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**TREATMENT OUTCOMES OF PATIENTS WITH LOW BACK PAIN
TREATED IN A PAIN REHABILITATION PROGRAM**

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COUNSELING PSYCHOLOGY
At the
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DEDICATION

This dissertation is dedicated to my loving family:

- To my parents, Peter and Carolyn: Throughout my many years of school, you have always instilled in me the importance of education and the value of obtaining knowledge for the greater good. You have supported me and provided me with these unique educational opportunities that I will be forever grateful. Without your continued love and encouragement, I would not be where I am today.
- To my sister, Leah: You have always guided me and paved the way for me. You have always been a strong shoulder for me to lean on and I could not have achieved this without you. Thank you for providing me with the support and encouragement I needed during my moments of doubt.
- To my husband, David: I would not have been able to accomplish my dream of earning my Doctorate without your continued emotional and financial support. Thank you for understanding on the days I was immersed in doctoral studies and for knowing when I needed to take a break.

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**TREATMENT OUTCOMES OF PATIENTS WITH LOW BACK PAIN
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ABSTRACT

The study utilized an individual change model to investigate the effectiveness of a chronic pain rehabilitation program at treating pain, mood (depression, anxiety, and stress), and function for chronic low back pain patients. This retrospective study consisted of a sample of 621 patients with a chronic low back pain diagnosis who completed an interdisciplinary rehabilitation program.

The outcomes of pain, mood and function were assessed at four waves including admission, discharge, 6-month, and 12-month follow-ups using established instruments. The Depression, Anxiety, Stress Scale (DASS) by Lovibond and Lovibond (1995a) was used to assess patients' self-reported levels of depression, anxiety and stress during the time period. The Pain Disability Index (PDI; Tait, Chibnall & Krause, 1990) assessed pain-related disability in several areas of functioning including: family/home functioning, recreational functioning, social functioning, occupational functioning, sexual functioning, self-care functioning, and life support functioning. Finally, a self-report Likert scale was used to determine patients' self-reported levels of pain on a 0-10 point scale. Individual characteristics including age, gender, support, working status, and disability compensation status were also used as predictor variables.

The study found that, regardless of patient characteristics or circumstance, treatment in an interdisciplinary chronic pain rehabilitation program was effective at improving patients' moods, increasing their levels of functioning, and improving their

perceptions of pain. Patients entered the program with pain conditions significantly different from zero, suggesting discomfort at admission. In addition, patients' rates of change were statistically significant, showing improvements in pain mood and functioning during the period under study.

The results from this dissertation study support the extant literature that interdisciplinary treatment is effective. Specifically, the results show not only statistical significance in terms of individual change, but also translate to clinical significance. Psychologists play a vital role in understanding and treating low back pain. Patients with chronic low back pain improved their levels of pain, mood and function during the time period under study. Of importance, this dissertation study was one of the first to examine pain, mood and function of individuals living with chronic low back pain treated in a rehabilitation program utilizing an individual change model. Although a limitation of the study is the lack of a control group, individual change modeling utilizes each patient as their own control. Future research would benefit from focusing on individual change in patients living with chronic conditions, in addition to, analyzing individual change in low back pain patients in comparison to various chronic pain conditions.

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CHAPTER I

INTRODUCTION

Many studies and systematic reviews have illustrated the effectiveness of multidisciplinary and interdisciplinary programs in successfully treating chronic pain conditions (Scascighini, Toma, Duver-Spielhman, & Sprott, 2008; Turk & Swanson, 2007), however, given the debilitating and severe nature of chronic pain, an examination of individual change specifically within an interdisciplinary Chronic Pain (CP) treatment program is warranted. Chronic pain is considered the most common cause of long-term disability in the United States. In the United States alone, 100 million people are living with chronic pain conditions (Institute of Medicine of The National Academies, 2011). Chronic pain is characterized as persistent pain lasting for three months or longer. While an infection, a serious injury, or other medical disease triggers some chronic pain, some people suffer from chronic pain with no known injury or evidence of underlying illness. The next section offers several theoretical explanations of chronic pain.

Physiological and Psychological Conceptualizations of Pain

Biomedical model. For centuries, pain has been identified and conceptualized through various frameworks and perspectives (France, Krishnan, & Houpt, 1988).

Though various interpretations have been offered to understand the phenomenology of

chronic pain, it was not until the 1600s that Descartes offered the postulation that bodily sensation and pain are transmitted within the brain (France, et al., 1988). Descartes argued that the bodily sensation of pain must be a result of a specific disease, which supports the traditional biomedical model. Consistent with Descartes' belief, the specificity theory of pain hypothesized that there are specific pain receptors transmitting information to the body (Vlaeyen, Crombez, & Goubert, 2007). Research, however, has provided additional insight into the traditional belief that pain is located within specific receptors or pain nerves, by recognizing the impact of psychological factors in the experience of pain (Vlaeyen et al., 2007).

Individuals living with pain often reject the notion that pain can be psychological or social, and often seek medical reasons to explain their pain. However, pain as associated only with medical reasons is an incomplete and reductionistic approach to understanding pain (Vlaeyen et al., 2007). The biological and neurological mechanisms of acute pain have been identified, but within the last few decades, there has been a shift in examining chronic pain from a psychological perspective.

Many physicians and researchers have defined and operationalized pain. Among the various definitions, the International Association for the Study of Pain defined pain as, "[Pain] is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (IASP Subcommittee on Taxonomy, 1986, p. 210). Some definitions distinguish between acute pain and chronic pain.

Acute pain is relatively short in duration and typically alerts the body that something is wrong, whether the pain is associated with a specific pathology or tissue

damage (France, et al., 1988). Chronic pain (CP) is persistent pain over an extended period of time, greater than six months. Chronic pain continues despite medical treatment and the etiology is commonly unknown. Pilowsky (1969) identified “abnormal illness behavior” as the increased irrationality, emotional distress, and social isolation experienced by chronic pain patients, particularly the longer the individual lives with chronic pain. In support of Pilowsky’s description of individuals living with CP, organic and psychological factors play a primary role in the development and experience of pain. Pain can often be experienced as secondary to multiple factors, including psychological symptoms like depression and generalized anxiety. As well, an individual’s perception of pain can be exacerbated or altered by various psychological states including anxiety, depression, bipolar disorder and psychosis. The uncertainty surrounding one’s experience of chronic pain can often affect their perception of pain. The next section provides specifics about a theory which addresses both physical and psychological components of pain.

Gate control theory of pain. The Gate Control Theory of Pain, proposed by Melzack and colleagues (Melzack, 1973; Melzack & Wall, 1965) was developed to address the physiological and psychological factors of pain. The conventional biomedical model for understanding and treating chronic pain was insufficient. The Gate Control Theory of Pain underscores the importance of understanding chronic pain within a biopsychosocial framework. This framework integrates all components of one’s experiences of pain, both the psychological and psychosocial aspects of pain. A detailed synopsis of this theory is beyond the scope of this dissertation study; however, it is important to provide an overview to understand the current conceptualizations of pain.

The Gate Control Theory was developed as a response to the criticisms of the conventional biomedical model (Turk, 1996), and posits that there are three differentiated systems related to the subjective experience of pain, including nociceptive stimulation: sensory-discriminative, motivational-affective, and cognitive-evaluative (Melzack & Casey, 1968). There are several types of nociceptors, which are considered primary neurons. The differentiated systems related to nociceptive stimulation all affect the subjective experience of pain. This theory postulates that the experience of pain includes peripheral stimuli with cortical variables, including mood and anxiety. It is also argued that one's subjective experience of chronic pain can be somatic or psychogenic and have a moderating or potentiating effect on the perception of pain (Turk, 1996). An individual's attempt to cope with pain is a result of a continuous sequence of Central Nervous System (CNS) activity, including excitatory and inhibitory influences (Turk, 1996).

The Gate Control Theory of Pain emphasizes the influence of the dorsal horn, located within the spinal cord (Melzack & Wall, 1965). The gate is an analogy used to describe the opening and closing of the dorsal horn when nerve fibers synapse on the way to the brain (Aronson, 2002). The gate functions as a negative feedback loop. As negative perceptions, such as pain, are experienced, the gate opens and remains open, exacerbating one's experience of pain. The large afferent fibers that receive the painful message, carry the message to the brain, alerting the individual that he/she is in pain. Likewise, the more focused an individual is on the pain, the more often the gate remains open, sending painful messages to the brain.

Melzack (1993) outlined the following propositions of the Gate Control Theory.

According to Melzack and Wall (1965), there were five key propositions of the Gate Control Theory of pain:

1. The transmission of nerve impulses from afferent fibres to spinal cord transmission (T) cells is modulated by a spinal gating mechanism in the dorsal horn.
2. The spinal gating mechanism is influenced by the relative amount of activity in large-diameter (L) and small-diameter (S) fibres: activity in large fibres tends to inhibit transmission (close the gate) while small-fibre activity tends to facilitate transmission (open the gate).
3. The spinal gating mechanism is influenced by nerve impulses that descend from the brain.
4. A specialized system of large-diameter, rapidly conducting fibres (the Central Control Trigger) activates selective cognitive processes that then influence, by way of descending fibres, the modulating properties of the spinal gating mechanism.
5. When the output of the spinal cord transmission (T) cells exceeds a critical level, it activates the Action System - those neural areas that underlie the complex, sequential patterns of behaviour and experience characteristic of pain. (Melzack, 1993, p. 618-619)

While the Gate Control Theory was groundbreaking at the time of inception, this theory has also spurred many researchers to study the effectiveness of this model as well as advance our understanding of pain (Moayedi & Davis, 2013). Through research and

scientific advances, researchers have found inaccuracies and oversimplifications in the details of this theory. Melzack and Wall's (1965) theory emphasized the close relationship and interplay of psychosocial and physiological activity. In particular, it demonstrated how these processes affect an individual's perception of pain (Gatchel, Haggard, Thomas & Howard, 2012).

Biopsychosocial perspective of pain. In response to the Gate Control Theory, other researchers offered alternative explanations of pain. As cited in Amundson and Wright (2004), Turk and Flor (1999) described the basic tenets of the biopsychosocial approach to the pain experience, essentially stating that one's experience of pain is determined by the interplay of biological, psychological, and social factors.

Predispositional factors and current biological factors may initiate, maintain, and modulate physical perturbations; predispositional and current psychological factors influence the appraisal and perception of internal physiological signs; and social factors shape the behavioral responses of patients to the perceptions of their physical perturbations. (Turk & Flor, 1999, p. 20)

Biopsychosocial approaches to chronic pain focus on the complex interaction among the biological, psychological and social factors that are inherent in our experiences. According to Amundson and Wright (2004), the most influential biopsychosocial approaches for working with chronic pain include the Operant Model, Glasgow Model, biobehavioral model and fear avoidance models. For the purposes of this dissertation, only the Operant and Fear Avoidance models are discussed.

Operant model. The Operant model (as described in Amundson & Wright, 2004), developed by Fordyce (1976) and colleagues (Fordyce, Shelton, & Dundore,

1982), detailed how pain behaviors, described as actions, verbalizations, or facial expressions in response to pain, perpetuate the experience of pain (Gatzounis, Schrooten, Crombez, & Vlaeyen, 2012). While operant conditioning does not dismiss the role of biological factors, it looks more closely at the role that learning has on pain experiences. Operant conditioning suggests reinforcement (both positive and negative) can serve as vehicles for pain behaviors. Acute pain behaviors (including moaning, groaning, medication intake, inactivity, frequent talk of pain experience) may develop into chronic pain behaviors through positive and negative reinforcement (Flor, Knost, & Birbaumer, 2002).

Skinner (1953) first introduced basic principles of operant learning theory and were later developed and applied to pain behaviors by Fordyce (1976). The basic principal of operant learning theory, according to Skinner, suggested that reinforced behaviors are likely to be repeated, however, behaviors that are not reinforced are likely to weaken or not be repeated (Gatzounis, et al., 2012). This suggests that reinforced pain behaviors, including a caregiver allowing a person with chronic pain to remain inactive, are more likely to continue the pain behavior of remaining inactive because it is being reinforced by the caregiver.

Fear avoidance models. The Fear-Avoidance model, as developed by Vlaeyen and Linton (2000), detailed how acute pain may become chronic pain utilizing the principles from a cognitive behavioral approach. The basic tenet of the fear avoidance model is that “the way in which pain is interpreted may lead to two different pathways” (Leeuw et al., 2007). People are likely to continue engagement in everyday activities when acute pain is perceived as non-threatening. However, when pain is perceived as

threatening, people are more likely to engage in avoidance behaviors as a result of fear or anxiety of the pain experience. The maladaptive coping strategy of avoiding the experience of pain based on a fear or anxiety is likely to lead to undesirable consequences, including disability (Amundson & Wright, 2004). Functional disability in everyday activities is strongly related to a fear avoidance approach to the pain experience rather than the severity of the pain itself (Crombez, Vervaeke, Lyssens, Baeyens, & Eelen, 1998).

Overall, the experience of pain is primarily psychological in nature. The understanding of pain has substantially developed from a strict medical approach to a biopsychosocial approach to pain. Pain is a multidimensional, complex interplay of various factors that affect the way an individual experiences pain.

Chronic Pain and Chronic Low Back Pain

Out of the millions living with chronic pain conditions, the most common condition is chronic low back pain (CLBP), accounting for 27% of chronic pain sufferers (Institute of Medicine of The National Academies, 2011). The rising cost of health care and medical treatment for chronic pain conditions has increased exponentially; in particular, the cost of treating CLBP conditions has become one of the most expensive conditions to treat. Considering the economic costs, \$100-200 billion in recent years and steadily increasing, efforts need to be made to improve the quality and appropriateness of care for CLBP (Freburger, Carey & Holmes, 2011). Individuals who suffer from CLBP typically experience the most debilitation and disability, compared to other chronic pain conditions, and are more likely to experience a resistance to various treatment approaches. When treatment approaches do not work, most patients who experience this

resistance are referred to multidisciplinary or interdisciplinary bio-psychosocial programs.

The framework for this dissertation study is specific to CLBP and expounds upon the extant literature by adding to the CLBP research. Given that CLBP is the most common cause of disability and that it also affects the lives of individuals on a psychological and social level, the effectiveness of treatment for chronic pain and CLBP and its associated conditions, including depression, anxiety and perceived level of functioning, is necessary. In addition, individuals living with CLBP are often absent from work or on some form of disability compensation (Muijzer, Geerten, de Boer, Groothoff, & Brouwer, 2012).

Several methods of treatment have been studied and implemented for treating CLBP. Chronic pain treatment is frequently questioned, given the rise of medical costs and treatment. The ability to pay for effective treatments has also come into question due to absenteeism from work due to disability. One can turn to the literature to realize the importance of reducing levels of disability, and improving mood and function, as related to chronic pain conditions.

Chronic Low Back Pain is just that - chronic. Most treatment approaches to chronic pain attempt to “fix” or “eliminate” the condition through surgery or pharmacological approaches. However, some research and experience, has suggested that chronic pain conditions are better dealt with if the individual learns to accept and cope with the condition through various self-management approaches; they learn to live with the condition in an effective and healthy manner (Turk & Okifuji, 2002). Some chronic pain patients may abuse medication as a way to eliminate the physical and emotional pain.

Some chronic pain patients may neglect their bodies and avoid physical exercise at all costs so they do not have to experience the fear of more pain. Learning to live with a chronic pain condition is important with any treatment. While individual approaches to treating chronic pain have been successful, it is argued that an interdisciplinary-biopsychosocial approach, that encompasses all areas of function associated with living with a chronic condition, is an important component of treatment. Although multidisciplinary/interdisciplinary rehabilitation programs have significantly increased over the last few decades (Flor, Fydrick, & Turk, 1992), and have been considered effective, there is still limited information on which treatment components, and which patient characteristics such as diagnoses, age, and social backgrounds, are most important (Scascighini et al., 2008). Scascighini et al. (2008) suggested that examining the effectiveness of interdisciplinary rehabilitation programs in connection with patient characteristics may be necessary. Thus, the purpose of this dissertation is to examine the individual change of pain, mood and function of individuals with CLBP treated in an interdisciplinary chronic pain rehabilitation program. The next section defines the important terms in this study of CP and CLBP treatment, followed by the research questions which guide this dissertation research.

Definitions

Chronic Low Back Pain (CLBP) is defined as a condition that lasts for more than 3 months. The etiology of CLBP is either mechanical or non-specified. The condition has no known underlying pathology, however can be caused by general conditions like a muscle strain or from a diagnosable condition like degenerative disc disease.

