of this study. Further investigation of the needs of this subset population is necessary to develop methods to intervene and improve outcomes. A possible research study to clarify this issue could ask: "What are the unique demographic, biologic and social contributors to health perceptions in persons receiving Medicaid insurance?" Equally important, understanding the health system barriers that delay care for persons with Medicaid insurance and lumbar degenerative spine conditions may also clarify the differences seen in persons with Medicaid insurance.

Although others have studied the role of polypharmacy in poor outcomes in lumbar degenerative spine conditions (Chou, 2010; Crisostomo, et al., 2008; McCarberg & Barkin, 2001; Nampiaparampil, et al., 2009), the association between perceived physical functioning and higher numbers of medications is a new finding. Further research is needed to understand the

unique contribution of each drug class in influencing patient outcomes. Additionally, the realationship between each drug class and its role in changes in perceived physical functioning requires further research.

Lastly, further research is needed regarding patient participation in prescribed exercise regimens. Since self-report measures for exercise are at risk for social desirability response bias, using an objective measure such as an actigraph may yield more meaningful results (ActigraphLLC, 2010). The actigraph is a small, non-invasive monitor that is worn around the waist and measures both duration and intensity of activity. Self-efficacy has also been shown to affect a person's participation in exercise based therapies (Crowe, et al., 2010; Frih, et al., 2009). Combining self-efficacy interventions with actigraph monitoring in at risk persons such as those with Medicaid insurance, female sex/gender and higher levels of comorbidities may help disentangle the issues surrounding lower levels of perceived physical functioning and higher perceived pain interference. In this research study, a number of research questions could be asked. 1) What are the actual activity levels of persons receiving physical therapy for lumbar degenerative spine conditions? 2) How do activity levels differ based on demographic, biologic and social personal factors? 3) How do activity levels differ based on health perceptions such as perceived physical functioning and perceived pain interference.

The other issue regarding prescribed exercise regimens is the number of physical therapy visits that a person receives. Further research is needed to understand the issues surrounding the necessary dose of physical therapy visits for lumbar degenerative spine conditions as well as the content of those visits. In the next section, the implications for policy will be discussed.

Implications for Policy

In the Institute of Medicine's publication *Unequal Treatment,* the plight of the poor and underserved are well described. They receive less aggressive physical therapy for disabling musculoskeletal conditions and experience more pain (Smedley, et al., 2003). In this study, systematic differences were seen in persons with Medicaid insurance. They had lower levels of perceived physical function and higher levels of pain interference. In this study there was no evidence of racial difference in outcomes although the IOM (Smedley, et al., 2003) has documented those as well.

Healthy People 2020 has established improving outcomes for chronic back conditions as one of their objectives (HHS, 2009). This study adds to the evidence supporting that objective by showing the differences in outcomes based on insurance type, sex/gender and increasing levels of comorbidities.

This study highlights differences in care outcomes based on insurance status. The Affordable Care Act (HHS, 2010) is one opportunity to improve care for the underserved with lumbar degenerative spine conditions. As was stated earlier in this writing, persons with Medicaid tend to present later in their disease processes for chronic conditions and this study has demonstrated that persons with Medicaid have poorer perceived physical functioning and higher levels of pain interference when he/she presents for treatment for lumbar degenerative spine conditions. One key objective of the Affordable Care Act is to provide services to minorities and low income individuals. This provides an opportunity to reduce the burden of suffering from lumbar degenerative spine conditions by providing access and decreasing financial burden to low income persons and families.

Contribution to Science

This study had contributed to science in a number of ways. This study showed that in lumbar degenerative spine conditions, females, especially those with increased numbers of comorbidities and older age, have lower levels of perceived physical functioning at the start of treatment for lumbar degenerative spine conditions. Persons with Medicaid insurance had significantly higher perceived pain interference and lower perceived physical functioning especially if combined with high numbers of comorbidities. Higher levels of perceived pain interference predicted whether or not persons used medication to treat symptoms of lumbar degenerative spine conditions but lower levels of perceived physical functioning predicted higher number of medications used to treat these conditions. Persons with higher levels of perceived pain interference were likely to be taking fewer medications for pain. In general, persons with Medicaid insurance used lower numbers of medications but were more likely to be using opiate medications. As perceived physical functioning scores increased, perceived pain interference decreased.

Conclusion

In conclusion, this study has utilized a novel theoretical model the combines concepts from Pender's health promotion model and Wilson and Cleary's health related quality of life model to understand outcomes in lumbar degenerative spine conditions (Pender, et al., 2006; Wilson, 1995). Persons with female sex/gender had lower levels of perceived physical functioning at start of treatment while persons with Medicaid insurance and higher levels of comorbidities had higher perceived pain interference at the start of treatment. After 12 weeks of treatment persons with Medicaid insurance had higher levels of perceived physical functioning and higher levels of pain interference. Higher levels of pain interference predicted the use of

medications but lower perceived physical functioning predicted higher numbers of medications used. Lower numbers of medication were used by persons with Medicaid insurance, those with lower levels of perceived physical functioning and those with higher levels of perceived pain interference.

Nurses need to use this information to closely screen persons with lower levels of perceived physical functioning, higher levels of perceived pain interference and those on multiple medications. Further research is needed to understand the unique needs of persons with Medicaid insurance that have lumbar degenerative spine conditions.

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