Interdisciplinary treatment is operationalized as a multi-disciplinary bio-psychosocial rehabilitation with, minimally, one physical dimension, one psychological dimension and one occupational dimension to treatment. Physical dimensions include exercise therapy, physical therapy or strength training. Psychological dimensions include individual therapy, group therapy or marriage/family therapy. Lastly, occupational dimensions include occupational rehabilitation or job-related disability. Interdisciplinary treatment emphasizes the communication among health care providers to optimize and coordinate treatment.

Mood includes any feelings associated with depression, anxiety or stress. Depression is operationalized as marked feelings of sadness and melancholy that interfere with daily functioning. Depression includes loss of interest in usual activities (that are not affected by chronic pain condition), difficulty starting the day due to sadness, and marked decreased feelings of happiness and excitement. Anxiety is associated with heightened feelings of awareness surrounding the chronic pain condition. In addition, anxiety is operationalized as feelings associated with fear, apprehension, and worry as it relates to functioning and pain-related behaviors. Lastly, stress is operationalized as overwhelming feelings of emotional and behavioral symptoms as it pertains to living with a chronic condition.

Lastly, *Function* is operationalized as the individual's ability to engage in everyday tasks that are associated with quality of living. Function might include cleaning the house, self-care, getting ready for work, and engaging in activities with family or friends.

Hypothesis and Research Questions

To continue the research and identification of best practices for patients experiencing chronic low back pain, this dissertation explores the following hypothesis with two research questions.

Hypothesis. The rate of improvement in pain, mood, and function for chronic low back pain patients will vary by certain demographic characteristics including age, gender, support, working status, and disability compensation status.

Research questions.

1. Do the patients' initial Pain Depression Inventory (PDI; Tait, Chibnall & Krause, 1990), Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995a) scores, and pain ratings significantly vary by disability compensation status, gender, age, and support?
2. Do the patients' rates of improvement from time of admission to 12-month follow-up, as measured by the Pain Depression Inventory (PDI), Depression Anxiety Stress Scale (DASS) scores, and pain ratings significantly vary by disability compensation status, gender, age, and support?

Significance and limitations. The research questions were examined by the primary researcher by analyzing data collected at a large Midwest hospital between 2008 and 2012. There are several advantages to conducting a retrospective study. Retrospective studies are relatively inexpensive and will cost little, if anything, to conduct. The database is rich and full of information that has not been analyzed in this capacity. In addition, there is likely to be a generation of hypotheses that can be prospectively tested by the current researcher. The results of this dissertation are expected

to support the extant literature and will allow future researchers to examine the effects of interdisciplinary research programs based on CLBP conditions while manipulating variables that were determined to be statistically significant in this study.

However, due to the non-experimental design of this study, there are several limitations to conducting a study retrospectively. The researcher may encounter incomplete documentation that is unrecoverable or unrecorded. In addition, there is potential for misinterpretation of information as it is retrieved from a larger-scale database. Despite the limitations, the results of this research will positively add to the existing literature by revealing the effectiveness of an interdisciplinary rehabilitation program on the quality of life of those living with CLBP as measured by pain, mood, and function.

The next chapter provides a review of the relevant literature in support of this dissertation study.

CHAPTER II

REVIEW OF THE LITERATURE

Chronic pain is estimated to effect 1.5 billion people across the globe (Global Industry Analysts, 2011). Numerous studies have documented the high incidence rate of Chronic Low Back Pain (CLBP) in not only the Western population, but worldwide (Wolter, Szabo, Becker, & Mohadjer, & Knoeller, 2011). The lifetime prevalence of CLBP among the adult American population is 80% (Wolter et al., 2011); one in four American adults will seek medical treatment for low back pain.

Chronic pain does not discriminate. This condition affects those across socioeconomic status, race, gender and age. With a chronic pain diagnosis usually comes a long-lasting or permanent relationship with medical and financial providers (Indahl, 2004). There are various types of chronic pain that include migraines, arthritis pain, fibromyalgia, neurogenic pain, and low back pain. Well-documented and successful treatments have been implemented as a way to improve functioning in the lives of those affected with a pain condition. The alarming statistics and prevalence of the condition have led to a sudden increase in research on chronic pain. Significant increases and attempts have been made to understand the etiology and treatment of chronic pain conditions, but there is still more to uncover. The focus of this literature review is to

explore chronic pain and chronic low back pain, as well as explore characteristics of CLBP and the types of treatments found most effective. This chapter provides an overview of CP and CLBP research, including pharmaceutical interventions, behavioral interventions, mood or affective factors, functioning, and the efficacy of multidisciplinary and interdisciplinary treatment approaches.

Overview of CP and CLBP Research

CLBP is the second most common disability in the United States, according to the Center for Disease Control and Prevention (Freburger et al., 2009). A neurological ailment, CLBP interferes with work, routine daily activities, and leisure or recreation activities to a disabling degree. While acute low back pain is equally debilitating, a measurement of chronicity depends on the pain persisting for more than 3 months. With no exact known cause, CLBP may start from diseases, stresses, or injuries that affect various structures in the body, including bones, ligaments, joints, nerves, and the spinal cord. Individuals who suffer from CLBP may experience emotional and cognitive symptoms that must be taken into account when treating patients with this chronic condition (Turner & Chapman, 1982). CLBP leads to job-related disability, impaired daily functioning, and mood impairments (including depression, anxiety, and stress).

According to Vora, Barron, Almudevar and Utell (2012), the rise of medical costs and work-related disability due to low back pain is on the rise in the United States. The medical costs, estimated to be around \$11 billion dollars in 1989 (Webster & Snook, 1994), are not the only costs for patients living with low back pain. The costs of living with chronic low back pain extend beyond the fiscal costs and include work loss, disability, legal fees, and wage loss. Hong, Reed, Novick, and Happich (2013) examined

the growing cost and economic burden chronic low back pain can have on the economy, but also the burden for individuals. Their research, although conducted in the United Kingdom, confirmed that the economic burden of chronic low back pain is at least double the typical healthcare costs. In addition, as cited in Hong et al. (2013), a study conducted in the United States suggested that medical care costs for CLBP patients is more than double typical healthcare costs (Gore, Sadoski, Stacey, Tai, & Leslie, 2012; Hong et al., 2013).

CLBP is a complicated condition. The combination of several risk factors interact to perpetuate the effects of chronic, persistent pain (Zimmermann, 2004). There are many risk factors associated with chronic low back pain including socio-demographics, psychological, lifestyle, physical, and work environments factors (Wolter et al., 2011). However, a diagnosis of low back pain is difficult and complex. A diagnosis of CLBP is reasonable to make if “1) the spinal structure is innervated; 2) is capable of causing pain similar to that encountered clinically; and 3) is susceptible to disease or injury known to be painful” (DePalma, Ketchum, & Saullo, 2011, p. 224). The following section focuses on demographic variables and patient characteristics (including working status and disability compensation status).

Demographic Research and Patient Characteristics

There is an abundance of literature on various demographic variables within the chronic pain literature. Gender and age are included because it is expected that men and women experience pain differently, as well as, the perception of pain for older patients. Individuals with disability compensation, who are not working, are expected to be less likely to make improvements or changes in their chronic pain status. Finally, support is

identified as a variable due to the willingness or tendency of partners to enable pain behaviors. Literature on these variables are included below.

Work and disability-compensation related research. Many studies have examined individual work-related variables for workers with CLBP conditions (Durand & Loisel, 2001; Muijer et al., 2012). These researchers have stated that returning to work increases the overall well-being of individuals with chronic pain.

A study conducted by Kuijer et al. (2005) examined work engagement or participation in work and the various components of health status for individuals living with CLBP. The study included ninety-two patients, with CLBP, who were being treated in a multidisciplinary rehabilitation program. Kuijer and colleagues conceptualized working as the patients abilities to perform their job without any restrictions. The findings suggested that work status and living with a CLBP diagnosis is multidimensional, particularly from a biopsychosocial framework. Kuijer et al.'s findings suggested that non-working CLBP patients reported more physical and mental limitations. In addition, non-working patients may have more depressive symptoms. Finally, the authors stated that patient willingness to engage in work-related activities may be dependent on self-reported physical and mental limitations, concluding that rehabilitation programs would benefit from reframing patient beliefs regarding their perceived degree of function and disability.

Vora et al., (2012) examined work-related CLBP outcomes after treatment in pain treatment centers. In contrast, these researchers concluded that treatment in pain centers did not yield significant improvements in function, but did find that as pain levels worsen so did the patients likelihood of returning to work.

Muijzer et al. (2012), qualitatively examined relevant factors in a CLBP patient's return-to-work status. Data gathered through focus groups revealed nineteen factors associated with return to work including, but not limited to age, educational level, attitude, self-efficacy, illness perception, and functional capacity. Their study, in addition to existing studies, also purported that functional capacity is strongly related to return to work likelihood.

Individuals living with chronic pain conditions, including CLBP, are likely to become dependent on financial services, such as welfare or disability services, due to the chronicity and duration of having a perceived disability or inability to return to work. Gagnon and colleagues (2013) examined the efficacy of an interdisciplinary rehabilitation program with individuals living with chronic low back pain conditions who also received worker's compensation (Gagnon et al., 2013). As cited in Gagnon et al. (2013), the United States had 60 times more worker's compensation claims due to back pain than Japan in 1999, for various reasons (Volinn, Nishikitani, Weining, Nakamura & Yano, 2005). However, despite the challenging nature of worker's compensation, the researchers found that the rehabilitation program was effective at decreasing emotional distress and pain intensity.

Various forms of compensation are available to chronic pain patients (including worker's compensation, social security disability). It has been noted by researchers that patients treated for a pain condition (72% CLBP patients), who also have a form of compensation, are likely to have poorer outcomes than patients treated without some form of compensation (Teasell, 2001). Rohling, Binder and Langhinrichsen-Rohling (1995) conducted 136 controlled studies with disability compensation patients about the

effects this status has on treatment outcomes. These researchers concluded that patients with chronic pain conditions who are receiving a form of compensation are likely to experience greater levels of pain and minimal success in treatment. Receiving compensation complicates an individual's experience of pain. Many compensation systems require individuals to submit claims and essentially prove their pain or condition. As noted by Newton-John and McDonald (2012), "Given that the experience of pain is purely subjective, this requires the injured workers to find some means of convincing others that their problems are genuine, which directly contradicts notions of rehabilitation and recovery" (p.39).

Gender. Individuals living with CLBP may progress through rehabilitative treatment at different rates due to the influence of several demographic factors, including gender, age, and marital status/support. The influence of the preceding factors may influence rehabilitative success and/or program completion of individuals being treated in an interdisciplinary rehabilitation program.

In general, gender differences are present in the prevalence of chronic pain conditions, with women appearing to experience greater susceptibility to pain experiences (Johannes, Le, Zhou, Johnston & Dworkin, 2010). A recent publication in the Journal of Behavioral Medicine noted dissimilar findings regarding the influence of gender on program outcomes (Farin, Gramm & Schmidt, 2013). Farin and colleagues found that gender, older age, and inability to work are relevant risk factors. Several researchers have examined the influence of gender on treatment outcomes, revealing inconclusive and inconsistent findings. According to Sagmanli, Yagci, Cavlak and Cetin

(2009) females living with chronic low back pain are more likely to experience psychological and social difficulties as compared to males.

Tlach and Hampel (2010) examined 431 chronic low back pain patients prior to treatment in a rehabilitation program. Researchers determined that females were more likely than males to experience psychological distress as well as pain-related difficulties (Tlach & Hampel, 2010). Sagmanli, Yagci, Cavlak and Cetin (2009) examined 118 Turkish men and women to explore the differences in “pain intensity, disability, emotional status and physical functioning” (Sagmanli et al., 2009, pg. 257) based on gender. Sagmanli and colleagues (2009) found significant differences between the way men and women experience and perceive pain, concluding that compared to men, women were more likely to have more intense pain, greater depression, and higher disability scores as rated on the Oswestry Disability Index (ODI) (Fairbank, Couper & Davies, 1980). Their findings further suggested that since women had greater perceptions of intense pain, they were more likely to also experience higher levels of depression as well as more disabling pain, resulting in greater disability. A research study conducted by Farin et al., (2013) further suggested that women’s perceptions of pain may also impact the way they experience pain and progress through rehabilitative treatment programs. However, Farin et al. (2013) also found that gender may be more predictive of treatment difficulties in the short term, but not as predictive later on. This suggests the importance in conducting further examinations about how gender plays a role in the treatment outcomes of individuals living with CLBP.

Investigations of how pain is perceived in men and women may offer additional insights into rehabilitation outcomes for people living with chronic pain conditions,

including chronic low back pain. As stated in Sagmanli et al. (2009), researchers have noted clear gender differences in the physiological, biological, psychological (depression, anxiety, and stress) and social responses to pain, including stereotypical gender responses to pain (Defrin, Shramm, & Eli, 2009; Stutts, McCulloch, Chung & Robinson, 2009).

Age. The experience of pain over the lifespan is important to understand when working with individuals living with chronic pain. Many studies have examined the role age plays in the experience of chronic pain (Sorkin, Rudy, Hanlon, Turk, & Stieg, 1990; Turk, Okifuki, & Scharff, 1995). Results from various studies suggest patients, regardless of age, report similar depressive symptoms, whereas studies have shown that patients' experiences of anxiety related symptoms may be more prevalent in younger individuals (Cossins, Benbow & Wiles, 1999). Finally, age and work-disability status negatively affects physical functioning for individuals living with chronic pain conditions.

Support. Observers of pain patients are likely inclined to aid in the pain patients' experiences and assist them in living with the chronic pain condition. The observer, commonly a family member or spouse, is likely to enable the person's pain experience and pain behaviors by doing things for them, rather than encouraging them to do things for themselves. This impacts the patient's perceived functioning and may cause strain in the relationship (Hadjistavropoulous, Craig & Fuchs- Lacelle). A study conducted by Schwartz, Slater, and Birchler (1996) found that marital conflict creates a cycle of pain behaviors by the patient and negative responses by the spouse.

The following section focuses on noninvasive treatment approaches for chronic pain and chronic low back pain conditions.

Treatments for CP and CLBP

Effective treatments are known and well-documented for CLBP. Haldeman and Dagenais (2008), as cited in May (2012) reported over “60 pharmaceutical products, 100 named techniques in chiropractic, physical therapy, osteopathy and massage therapies, 20 different exercise programs, 26 different passive physical modalities, 9 educational and psychological approaches, and 20 different injection therapies” (p.236). For determining best approaches for the treatment of CLBP, the length of treatment or rehabilitation was considered, along with the multidisciplinary nature of the approach and the use of best supported outcome measures (Gaskell, Enright, & Tyson, 2006). Therapeutic approaches for treating CLBP can be divided into two categories: noninvasive and invasive treatments. Noninvasive approaches for treating CLBP may include pharmacology, behavioral treatments, physical therapy, and biofeedback. This literature review continues by highlighting the most prominent of the noninvasive treatments for CLBP.

Pharmaceutical interventions. Pharmaceutical interventions have been consistently used to treat CLBP for several reasons. Treating the pain itself is the primary reason for pharmaceutical interventions; however, other symptoms may be effectively treated for chronic pain sufferers. Antidepressants are frequently used to help with depression, anxiety, and pain tolerance. They are prescribed to patients with CLBP to provide pain relief, help with sleep and reduce depression. Depressed mood is a common symptom associated with CLBP due to the debilitating nature of the condition. Medication regimens, including antidepressants, are effectively used to increase mood and improve ability to cope with persistent pain (Alcoff, Jones, Rust, & Newman, 1982; Pheasant et al., 1983). However, the use of antidepressants has been called into question

in light of recent research. In a systematic literature review, Urquhart, Hoving, Assendelft, Roland, and van Tulder (2010) found that the use of antidepressants did not significantly improve depressive symptoms or relieve back pain any more than placebos. The conflicting evidence suggests a need to explore the effectiveness of antidepressants to treat back pain and depression (Urquhart et al., 2010).

Muscle relaxants are used as a treatment intervention to decrease the frequency of muscle spasms associated with pain conditions. It has been noted that patients visiting primary care physicians are prescribed muscle relaxants to manage chronic pain (Cherkin, Wheeler, Barlow, & Deyo, 1998), however the effectiveness of certain muscle relaxants is in question (Salzman, Pforringer, Paal, & Gierend, 1992). In an effort to decrease the disruptive nature of pain as a result from spasms within the muscles, the chronic pain sufferer is able to increase daily functioning activities (Salzmann et al., 1992). While muscle relaxants have been proven to be effective in the management of CLBP, the use of muscle relaxants is controversial and highly disputed among physicians due to the adverse effects that may impede improvement in functioning. Some of these adverse effects include sedation, drowsiness, headache, vomiting and, most importantly, abuse potential. Given the controversy, clinical guidelines have suggested using muscle relaxants in combination with non-steroidal anti-inflammatory drugs (NSAIDs). Despite the adverse risks, the majority of physicians reportedly use muscle relaxants for treating low back pain (Koes, van Tulder, Ostelo, Kim Burton, & Waddell, 2001).

Non-steroidal anti-inflammatory drugs (NSAIDs) have been proven to aid in chronic pain treatment based on the analgesic and anti-inflammatory properties (Coats, Borenstein, Nagia, & Brown, 2004). Of the medications most frequently used to treat

CLBP, a review of over 65 studies have concluded the short-term use of NSAIDs to be effective for symptom relief (Roelofs, Deyo, Koes, Scholten, & van Tulder, 2011). In addition, studies have demonstrated long-term evidence for decreased pain and improved daily functioning (Katz et al., 2003).

Behavioral interventions. Behavioral interventions for CLBP can range from exercise therapy to educational programs to psychotherapeutic treatments. The studies of behavioral interventions have demonstrated improvement in functioning of CLBP. Researchers have examined the positive effects of behavioral interventions for chronic pain in general, including exercise therapy, patient education, biofeedback, and behavioral modification (Turner & Chapman, 1982). The following paragraphs describe the research pertaining to behavioral interventions, including exercise/physical therapy, biofeedback, and behavioral/cognitive behavioral therapy.

Physical therapy is key to exercise therapy, including general physical fitness programs, aerobic and anaerobic exercise, and flexibility or strengthening exercises. Studies have strongly suggested the effectiveness of exercise therapy for the treatment of back pain increases when used in conjunction with other, perhaps more non-conservative methods of treatment (Alexandre, de Moraes, Correa Filho, & Jorge, 2001). Exercise or physical therapy programs work to improve the functioning of back pain by slowly working the muscles to improve strength and support. Improving the strength of the muscles associated with the debilitating pain leads to more frequent, pain-free use of the muscles. This increased use improves the structures and functions of the muscle fibers and associated ligaments and tendons (Alexandre et al., 2001).

As cited in various clinical practice guidelines, physical therapy and supervised exercise have proven to be effective in reducing pain and improving functional performance in the treatment of patients with CLBP as cited in Garcia, Gondo, Costa, Cyrillo, and Costa (2011). There is an underutilization of physical therapy, which suggests that individuals perceived to have disabling pain are viewed as unable to partake in physical therapy exercises (Freburger et al., 2011). It is important for patients experiencing CLBP to engage in active forms of back exercises to rehabilitate the spine and alleviate back pain. Avoiding stiffness, weakness and consistency of CLBP is important in physical therapy exercise.

The most effective physical therapy treatment is still unknown. Various exercises have been proven to be helpful in improving function of patients with CLBP including: stabilization exercises, strengthening exercises, low-impact aerobic exercises, motor control exercise, endurance training, manual traction, kinesiotherapy, and physical retraining approaches. Freburger et al. (2011), conducted a study with CLBP patients which revealed that physical therapy treatments for CLBP were encouraging. The researchers concluded that engaging in physical therapy treatment is an effective intervention; however, less than one third of the highly disabled patients (those who are physically impaired by pain) received physical therapy as a treatment (Freburger et al., 2011). In a review of the available literature, Smith and Grimmer-Somers (2010) found that physiotherapy exercise programs were more effective in reducing pain scores than other novel approaches to treatment, particularly at the 6-month follow-up. In addition, experiences of successful exercising may reinforce the patients' beliefs in their physical abilities.

Cognitive-behavioral and biofeedback approaches. Cognitive-Behavioral Treatment (CBT) approaches to CLBP aim at improvement in the quality of functioning and living by reducing negative thoughts and fixations about, and on, the pain to improve quality of functioning and living. CBT interventions for CLBP aim at improving daily functioning and managing disabling pain. A follow-up study conducted in the Netherlands found that more than half of the participants showed improvement in functioning and pain management and quality of life (80%) using a CBT approach to treatment (van Hooff et al., 2010). In addition, a systematic review of randomized controlled trials compared the effectiveness of CBT with other forms of treatment. The results suggested that CBT produced significantly greater changes in individuals' abilities to cope with pain through cognitive reframing, in their pain experiences, and in a reduction of behavioral expressions of pain (Morley, Eccleston, & Williams, 1999; Roelofs, Boissevain, Peters, de Jong & Vlaeyen, 2002). This suggests that CBT methods for dealing with chronic pain conditions are a generally effective and successful treatment approach (Morley et al., 1999; Roelofs et al., 2002). The use of CBT in treating CLBP is ultimately to teach people how to challenge negative or problematic thoughts surrounding their pain and disability, and to test out new ways for improving activity. CBT is intended to help people change the way they think about pain and, in turn, how they behave when they experience pain.

Biofeedback is a popular intervention for treating chronic pain and has been used as a primary treatment or in conjunction with other treatments (Glombiewski, Hartwich-Tersek & Rief, 2010). Individuals with chronic low back pain experience heightened levels of emotional, cognitive and behavioral symptoms. Biofeedback is a technique used

to show the individual their normal and abnormal physiological reactions, through the use of visual signs and sounds, to teach them they are in control of their behaviors by learning how to effectively cope with life stressors and unperceived events (Newton-John, Spence, & Schotte, 1995). Newton and colleagues (1995) examined 44 chronic low back pain patients who were assigned to different groups including CBT, biofeedback, or wait list control. Post treatment results for CBT and biofeedback groups revealed significant improvement in disability, pain intensity, and depression. Relaxation and deep breathing, in conjunction with biofeedback, is an effective strategy to train individuals with chronic pain to control their responses to stressors and events (Hanley, Racihle, Jensen & Cardenas, 2008). However, some studies have contradicted these findings, concluding that biofeedback treatments do not result in improved outcomes at post treatment or at 6-month follow-up (Glombiewski et al., 2010).

A brief review of effective, noninvasive treatments in working with chronic pain and chronic low back pain has been reviewed. The available literature is extensive and suggests improving a patient's quality of life living with a chronic condition is possible. The following section focuses on research related to mood and functioning.

Research on Mood: Depression, Anxiety, Stress

In addition to the physical factors associated with CLBP and other chronic conditions, individuals often experience affective factors, with the most prevalent being depression (Sarda, Nicholas, Pimenta, & Asghari, 2008). Many studies have documented the comorbidity of chronic pain and depression (Wilson, Eriksson, D'Eon, Mikail & Emery, 2002; Gallagher & Verma, 2004). As noted in Sarda et al. (2008), the variance of depression among chronic pain populations ranges from 1.5% to 57% of patients

(Campbell, Claow & Keefe, 2003; Worz, 2003;) suggesting that depression is a common factor in chronic pain patients, but also indicating a need to examine how depression affects specific chronic pain samples, including those living with CLBP. Treating CLBP typically extends beyond the bounds of treating the pain itself. Living with CLBP often strongly relates to difficulties with mood regulation. The presence of CLBP is likely to increase the duration of a depressed mood and vice versa (Ohyan & Shatzberg, 2003).

Depression is a clinical diagnosis generally seen in CLBP populations and it is important to examine the relationship between pain and depression and how both pain and depression can improve when treated in a multidisciplinary program. A study conducted with a Turkish population found that depression was directly related to both physical and psychosocial functioning in patients with CLBP. The researchers concluded that the intensity of the pain experienced resulted in perceived disability and depression (Sagmanli et al., 2009). Fishbain, Cutler, Rosomoff, Khalil and Steele-Rosomoff (1997) reviewed the comorbid presence of depression and pain. Their systematic review found a statistical difference between individuals with chronic pain and depression when compared to healthy controls. Depression was found to be more common and intense in individuals living with chronic pain when compared to healthy controls without a pain condition (Fishbain et al., 1997).

In a study examining the effects of depression on success of rehabilitation, it was reported that depression reduced the likelihood of responding to pain treatments and worsened the effects of chronic pain on the physical and psychological functioning of individuals (Worz, 2003). The nature of depression and chronic pain conditions has been debated, specifically related to the shared symptoms of chronic pain and depression.

Nicholas, Coulston, Asghari and Sing Malhi (2009) examined the relationship between chronic pain and depressive symptoms in patients. The researchers presented an argument suggesting that the association between depression and chronic pain is complicated. Some argue that pain occurs first and then ultimately leads to depressive symptoms. Others argue that depression and chronic pain occur simultaneously resulting in a comorbid condition (Bair, Robinson, Katon et al., 2003; Nicholas et al., 2009). Pincus and colleagues (2004) found that chronic pain patients tend to endorse somatic symptoms associated with depression more often than depressed people without chronic pain (Pincus, Williams, Vogel & Field, 2004). The debate on how depression is experienced, and the method used to determine depressive symptoms, indicates a need to re-evaluate how depression is experienced in CLBP patients in rehabilitation programs.

Anxiety is also significantly associated with chronic pain (Asmundson & Katz, 2009). Anxiety is linked to lower tolerances of pain and increased pain perceptions (McCracken & Gross, 1998). Those suffering with back pain, who also experience anxiety, may be less receptive to treatment and more likely to be avoidant (Boersma et al., 2004) or noncompliant with treatment due to anxious tendencies. Boersma et al. (2004) replicated previous research findings by Vlaeyen and colleagues noting that exposure techniques may be beneficial in decreasing fear and avoidance beliefs (Vlaeyen, de Jong, Gelen, Heits, & van Breukelen, 2002). Depression and anxiety occur in 20-50% of patients with chronic pain (Asher, 2006). This anxiety is likely related to the unknown of the pain and future expectations. Pain is persistent. Pain interferes with daily functioning and the interferences can lead to anxiety of the unknown. In addition, pain hinders one's ability to move with ease, resulting in a fear or general anxiety associated

with moving and/or general movements. In a study conducted through a rehabilitation center, it was found that subjects who reported a high degree of fear and anxiety surrounding physical movement, as it is related to their pain, tended to avoid simple movements which, in turn, further exacerbated pain and pain disability (Vlaeyen, Kole-Snijders, Boeren & van Eek, 1994). In a literature review conducted by Jensen, Turner, Romano and Karoly (1991), they concluded effective coping strategies that are learned and implemented in therapeutic sessions can be helpful for decreasing the anxiety associated with pain.

Depression, anxiety and stress are highly interrelated emotions in patients with CLBP. Stress exacerbates pain. Pain influences anxiety and perceived abilities to engage in everyday activities or daily functioning skills. The lack of confidence and fear of engaging in daily activities may result in depressive symptoms. Emotional stress affects perceptions of pain and this link may help in managing and coping with CLBP. In a study examining stress-related responses in people with chronic pain, Flor and Turk (2010) found an association between stress-related responses and perceived levels of pain. In addition, biofeedback has illustrated the link between stress and anxiety and the effects on the body (Flor & Turk, 2010). Observing how an individual's body responds to stress and relaxation techniques during biofeedback sessions helps the individual recognize the control they have over their bodies. Further examination on how pain affects mood, and vice versa, is necessary for treating CLBP patients.

Function

Perceived and real difficulties in functioning status are evident in those living with CLBP. Living with chronic pain may cause debilitation to a significant degree that prevents the individual from engaging in everyday activities. Level of function is determined by one's ability to engage in daily living tasks (getting dressed, cleaning the house), work disability (ability to attend work without impairment), and ability to engage in leisure activities without impairment. Improved functioning has been associated with decreased pain levels and improved mood (Gatchel, Bo Peng, Peters, Fuchs, & Turk, 2007).

Individuals living with untreated CLBP are generally absent from work, which results in work related disability and sickness absence (Kuijer et al., 2005). Kuijer et al., (2005) noted the relatedness of CLBP and work-status and conceptualized CLBP and work-status from a biopsychosocial model according to the International Classification of Functioning (ICF). The ICF classification model is divided into two parts including (a) Body Functions and Structures and (b) Contextual Factors. According to the ICF, as noted in Kuijer et al., (2005), body functions include all the physiological and psychological functions, while the body structures include anatomical parts of the body. Part 2, or the contextual factors of the model, includes the overall health condition of the individual or patient. For example, as cited by Kuijer and colleagues (2005), patients living with CLBP may have difficulty engaging in activities of daily living (ADL) including household tasks or self-care (Mackenbach, Borsboom, Nusselder, Looman, & Schrijvers, 2001).

Participation in ADL for individuals living with CLBP may be difficult due to their overwhelming pain experiences and lack of overall muscle strength or physical fitness. In addition, Kuijer et al. (2005) described the ICF model not only in terms of participation in an activity, but also including the environmental factors that impact involvement, in any ADL. As stated in Kuijer et al., (2005), several personal factors may influence the disability or level of functioning for an individual living with CLBP including: education (Fishbain et al., 1997), age, gender (Hagen & Thune, 1998), depression (Watson, 1999), coping (Waddell & Main, 1998), pain cognition (Wunderlich, 1999), and self-efficacy (Moffroid, 1997). The functioning of individuals living with CLBP is likely to be impacted by disability or litigation status. For a more detailed description and visual depiction of the ICF model, please refer to the article by Kuijer et al., (2005) on work status and chronic low back pain.

The focus of this dissertation is to assess the efficacy of an interdisciplinary approach to treating CLBP. A multidisciplinary or interdisciplinary approach is likely to improve mood and decrease the perception of pain. Improving mood is likely to occur through psychotherapeutic interventions including CBT and biofeedback. Decreasing pain levels is likely to occur through medication compliance, physical therapy, and CBT. The next section reviews the literature about multidisciplinary and interdisciplinary approaches to treating chronic pain and CLBP conditions.

Multidisciplinary and Interdisciplinary Treatment Approaches

Although frequently used interchangeably in the literature, there is a clear distinction between multidisciplinary and interdisciplinary treatment programs (Gatchel, McCreary, McCreary, & Lippe, 2014). According to Gatchel et al. (2014),

multidisciplinary treatment involves the communication among several health care providers, including the physician, psychologist and physical/occupational therapists. Interdisciplinary treatment involves the same health care providers, but there is a clear distinction in the type of communication and the way information is communicated among the providers. Interdisciplinary treatment involves the same treatment within one facility, emphasizing the importance of constant communication and coordination of treatment for the patients (Gatchel et al., 2014).

Multidisciplinary approaches to treating CLBP have been substantially supported in the literature (Flor et al., 1992; Guzman, Esmail, Karjalainen, Malmivaara, Irvin & Bombardier, 2002; Scascighini et al., 2011). Multidisciplinary approaches to treatment include a biological, psychological and social approach to treating the chronic condition. Common programs within this approach may include physical exercise, muscle training, individual/group/family psychotherapy, patient psycho-education, behavior or cognitive behavioral therapy, medication management and compliance, and workplace-based interventions (Buchner, Zahlten-Hinguranage, Schiltenswolf, & Neubauer, 2006).

Flor and colleagues (1992) conducted a meta-analytic review of chronic back pain patients treated in multidisciplinary rehabilitation program. These researchers found improvements in not only pain and mood, but also improvements in patients' return-to-work status upon completion of treatment.

The researchers of a Scandinavian study found that after six months in a multidisciplinary treatment program, 67.4% of the patients returned to their previous workplace, suggesting decreased levels of chronic pain and increased capacities for coping and living with chronic pain (Buchner et al., 2006). In a systematic literature

review conducted by Guzman et al. (2001), researchers examined randomized and non-randomized studies on multidisciplinary biopsychosocial rehabilitation programs for treating chronic pain, suggesting effectiveness of participation in treatment. However, a recent review by Weiner and Nordin (2010) found interdisciplinary treatment was more effective for treating chronic low back pain than other traditional approaches to chronic pain (Gatchel et al., 2014).

A comprehensive Cochrane review provided evidence for the success of multidisciplinary and interdisciplinary programs. In a sample of 1,964 patients, researchers concluded that treatment in a multidisciplinary program resulted in pain reduction and modest evidence for functional improvement. The same review concluded that less intense and less comprehensive programs did not reduce pain or improve function (van Tulder, Koes, & Malmivaara, 2006). A biopsychosocial approach to treating CLBP is comprehensive and covers all areas of functioning, not just treating the physical pain. More comprehensive programs that account for all areas of functioning are likely to improve perceived levels of pain and disability.

The results of the aforementioned studies suggest that a multidisciplinary/interdisciplinary biopsychosocial approach to treatment is significantly more effective than a biomedical approach alone. A systematic review of the efficacy of multidisciplinary pain programs, conducted by Scascighini, et al. (2008), concluded that multidisciplinary rehabilitation programs are generally effective for treating chronic pain conditions. However, future studies may benefit from examining the relationship between multidisciplinary treatment components and patient characteristics, including specific diagnoses.

In an effort to further examine the efficacy of interdisciplinary approaches with the treatment of CLBP, this dissertation research examines the relationship between rate of improvement in pain, mood, and function for chronic low back pain. The next chapter describes the research methods of this dissertation research. Outcome results from an interdisciplinary program in Northeast Ohio provided the data for examining a more comprehensive approach for the treatment of CLBP.

CHAPTER III

METHODOLOGY

The primary purpose of this dissertation research was to determine if participating in a Chronic Pain Rehabilitation Program (CPRP) improved patients' mood, increased their level of physical functioning, and improved their perception of pain. Specifically, the following research questions were addressed:

Research Questions

1. Do the patients' initial Pain Depression Inventory (PDI; Tait, Chibnall & Krause, 1990), Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995b) scores, and pain ratings significantly vary by disability compensation status, working status, gender, age, and support?
2. Do the patients' rate of improvement from time of admission to 12-month follow-up, as measured by the Pain Depression Inventory (PDI), Depression Anxiety Stress Scale (DASS) scores, and pain ratings significantly vary by disability compensation status, working status, gender, age, and support?

In this chapter, the research methodology used in the study is presented. The chapter begins with a description of the Chronic Pain Rehabilitation Program, which acts as the primary treatment site of the study.

Chronic Pain Rehabilitation Program

The Chronic Pain Rehabilitation Program (CPRP), at a major hospital in the Midwest, is an intense, typically 4 week interdisciplinary outpatient program that admits patients based on the severity and impairing effects of their pain. The CPRP requires attendance in all components of rehabilitation (i.e. groups) conducted during the course of the patients' stays. The CPRP programs include: medication management, individual psychotherapy and psycho-physiological testing (biofeedback), physical therapy and occupational therapy, psychodynamic groups, an interpersonal skills group including intimacy/sexuality and relationships and pain, a feelings group including emotional factors and pain, self-esteem, chronic pain syndrome, a recovery skills group, a mixed topics group including patho-physiology of pain, pain behavior, and ABC's and distorted thinking, a rage group, a substance use disorder (SUDS) group and 12-step recovery, a cognitive behavior treatment group, a family education group, relapse prevention, an assertiveness group, yoga, and a grief group.

All participants included in this study have been compliant with all components of the treatment program. Upon completion of the treatment, participants are encouraged to attend monthly follow-up appointments. During the maintenance appointments, patients participated in group therapy, individual therapy and medication management. At follow-up with compliant patients (those who successfully completed and graduated from the program), 6-month and 12-month questionnaires are administered to gauge their levels of functioning after treatment.

Chronic Pain Rehabilitation Program Database

Data on participants of the program is archived and maintained at the CPRP office. The database is one of the largest chronic pain databases in the country and is a source for many research projects and studies. The available data includes approximately 15 years (1999-2013) and a multitude of potential variables. The database has been maintained over the years for the clinical and research purposes of the staff and students trained at the CPRP. The database includes variables ranging from demographics, diagnoses, physical and occupational therapy numbers, substance use and type, and work related variables. The evolution of the content in the database has been determined by researcher interest and scholarly inquiry.

Prior to admittance to the CPRP, all participants are informed about the data collection process and all consent to the data collection process. They are informed that all data, including demographic variables, pain status, pain diagnosis, physical therapy variables, psychotherapy variables and group therapy variables are recorded in the database at the hospital for research purposes. Participants completed the measures at the onset of treatment (admission) and upon completion of treatment (discharge). In accordance with The Health Insurance Portability and Accountability Act (HIPAA) guidelines and the hospital IRB protocol, all participant data was kept private and confidential.

The hospital's Institutional Review Board (IRB) obtained approval prior to the data collection for the collection and maintenance of their database. All data was collected and entered into the CPRP database. The data collected onsite at admission and

discharge is more complete than the 6-month and 12-month follow up points, due to variability in response rates from the mailing.

Data for Current Study

The data for this dissertation study was extracted from the CPRP database. Permission to use the database was granted by the CPRP office (see Appendix A). Given the large number of potential intervening variables related to the patients' conditions, this dissertation is delimited to patients with a diagnosis of primary chronic low back pain within the last five years. The resulting data set includes patients admitted to the CPRP between 2008 and 2012, with a diagnosis of CLBP. For the purpose of this dissertation, a database was compiled with the specific variables of demographic information, self-reported pain, depression, anxiety, stress, pain-related disability or functioning, disability compensation status, and work status. The data for each patient was collected at admission, discharge and 6-month and 12-month follow-ups. Admission and discharge data was collected during treatment within the program. The follow-up data was collected through a CPRP mailing of a questionnaire to patients at 6 months and 12 months after discharge from the program. All data was collected by the staff working at the CPRP including psychiatrists, psychologists, post-doctoral psychology fellows, pre-doctoral psychology interns, and counselors.

Application for permission to conduct research was also submitted to the Cleveland State University Institutional Review Board. Documentation of their permission is included in Appendix B.

Measures

Depression, anxiety, stress scale. The Depression, Anxiety, Stress Scale (DASS), developed by Lovibond and Lovibond (1983), is a scale used to measure distinctive aspects of depression, anxiety, and stress (Shea, Tennant, & Pallant, 2009). The measure is a 42-item self-report instrument comprised of three 14-item subscales that measure depression, anxiety, and stress. Participants rate the extent to which they have experienced these core symptoms within the past week on a 4-point frequency scale (Taylor, Lovibond, Nicholas, Cayley, & Wilson, 2005). The rating scale ranges from 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time). Respondents are asked to consider the questions as they apply to them over the past week.

The depression subscale contains questions that focus on “low mood, low self-esteem, and poor outlook for the future” (Shea et al., 2009; p. 4). The anxiety subscale contains questions that assess physiological arousal and fear response (Shea et al., 2009). Lastly, the stress subscale contains questions regarding the individual’s “persistent arousal and tension” (Shea et al., 2009; p. 4). The DASS scale has demonstrated sound psychometric properties in clinical and non-clinical settings including an adequate alpha coefficient (Brown et al., 1997). The DASS demonstrates good internal consistency with scale alphas ranging from 0.84 to 0.97 (Antony, Bielnig, Cox, Enns, & Swinsons, 1998; Brown et al., 1997; Lovibond & Lovibond, 1995a; Scheman et al., 2007).

The Depression Anxiety Stress Scale (DASS) was used in this dissertation research to measure components of mood, including depression, anxiety, and stress. The DASS has been used in previous studies and the usefulness of the measure has been

supported (Anthony et al., 1998). Brown et al. (1997) examined the psychometric properties of the DASS in a clinical sample in two separate studies. The DASS demonstrated good internal consistency with alphas ranging from 0.84-0.97 (Anthony et al., 1998; Brown et al., 1997; Lovibond & Lovibond, 1995; Scheman et al., 2007). The collective results of both studies revealed strong support of the psychometric properties for assessing depression, anxiety and stress (Brown et al., 1997). A copy of the DASS is included in Appendix C.

Pain disability index. The Pain Disability Index (PDI; Tait et al., 1990) is a short, self-report assessment tool that assesses aspects of functioning. The PDI does not directly include pain items, rather the PDI measures the degree to which pain interferes with daily functioning in seven domains including: family/home responsibilities, recreation, social activity, occupation, sexual behavior, self-care, and life-support activities (Bicer, Yazici, Camdeviren, Milcan, & Erdogan, 2005). Two factors are measured by the PDI including (a) voluntary activities (family/home, recreation, social activities, occupation, sexual behavior) and (b) obligatory activities (self-care, life support) (Soer, Reneman, Vroomen, Stegeman, & Coppes, 2012). The PDI uses an 11-point numeric rating scale, ranging from 0 (no disability) to 10 (severe/total disability, with total scores ranging from 0-70 (Bicer et al., 2005). Tait et al., (1990) supported the psychometric properties and validity of this measure and indicated that the PDI is a good measure of pain-related disability with an alpha of 0.86. The PDI has been used in previous research by Soer et al. (2012) and they concluded that a change of score on the PDI is a clinically important change for patients living with chronic back pain. A study conducted by Tait et al. (1990), conducted a study with 46 patients, revealing the PDI

was associated with pain behaviors displayed by these patients. A copy of the PDI is included in Appendix D.

Numeric Rating Scale (NRS). A Numeric Rating Scale, a commonly used rating tool in research and clinical practice, was used to determine the individual's perception of the severity of pain. Participants rated their pain on a scale ranging from 0 (no pain) to 10 (the most severe pain). This unidimensional-type scale was used in the CPRP and in this dissertation research to determine how individuals expressed the amount of pain they were experiencing (no pain to severe/unbearable pain).

Other measures. Six-month and 12-month follow-up questionnaires (developed by researchers at the CPRP program) were mailed to each participant that successfully completed and graduated from the CPRP. These questionnaires were used to gauge the participants' perceptions of pain, affective feelings towards their pain, and level of perceived disability after being treated in an interdisciplinary rehabilitation program. The questionnaires included the aforementioned measures (DASS, PDI, and NRS) and were able to provide qualitative feedback on program experiences, including what training and treatment techniques were helpful for them and easy (or not easy) to implement into their daily lives after completing the program. The primary data utilized from the 6- month and 12-month questionnaires for this dissertation study included results from the DASS, PDI, and NRS Likert Scale. All other qualitative data collected from the mailings were not used for this study.

Variables

Pain was operationalized as the patient's self-reported level of pain. In addition, pain was identified by the patient's self-reported level of pain that impairs functioning in

seven domains of life. The variable, pain, was measured by the ten-point self-reported numeric rating scale (NRS). It was expected that participation in the program would decrease the patients' self-reported numeric rating scales pain scores, indicating minimal to no pain.

Depression was operationalized as marked feelings of sadness and melancholy that interfere with daily functioning. Depression was measured by the Depression, Anxiety, Stress Scale (DASS). It was anticipated that scores on the DASS inventory, depression subscale, would decrease, indicating decreased feelings of depression, particularly related to pain.

Anxiety includes heightened feelings of awareness surrounding the patient's chronic pain condition. In addition, anxiety was characterized as feelings associated with fear, apprehension, and worry as related to functioning and pain-related behaviors. Anxiety was measured by the Depression, Anxiety, Stress Scale (DASS). It was expected that scores on the DASS inventory, anxiety subscale, would decrease, indicating decreased feelings of nervousness, worry and apprehension, particularly related to pain.

Stress includes overwhelming feelings of emotional and behavioral symptoms as it pertains to living with a chronic condition. Stress was measured by the Depression, Anxiety, Stress Scale (DASS). Scores on the DASS inventory, stress subscale, would decrease, indicating decreased feelings of pressure and strain, particularly related to pain.

Function is the individual's ability to engage in everyday tasks that are associated with quality of living. Function was identified in seven domains of every day functioning including: family/home responsibilities, recreation, social activity, occupation, sexual

behavior, self care, and life-support activities. Function was measured by the Pain Disability Index (PDI).

Working Status is a dichotomized variable that was dummy coded (0=not working; 1=working). Patients were considered as working if they reported having a full-time, part-time, or restricted job at admission. Patients who reported that they were not working or who were retired were considered to not be working.

For the purpose of this research, *Disability Compensation Status* included the Bureau of Worker's Compensation (BWC), as well as, Social Security Disability Status (SSDI). According to Merriam-Webster's dictionary, *Worker's Compensation* is defined as benefits provided to patients who suffer occupational related or personal injury during the course of employment. *Social Security Disability*, as defined by Merriam-Webster's dictionary, is the limitation in an individual's ability to pursue employment due to a physical or mental impairment (retrieved April 5, 2013 from www.merriam-webster.com). For this research each participant's involvement in disability services was gathered at admission during an intake interview and discharge, conducted by professionals working at the Chronic Pain Rehabilitation Program. In addition, involvement in disability services was gathered at follow-up treatment by a questionnaire mailed to graduates from the program. The variable was dichotomous, denoting whether patients were or were not receiving disability compensation.

Demographic variables such as age, gender, and support were also collected for each participant. The *Support* variable indicated whether support was absent or present in the patient's life. Support may have included a married spouse or a live-in partner. The absence of support included being divorced, separated, single, or a widow/widower.

Data Analysis

Since individual patient information was collected at different times, with records from admission to discharge, an individual change model (Willms & Raudenbush, 1989; Raudenbush & Bryk, 2002) is considered best suited for the data analysis. This model allows for repeated data collections and observations of individual patients over time. The model defines each individual patient's change trajectory from admission to discharge. Under certain circumstances, the model can be used to predict future change of individual patients. By using an individual change model, it allows the individual change of patients to be investigated over time as a function of patients' personal characteristics and conditions. Such a model can be used in a variety of research situations where data is observed longitudinally over time. For instance, Bagaka's (2010) utilized the individual change model to assess the district student performance in examinations over a seven-year period in Kenya between 2001 and 2007. The HLM Version 6.06 statistical package (Raudenbush et al., 2001) was used for data analyses.

Utilizing an individual change model determined the predicted individual growth, as well as the rate of change, for patients treated in an interdisciplinary rehabilitation program. The time span was divided into four waves: admission, discharge, 6-month follow up, and 12- Month follow up. The individual trajectories were defined over these four waves.

Model Specification

Level-1 model. At Level-1, each patients' change trajectory was modeled according to their scores over the time period from admission to 12- month follow up. Each individual patient's growth trajectory is represented by the equation:

$$y_{it} = \pi_{0i} + \pi_{1i}a_t + e_{it} \quad (1)$$

where, π_{1i} is the rate of change in individual patient depression, anxiety, stress, pain-related disability, and pain for patient i during the period 2008-2012. y_{it} is the pain outcome for the i^{th} patient at time t . The y-intercept π_{0i} is the initial pain condition of patient i at admission. The error associated with y_{it} at time t is represented by e_{it} .

Obviously, both π_{0i} and π_{1i} varied for each patient as a function of measured individual patient characteristics and demographic variables. The model is ideal in examining the impact of CLBP status on patients' growth trajectories in terms of their scores on the various assessments. Accordingly, at Level- 2 model, π_{0i} and π_{1i} are modeled as a function of individual characteristics.

Level- 2 model. At Level-2, both the y-intercept (π_0) and the rate of change (π_1) are allowed to vary for each patient as a function of working status, disability compensation status, gender, age, and support. Specifically, Level-2 investigated how the patient outcome can be predicted by the aforementioned variables (chronic low back pain, working status, disability compensation status, gender, age, and support). The extent to which patient variables can predict the initial change in pain, function and mood was assessed using the general model

$$\rho_{0i} = b_{00} + b_{01}(WC_i) + b_{02}(DS_i) + b_{03}(age_i) + b_{04}(gender_i) + b_{05}(Supp_i) + r_{0i} \quad (2)$$

The parameter, π_{0i} is defined in equation (1). The regression coefficient β_{00} represents the expected patient pain outcome (pain, mood, function) at the initial status of admission.

The regression coefficient β_{01} represents the predicted initial status for patients who are working and those patients who are not working. The regression coefficient β_{02} represents

the predicted initial status for each specific outcome between patients who have disability compensation and those who do not have disability compensation. The regression coefficient β_{03} represents the predicted age gap in terms of specific pain outcome at the initial status. The regression coefficient β_{04} represents the predicted differences in gender in terms of specific pain outcome at the initial status. Finally, the regression coefficient β_{05} represents the predicted initial status for each specific outcome between patients who have support and who do not have support. The term r_{1i} is the random error associated with the initial status of patient i that is assumed to be independently and normally distributed with the mean 0, variance, t_{00} , and covariance t_{01} .

Similarly, each patient's rate of change in pain outcomes over the time span from admission to discharge was represented as a function of patients' personal characteristics by the model:

$$\rho_{1i} = b_{10} + b_{11}(WC_i) + b_{12}(DS_i) + b_{13}(age_i) + b_{14}(gender_i) + b_{15}(Supp_i) + r_{1i} \quad (3)$$

The parameter, ρ_1 is defined as in equation (1) and b_{10} , the estimated intercept, is the expected rate of change in the pain outcome for a typical patient. The accelerator parameters, b_{11} and b_{12} represent the relationship between a chronic low back pain diagnosis, working status, and disability compensation status on the patients' rates of change. The accelerator parameters b_{13} , b_{14} , and b_{15} represent the relationship between a chronic low back pain diagnosis and age, gender, and support, respectively. The term r_{1i} is the random error associated with the rate of change for patient i , which is assumed to be independently and normally distributed with a mean equal to 0, variance, t_{00} , and covariance t_{01} .

This chapter provided the specific research questions and how each question was addressed utilizing the extracted variables from the primary database within five years. Utilizing an individual change model determined the predicted individual growth as well as the rate of change for patients treated in an interdisciplinary rehabilitation program. At Level-1, each patient change trajectory was modeled according to their pain outcomes from admission to 12 month follow up. Level-2 investigated how the average patient outcome can be predicted by chronic low back pain status, disability compensation status, gender, age and support. The following chapter presents the results from the data analysis.

CHAPTER IV

RESULTS

In this chapter, trends in pain outcomes for each participant/patient were examined from 2008 to 2012. As a result, the predicted initial status (admission) and the rate of change during the time period under study was established; the time periods included admission, discharge, 6 month follow-up and 12 month follow-up. For each of these periods, an individual change model (Raudenbush & Bryk, 2002) was used to determine the extent to which age, gender, disability compensation status, working status, and support predicted these change trajectories.

Demographic Characteristics of the Respondents

The data was analyzed based on the data compiled starting in 2008 and ending in 2012. Data from 621 chronic low back pain (CLBP) patients who completed the program was analyzed. The outcome variables were derived from the following measures: Depression, Anxiety, Stress Scale (DASS); Pain Disability Index (PDI); and a Likert Rating Scale for Pain (NRS). The outcome variables included depression, anxiety, stress, family/home functioning, recreation functioning, social functioning, occupation functioning, sexual functioning, life support, self- care, and reported level of pain.

The primary independent variables included gender, age, support, disability compensation status, and working status. Table 1 presents the breakdown of participants by selected demographic characteristics.

Table 1

Distribution of respondents by general demographic characteristics

Characteristic	Levels	Number	Percent
Sex/Gender	0=Female	392	63.1
	1=Male	229	36.9
Age	Range 18-87	Mean=48	
Working Status (working or not working)	0=no	256	46
	1=yes	301	54
Disability Compensation Status	0=no	306	55.1
	1=yes	259	44.9
Support (has a significant other or does not have a significant other)	0=absent	230	37
	1=present	391	63

From this table, it is shown that, other than gender and having a significant other which had a two-third, one-third split, the other demographic variables such as working and disability compensation status were fairly evenly split. Respondents ranged in age from 18 to 87 years. The research findings related to the research questions in this study are presented in the remaining part of this chapter according to pain outcome.

Depression, Anxiety, Stress Scale

Depression. Individual change analysis results for depression are presented in Table 2. From these results, it is shown that participants' levels of depression were found to be significantly different from zero at admission ($\beta = 16.69$, $p < 0.01$) and the rate of change over time ($\beta = -3.018$, $p = 0.002$), which was also significantly negative. Specifically, patients' predicted levels of depression at admission was about 17 but was predicted to decrease by approximately 3 points per period. In addition, working status ($\beta = -2.48$, $p = 0.006$) was a statistically significant predictor of the level of depression at admission, suggesting patients who were working at time of admission experienced 2.5 points less depression than patients who were not working (see Figure 1).

Table 2

Individual change analysis results for initial status and rate of change in patients depression based on the DASS.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	16.69	0.00*	-3.02	0.002*
Gender	1.69	0.062	0.284	0.561
Age	-0.01	0.630	0.010	0.579
Disability	0.56	0.531	-0.602	0.212
Working	-2.48	0.006*	0.543	0.273
Support	-0.30	0.757	-0.741	0.169

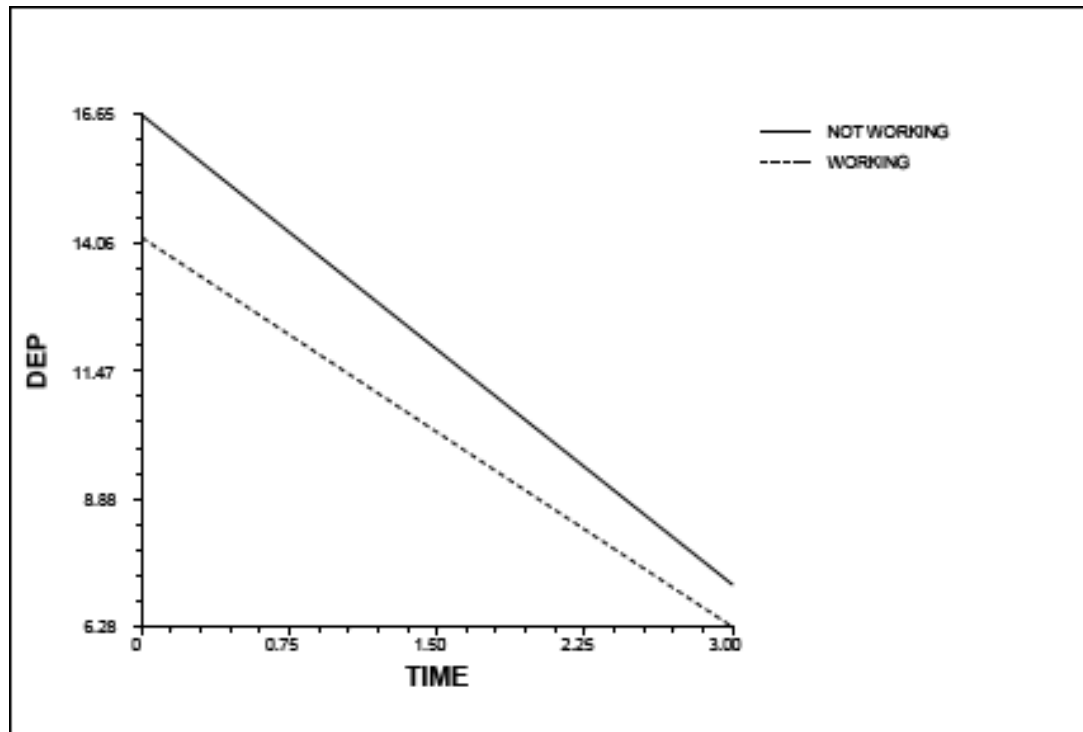


Figure 1. Trends in depression of patients for admission, discharge, 6 month and 12 month follow-ups by working status.

Anxiety. Individual change model results for anxiety are presented in Table 3.

From these findings we note that anxiety ratings were significantly different from zero at admission ($\beta = 14.55$, $p < 0.01$) but with a significantly negative rate of change ($\beta = -3.41$, $p < 0.01$) per period. At admission, patients' anxiety levels as measured by the DASS were predicted to be around 15, but were predicted to decrease by approximately 3 points for each period.

Age ($\beta = -0.05$, $p = 0.046$) was a statistically significant predictor of anxiety, both at the initial status (admission) and rate of change ($\beta = 0.029$, $p = 0.034$). One year younger was predicted to correspond to 0.05 points higher anxiety level at initial status. Specifically, anxiety levels for younger patients were predicted to decrease faster compared to older patients. For every year younger, patients' anxiety levels were

predicted to decrease by 0.03 points. In addition, gender ($\beta = 0.76$, $p = 0.042$) was a statistically significant predictor of the rate of change in anxiety. Female anxiety levels were predicted to decrease approximately 1 point faster per period than males (see Figure 3).

Table 3

Individual change analysis results for initial status and rate of change in patients anxiety based on the DASS.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	14.55	0.000*	-3.41	0.000*
Gender	-0.87	0.234	0.76	0.042*
Age	-0.05	0.046*	0.03	0.034*
Disability	1.21	0.101	-0.11	0.773
Working	-1.08	0.150	0.033	0.929
Support	-0.478	0.546	-0.46	0.251

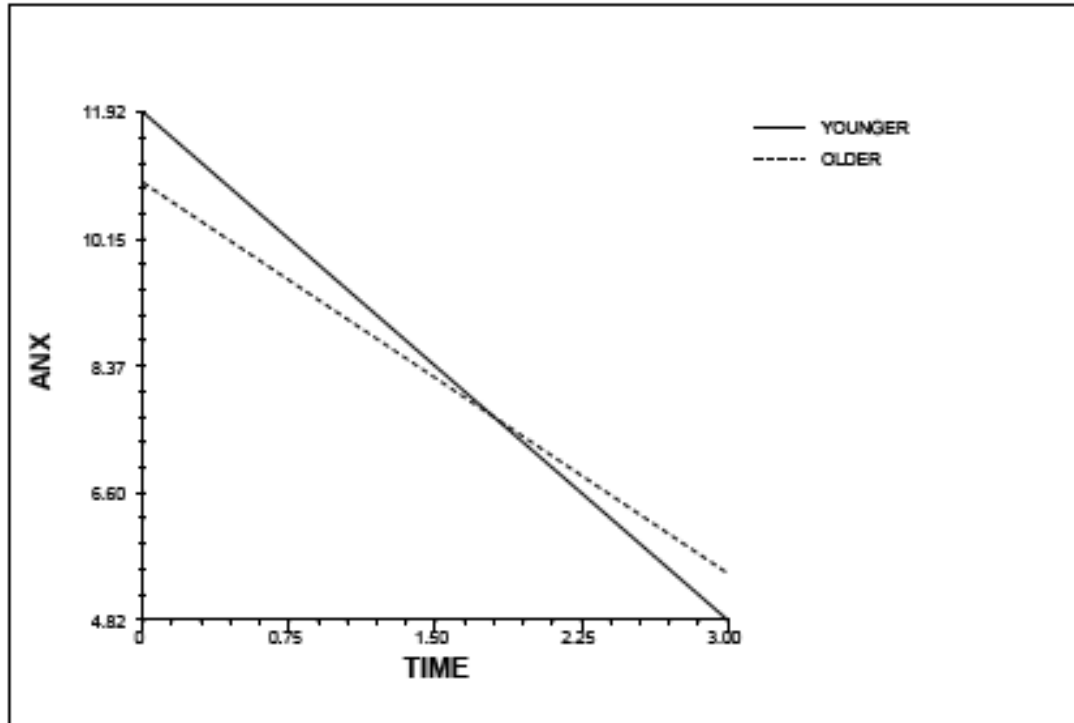


Figure 2. Trends in anxiety of patients for admission, discharge, 6 month and 12 month follow-ups by age.

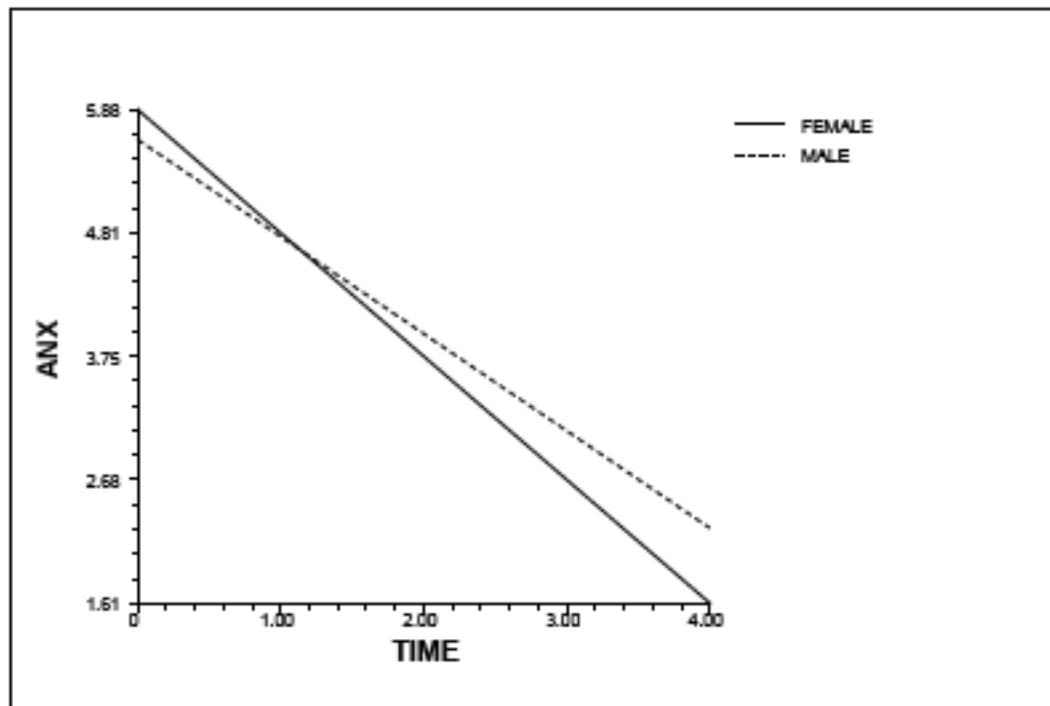


Figure 3. Trends in anxiety of patients for admission, discharge, 6 month and 12 month follow-ups by gender.

Stress. Individual change model results for stress are presented in Table 4. From these results we note that patients' stress ratings were significantly different from zero at initial status ($\beta = 22.39$, $p < 0.01$) and rate of change ($\beta = -3.61$, $p < 0.01$). Specifically, patients' stress levels were predicted to be approximately 22, as measured by the DASS at admission, but were predicted to decrease by approximately 4 points each period. In addition, age ($\beta = -0.11$, $p < 0.01$) was a statistically significant predictor of stress levels at initial status with younger patients predicted to have about 0.11 higher levels of stress at admission than older patients (see Figure 4).

Table 4

Individual change analysis results for initial status and rate of change in patients stress based on the DASS.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	22.39	0.000*	-3.61	0.000*
Gender	-0.31	0.720	0.70	0.128
Age	-0.11	0.000*	0.023	0.139
Disability	0.045	0.959	-0.094	0.837
Working	-1.263	0.146	0.172	0.700
Support	-0.431	0.634	-0.77	0.120

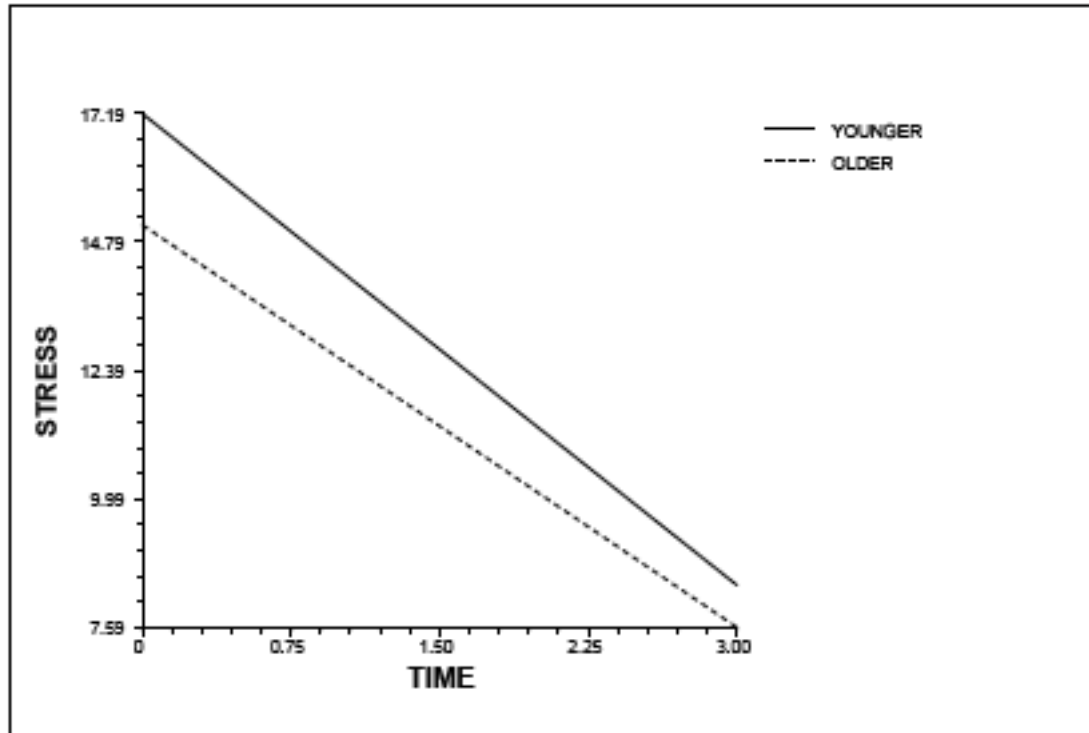


Figure 4. Trends in stress of patients for admission, discharge, 6 month and 12 month follow-ups by age

Pain Disability Index

Family and home. Individual change model results for Family/Home functioning is presented in Table 5 which shows that patients' family and home functioning was found to be significantly different from zero at both admission ($\beta = 5.96$, $p < 0.01$), but with a significantly negative rate of change ($\beta = -1.66$, $p < 0.01$) over time. In this case, the patients predicted Family/Home functioning was 5.96 at admission and was predicted to decrease at a rate of 1.66 points per period. In addition, age ($\beta = 0.02$, $p = 0.006$) and support ($\beta = -0.317$, $p = 0.038$) were statistically significant predictors of the rate of change per period. Older patients were predicted to have approximately 0.02 greater family and home related disability than younger patients (see Figure 5). Finally, per period, patients without support were predicted to have

approximately 0.3 slower change in family and home functioning per period (see Figure 6).

Table 5

Individual change analysis results for initial status and rate of change in patients' family and home functioning from the PDI.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	5.96	0.000*	-1.66	0.000*
Gender	-0.26	0.126	0.23	0.105
Age	-0.00	0.925	0.02	0.006*
Disability	0.289	0.084	-0.08	0.542
Working	-0.19	0.272	-0.00	0.988
Support	-0.12	0.513	-0.32	0.038*

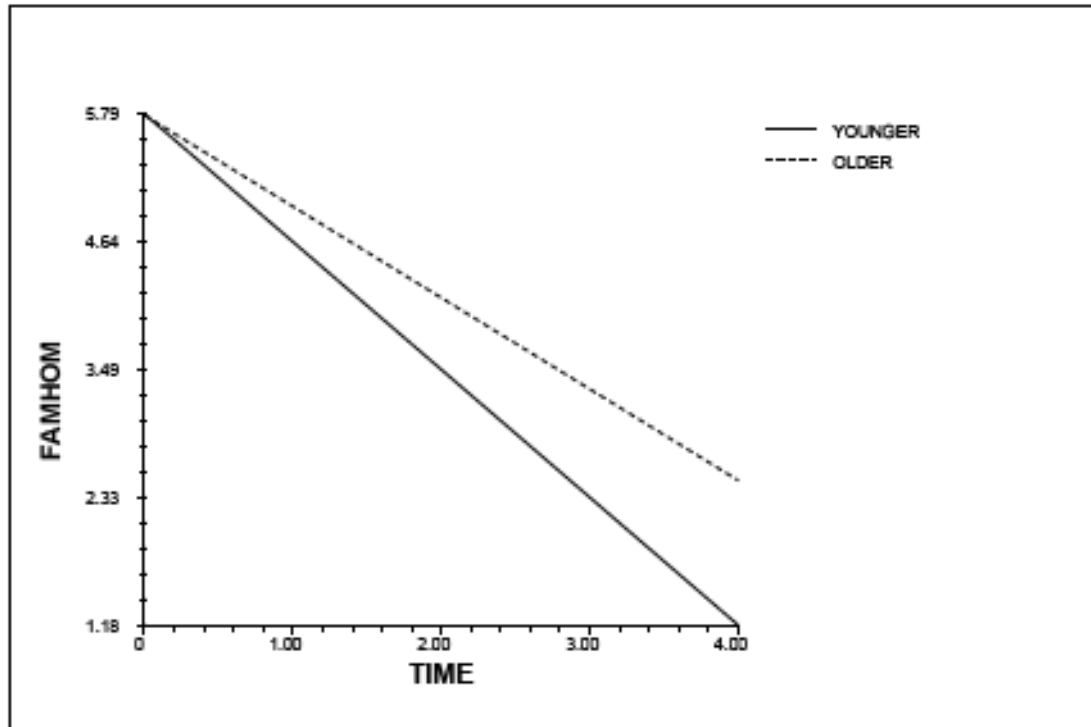


Figure 5. Trends in family and home functioning of patients for admission, discharge, 6 and 12-month follow-ups by age.

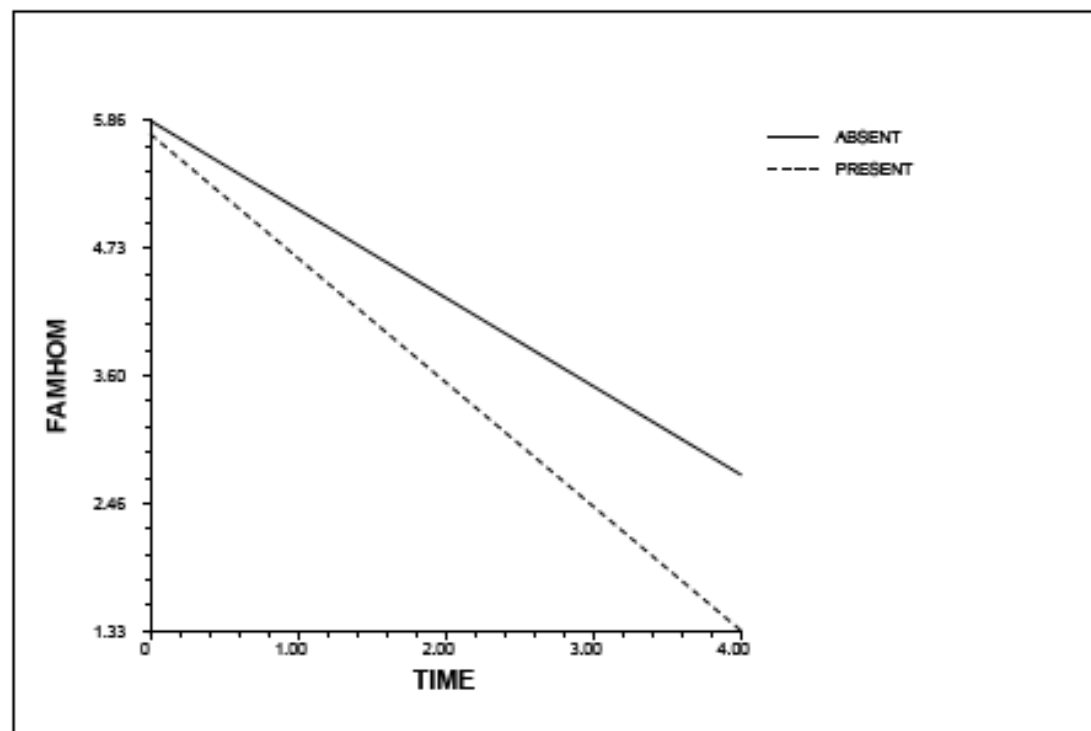


Figure 6. Trends in family and home functioning of patients for admission, discharge, 6 and 12-month follow-ups by support.

Recreation. Individual change model results for Recreational functioning are presented in Table 6. From these findings, it is shown that recreational functioning on the PDI was significantly different from zero at initial status ($\beta = 7.184$, $p < 0.01$) but with a significantly negative rate of change ($\beta = -2.07$, $p < 0.01$). Age ($\beta = -0.102$, $p = 0.515$) was a statistically significant predictor of recreational activity at the rate of change. Specifically, younger patients had a faster rate of change in recreational functioning compared to older patients. For every one year, the rate of change for recreational functioning was predicted to increase by 0.02 points (see Figure 7). Working status ($\beta = -0.383$, $p = 0.036$) was a statistically significant predictor of recreational functioning at initial status (admission). Specifically, patients who were not working at admission were predicted to be .383 higher in terms of recreational disability than working patients (see Figure 8).

Table 6

Individual change analysis results for initial status and rate of change in patients recreational functioning from the PDI.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	7.18	0.000*	-2.07	0.000*
Gender	0.03	0.861	0.22	0.112
Age	-0.01	0.091	0.02	0.003*
Disability	0.07	0.699	0.18	0.219
Working	-0.38	0.036*	0.00	0.979
Support	-0.24	0.214	-0.10	0.515

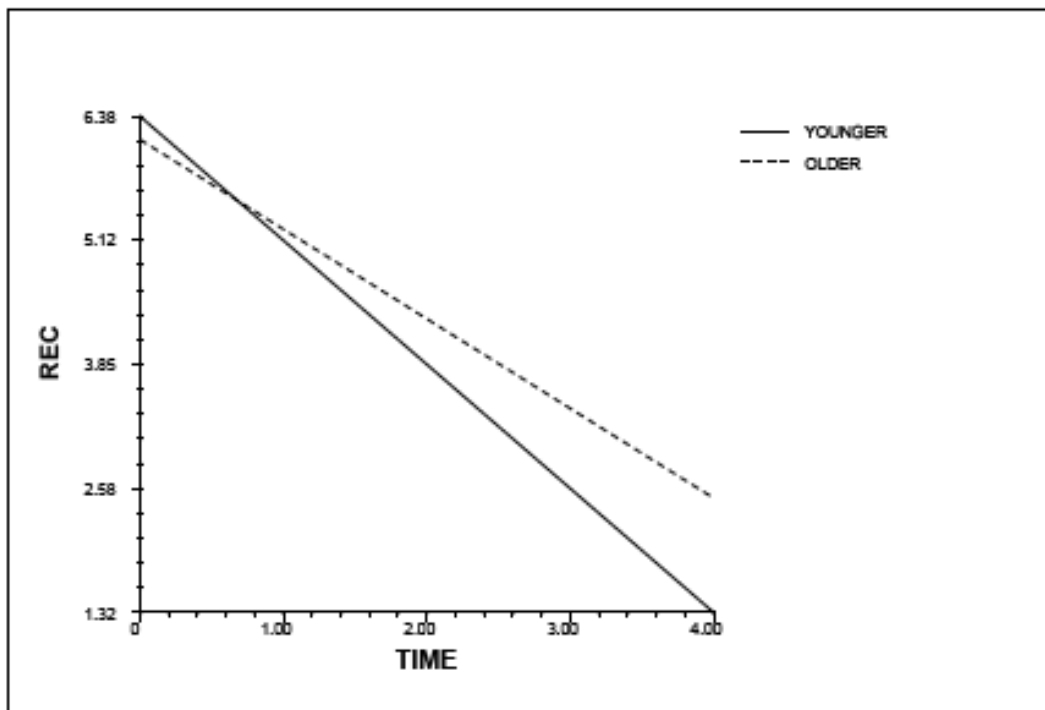


Figure 7. Trends in recreational functioning of patients' for admission, discharge, 6 month and 12-month follow-ups by age

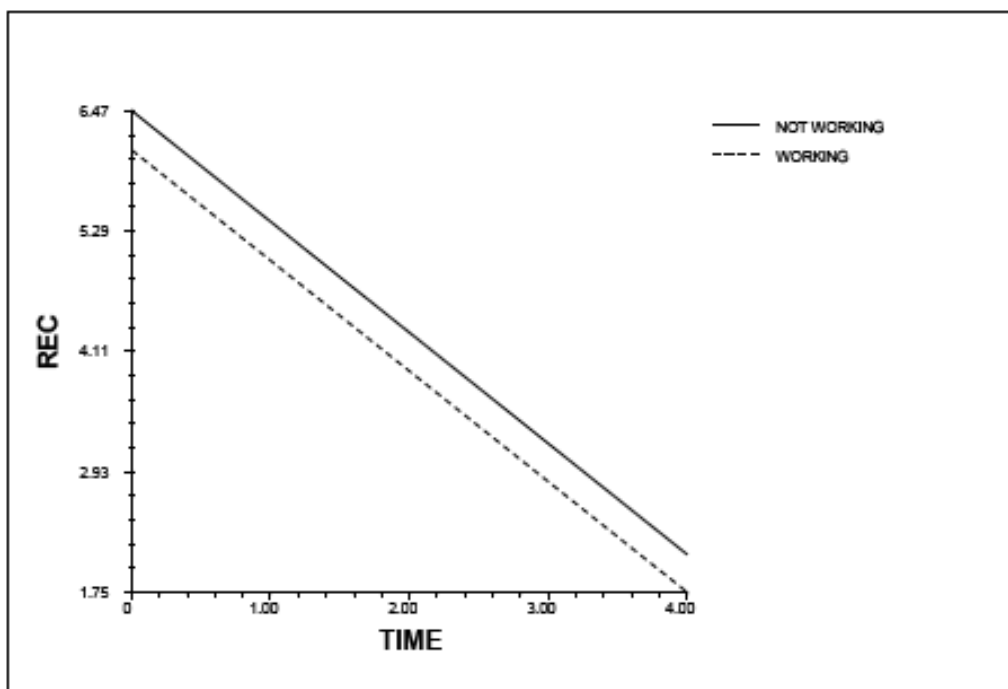


Figure 8. Trends in recreational functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by working status.

Social. Individual change model analysis results for Social functioning are presented in Table 7 and show that participants' levels of social functioning were significantly different from zero at initial status ($\beta = 6.09, p < 0.01$) and the rate of change over time ($\beta = -1.79, p < 0.01$) was also significantly negative. At admission, patients' social functioning was expected to be around 6 on the PDI. However, per period, patients' level of social functioning was predicted to decrease by approximately 1.8 points per period. In addition, age ($\beta = 0.018, p = 0.003$) was a statistically significant predictor of the rate of change in of social functioning, suggesting one-year younger patients were predicted to improve at approximately 0.018 faster change in social functioning per period (see Figure 9). Finally, support ($\beta = -0.35, p = 0.033$) was a statistically significant predictor of the rate of change, suggesting patients who had support were expected to have 0.35 faster change in pain related disability in the social functioning domain (see Figure 10).

Table 7

Individual change analysis results for initial status and rate of change in patients social functioning from the PDI.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	6.09	0.000*	-1.79	0.000*
Gender	0.05	0.780	0.18	0.230
Age	-0.00	0.348	0.02	0.003*
Disability	0.10	0.621	0.03	0.847
Working	-0.39	0.054	-0.01	0.969
Support	-0.19	0.375	-0.35	0.033*

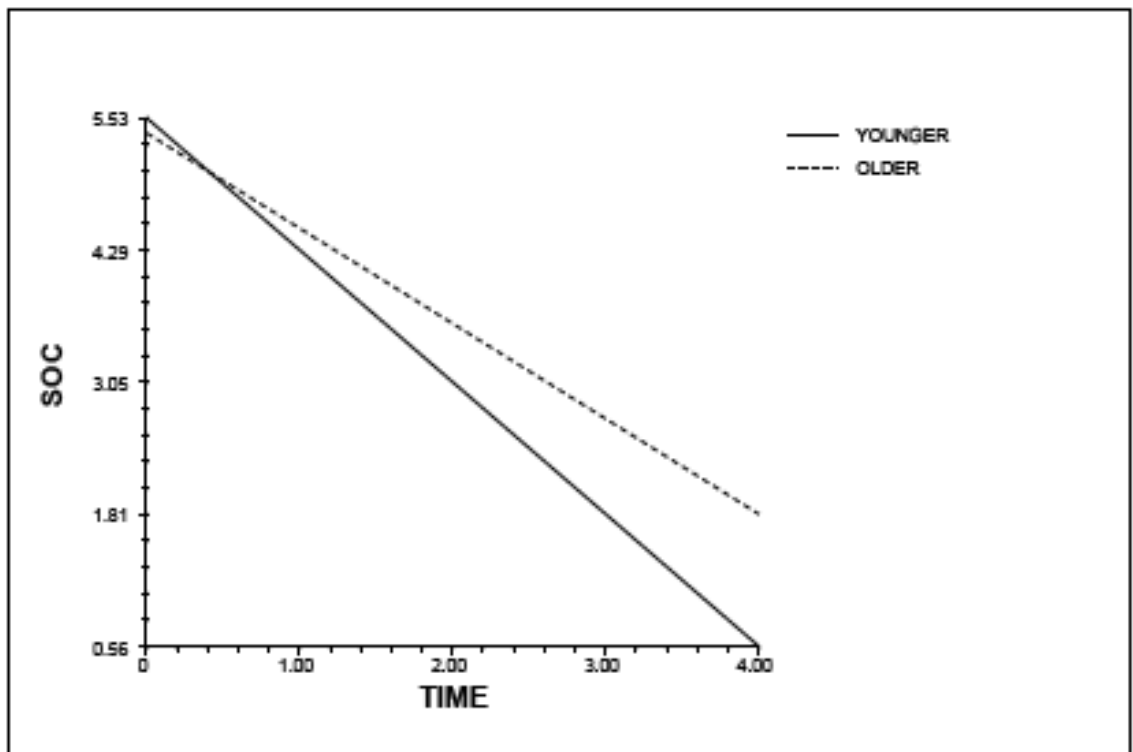


Figure 9. Trends in social functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by age.

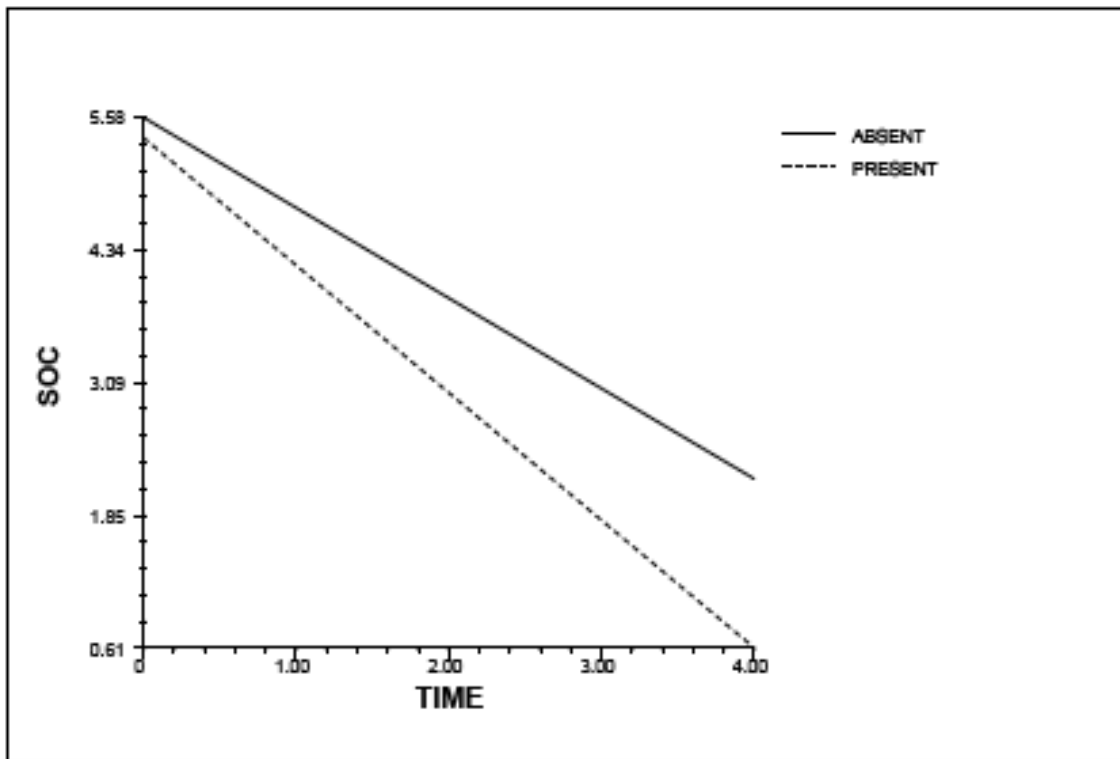


Figure 10. Trends in social functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by support.

Occupation. Individual change analysis results for Occupational functioning are presented in Table 8. From these findings we note that functioning in the occupational domain was significantly different from zero at initial status ($\beta = 8.46$, $p < 0.01$) and the rate of change ($\beta = -2.17$, $p < 0.01$), which was also significantly negative. Patients' predicted pain related disability in the occupational domain at admission was 8.464, as measured by the PDI, but predicted to decrease approximately 2 points per period. In addition, disability compensation status ($\beta = 0.63$, $p = 0.006$) and working status ($\beta = -0.92$, $p < 0.01$) were both statistically significant predictors of occupational functioning at initial status. Patients who were working at admission were predicted to have approximately 1 point less pain related disability in the occupational domain (see Figure 11), whereas patients who had some form of disability compensation were predicted to

have approximately 0.6 slower change in pain related disability in the occupational domain (see Figure 12). Age ($\beta = 0.02$, $p = 0.001$) was a statistically significant predictor at initial status and of rate of change with younger patients predicted to experience 0.04 greater pain related disability in occupational functioning at admission, but per one year the rate of change was predicted to decrease by 0.02 in terms of occupational related disability (see Figure 13).

Table 8

Individual change analysis results for initial status and rate of change in patients occupational functioning from the PDI.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	8.46	0.000*	-2.17	0.000*
Gender	0.22	0.326	0.22	0.159
Age	-0.04	0.000*	0.02	0.001*
Disability	0.63	0.006*	0.10	0.531
Working	-0.92	0.000*	0.15	0.353
Support	0.02	0.938	-0.28	0.109

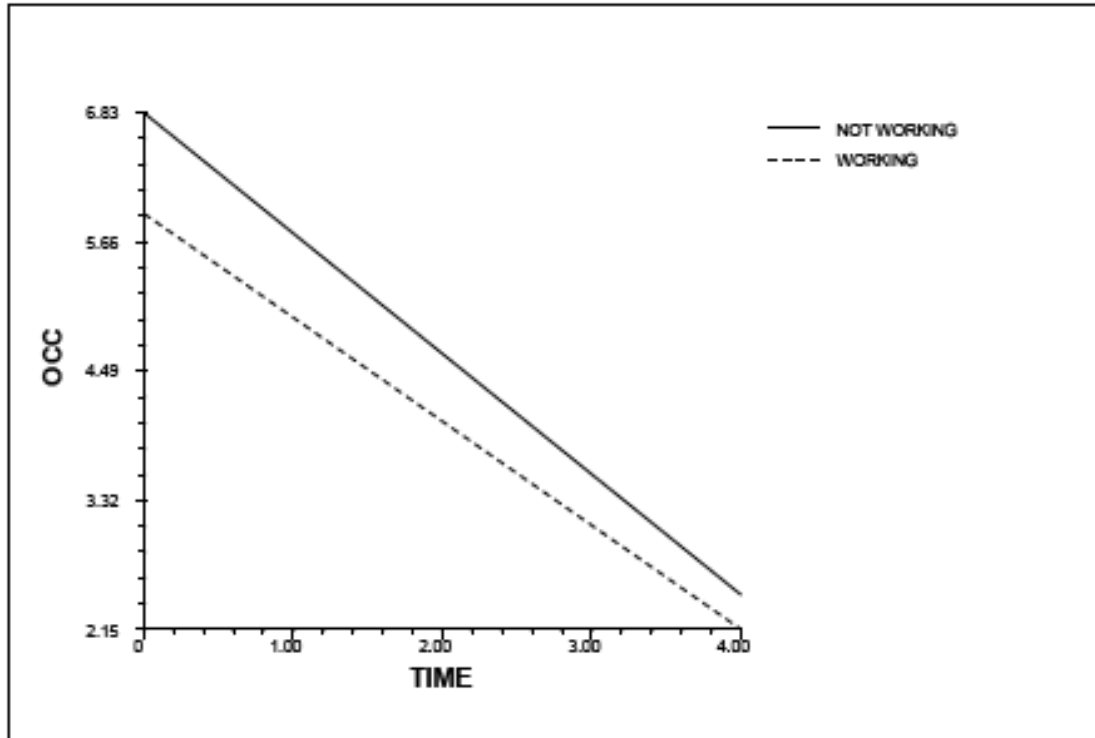


Figure 11. Trends in occupational functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by working status

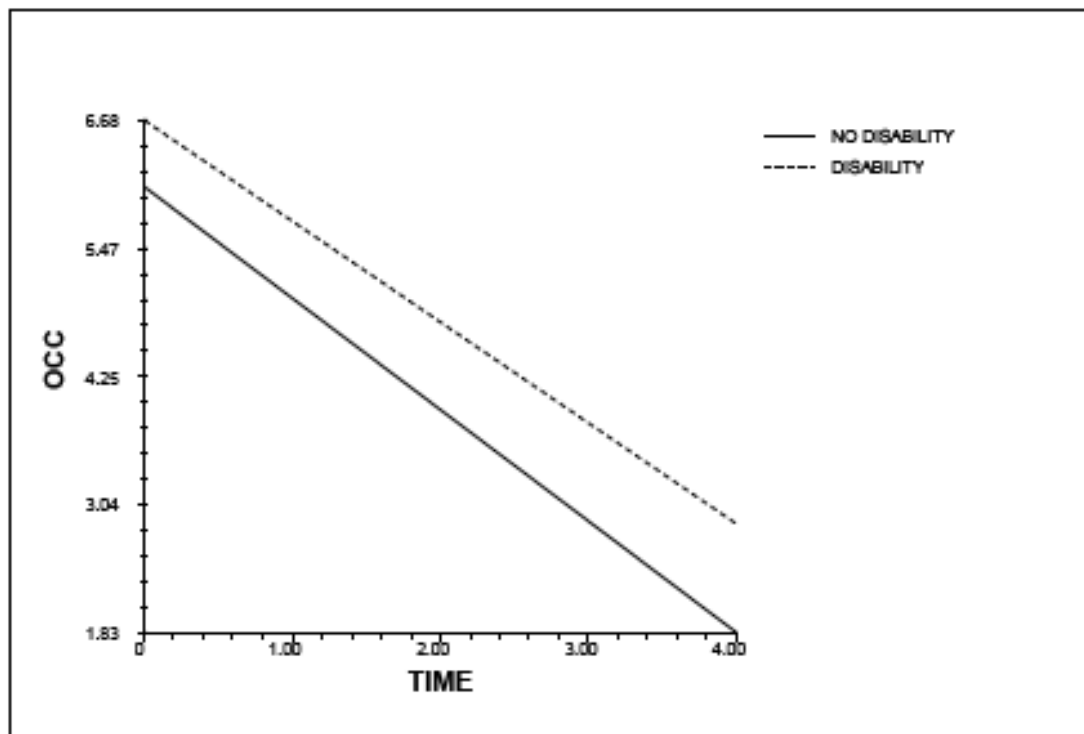


Figure 12. Trends in occupational functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by disability.

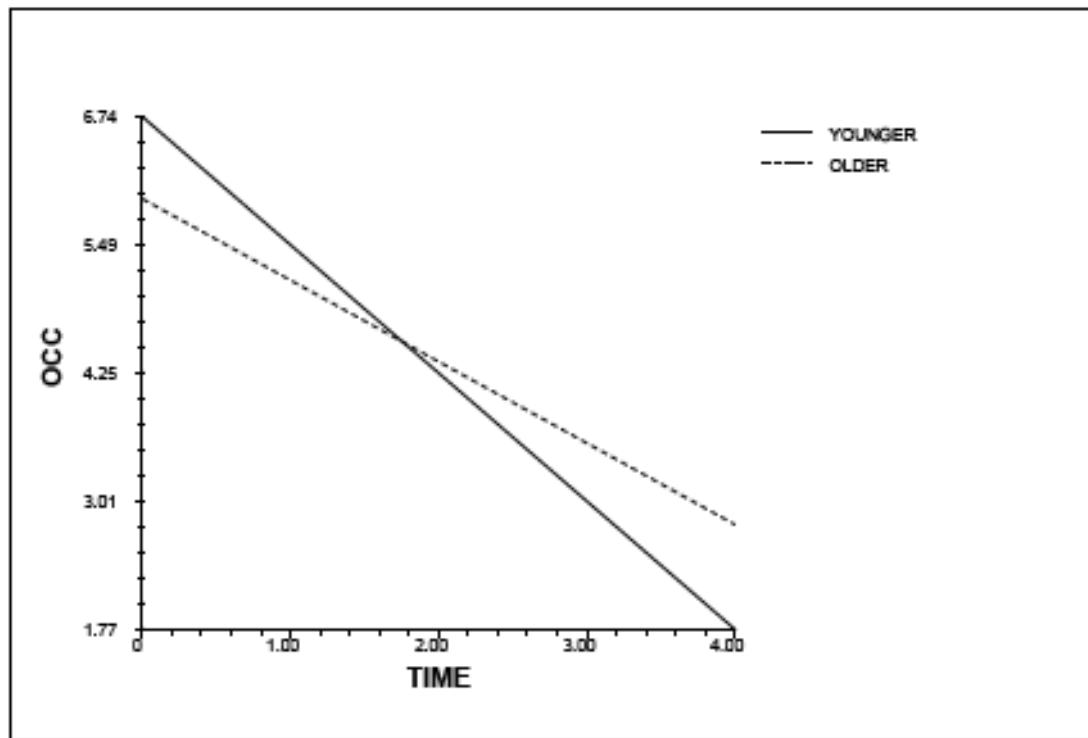


Figure 13. Trends in occupational functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by age.

Sexual behavior. Individual change analysis results for Sexual functioning are presented in Table 9. These results suggest that sexual functioning was significantly different from zero at initial status ($\beta = 4.46$, $p < 0.01$) but with a significantly negative rate of change ($\beta = -1.51$, $p < 0.01$). Overall, patients predicted sexual functioning was 4.5 as measured by the PDI at initial status, however, pain related disability in this domain was expected to decrease 1.5 per period. Age ($\beta = 0.02$, $p = 0.001$) was a statistically significant predictor of sexual functioning at the rate of change, suggesting older patients were predicted to experience 0.021 slower change in sexual functioning per period than younger patients (see Figure 14). In addition, support ($\beta = -0.41$, $p = 0.014$) was a statistically significant predictor, suggesting patients who did not have support

reported 0.41 more sexual related disability, per period, in the sexual functioning domain than patients who had support (see Figure 15).

Table 9

Individual change analysis results for initial status and rate of change in patients sexual functioning from the PDI.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	4.46	0.000*	-1.51	0.000*
Gender	0.52	0.057	0.28	0.100
Age	0.00	0.686	0.02	0.001*
Disability	0.19	0.488	0.02	0.915
Working	-0.49	0.077	-0.21	0.210
Support	1.29	0.000*	-0.41	0.014*

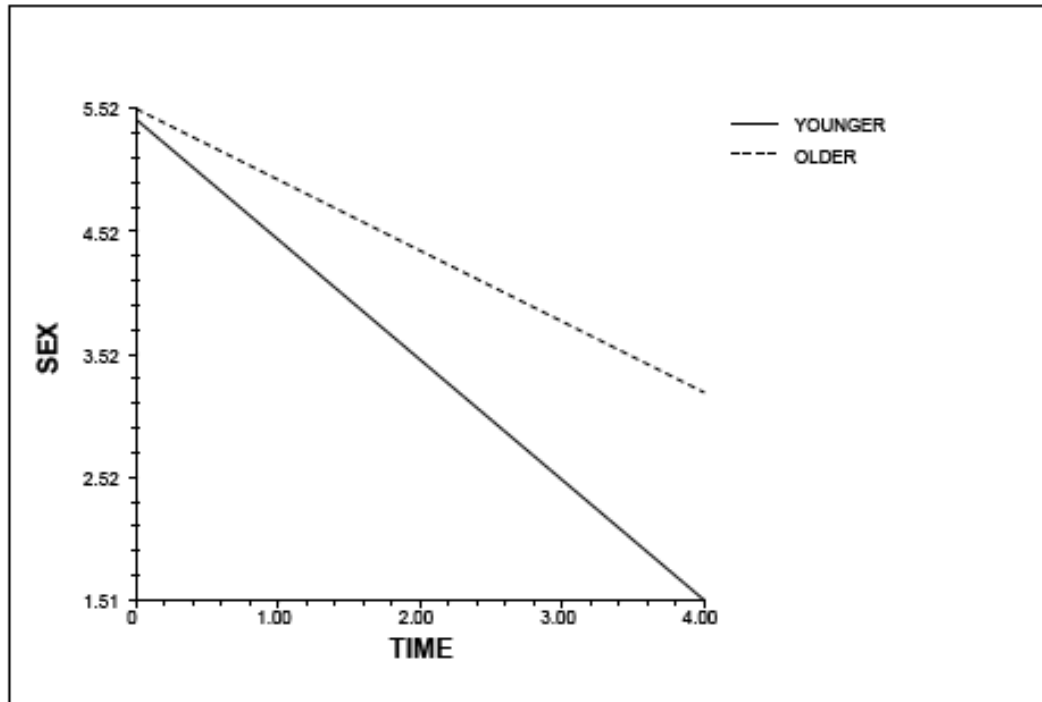


Figure 14. Trends in sexual functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by working age.

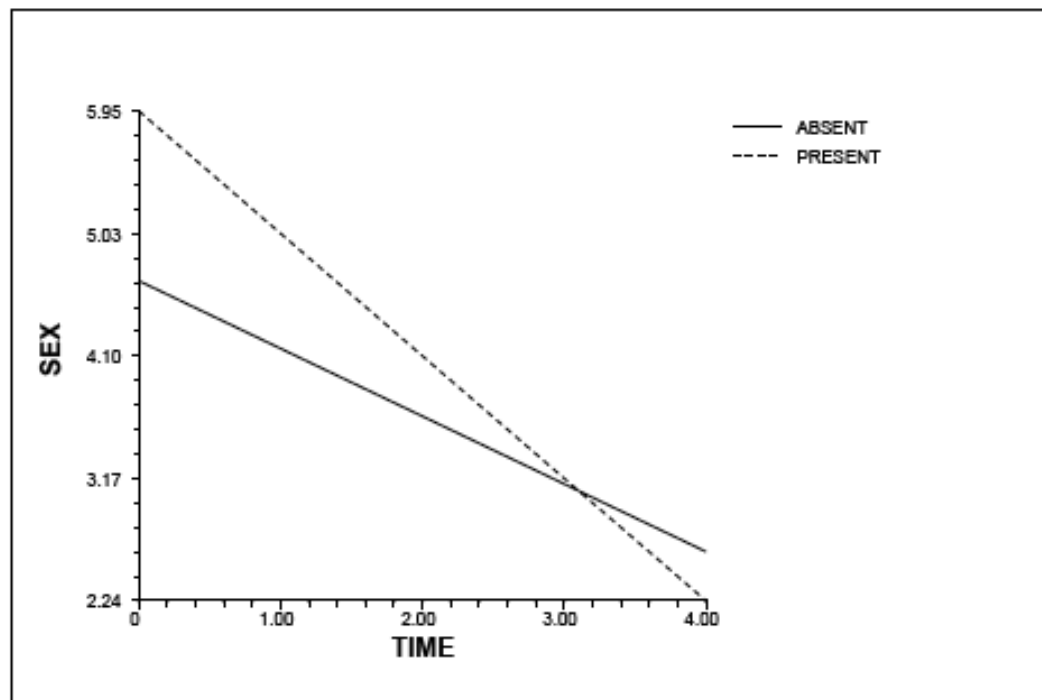


Figure 15. Trends in sexual functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by support.

Self-care. Individual change model results for Self-Care are presented in Table 10. From these findings, we note that the self-care domain was significantly different from zero at initial status ($\beta = 3.64, p < 0.01$) but with a significantly negative rate of change ($\beta = -1.34, p < 0.01$). At admission, patients' self-care functioning was predicted to be 3.6, as measured by the PDI, but was predicted to decrease by 1.3 points per period. Support ($\beta = -0.69, p = 0.003$) was a statistically significant predictor of sexual functioning at initial status (admission), suggesting patients without support were expected to be 0.69 greater disability in the self-care domain (see Figure 16). Gender ($\beta = 0.37, p = 0.005$) and age ($\beta = 0.01, p = 0.011$) were statistically significant predictors of self-care at the rate of change. Females functioning in the self-care domain were predicted to change by approximately 0.37 points faster per period (see Figure 17), whereas older patients were predicted to have 0.012 slower change in the self-care domain per period (see Figure 18).

Table 10

Individual change analysis results for initial status and rate of change in patients' self-care functioning from the PDI.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	3.63	0.000*	-1.34	0.000*
Gender	-0.29	0.181	0.37	0.005*
Age	0.01	0.382	0.01	0.011*
Disability	0.37	0.084	-0.07	0.574
Working	-0.13	0.560	-0.01	0.935
Support	-0.69	0.003*	-0.05	0.727

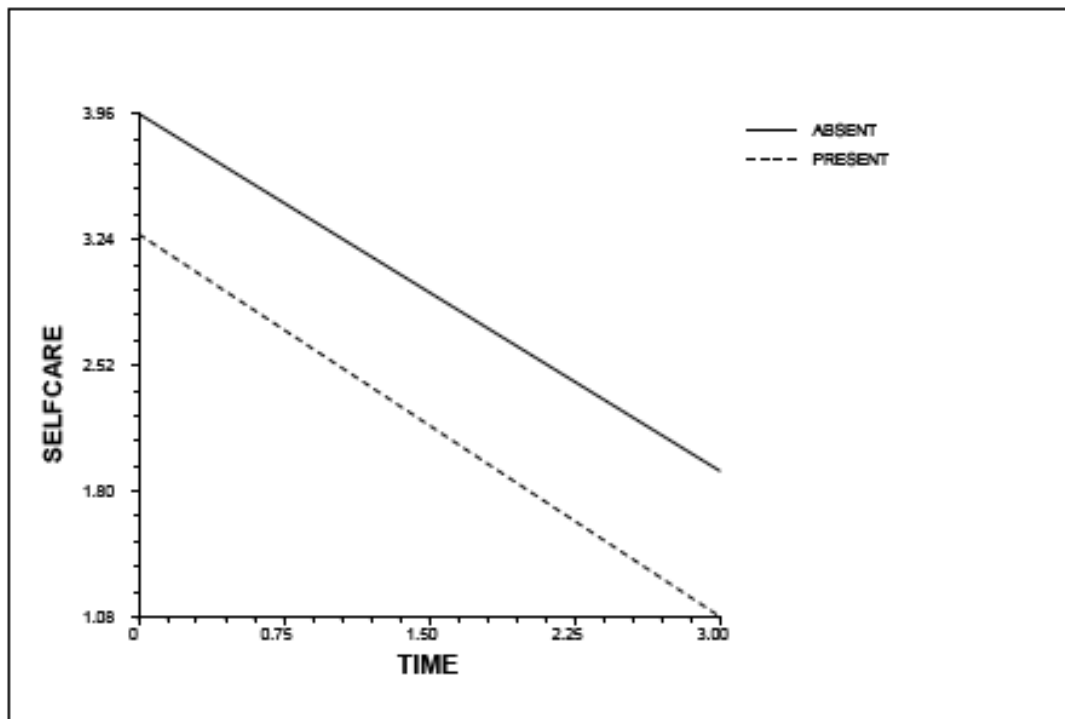


Figure 16. Trends in self-care functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by support.

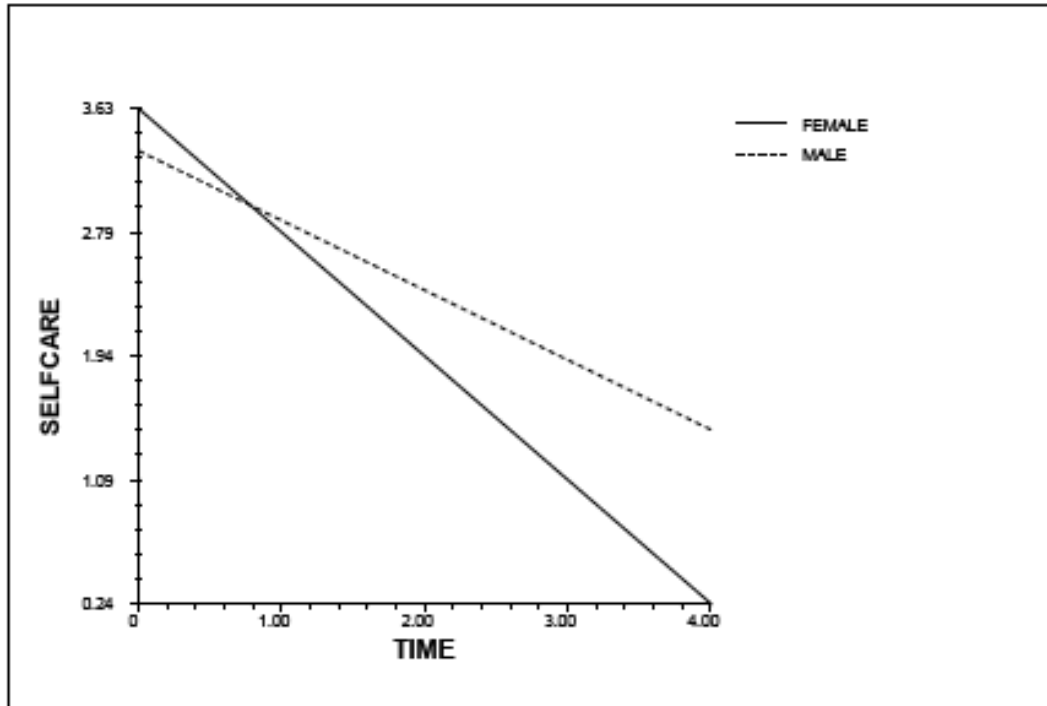


Figure 17. Trends in self-care functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by gender.

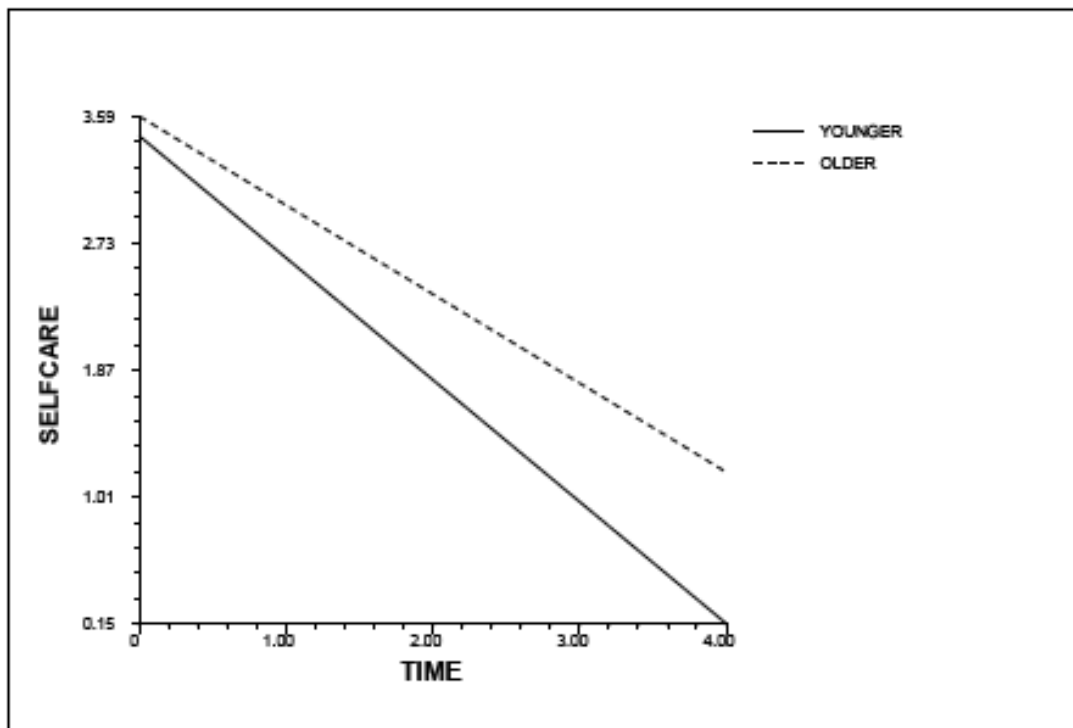


Figure 18. Trends in self-care functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by age.

Life support. Individual change model results for Life Support are presented in Table 11. From these results, we note that life support was significantly different from zero at the initial status ($\beta = 4.13$, $p < 0.01$) but with a significantly negative rate of change ($\beta = -1.50$, $p < 0.01$). At admission, patients life-support functioning, as measured by the PDI, was predicted to be 4.13, however, was expected to drop by 1.5 points per period. Gender ($\beta = 0.32$, $p = 0.021$) and age (0.01, $p = 0.008$) were statistically significant at the rate of change. Females life support functioning was predicted to change 0.32 faster per period than males (see Figure 19). Finally, for every year older, patients' life support functioning was predicted to change approximately 0.32 points slower per period than younger patients (see Figure 20).

Table 11

Individual change analysis results for initial status and rate of change in patient's life support functioning from the PDI.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	4.13	0.000*	-1.50	0.000*
Gender	-0.25	0.284	0.32	0.021*
Age	-0.00	0.792	0.01	0.008*
Disability	-0.10	0.682	0.11	0.442
Working	-0.32	0.179	0.04	0.766
Support	-0.58	0.023	-0.04	0.786

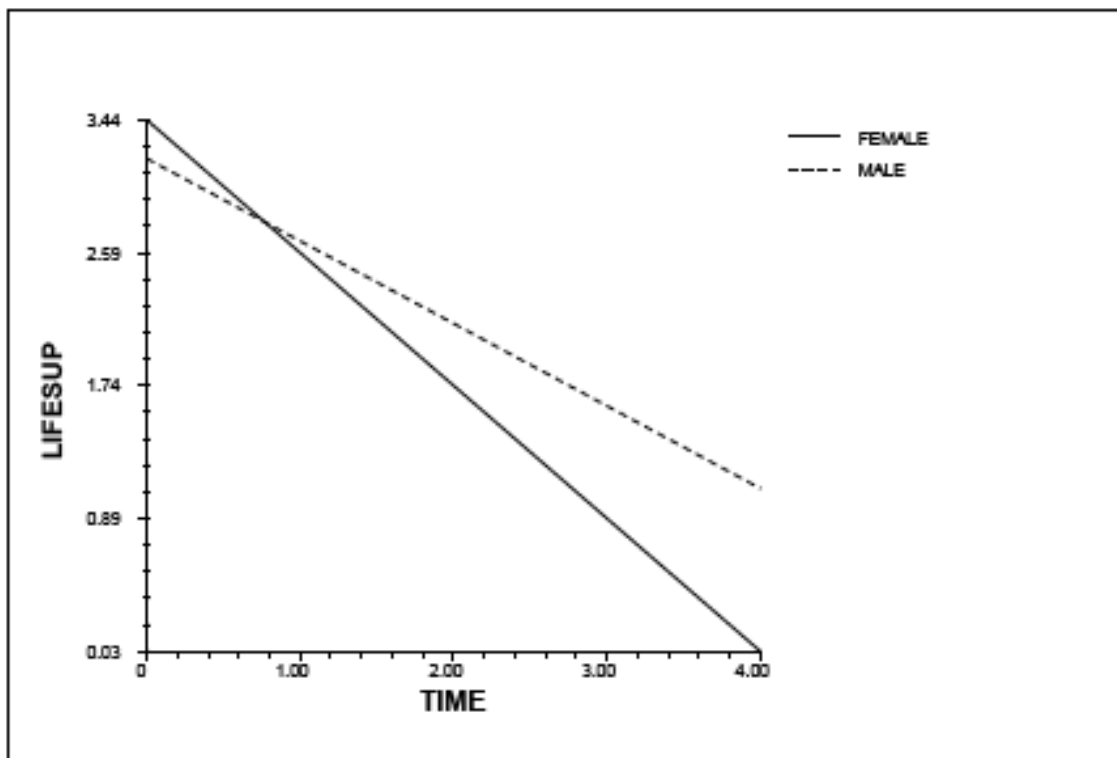


Figure 19. Trends in life-support functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by gender.

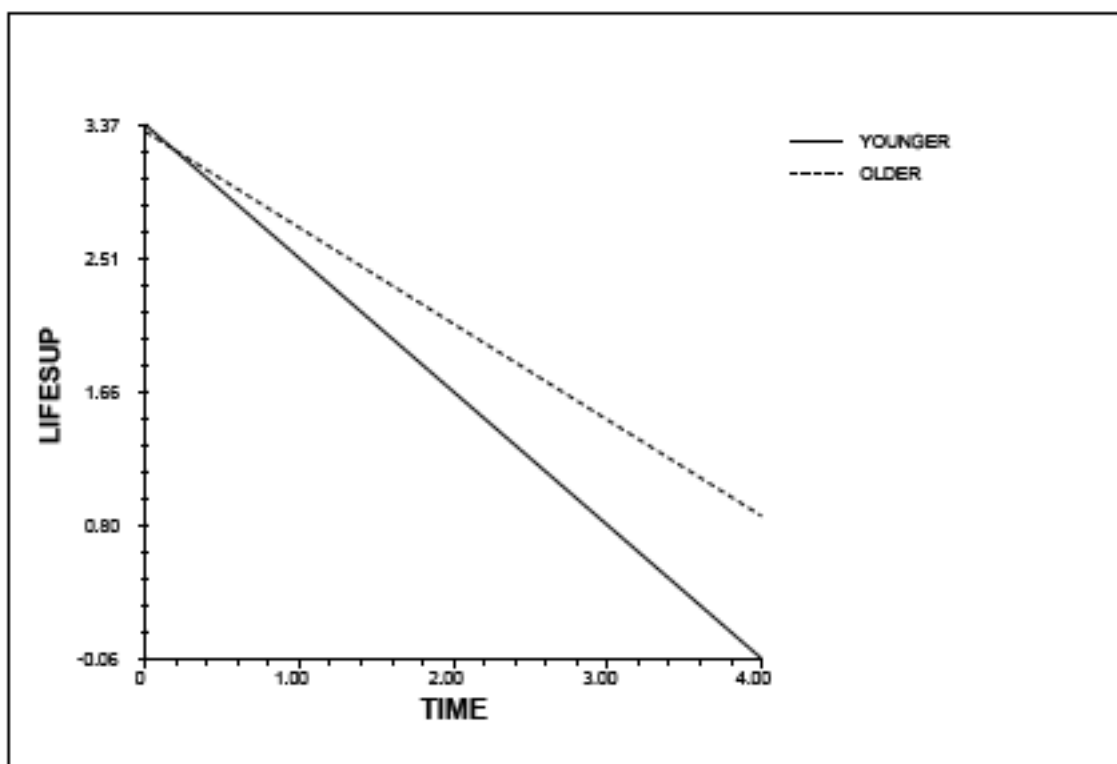


Figure 20. Trends in life-support functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by age.

Pain disability index total. Individual change model results for the total score on the Pain Disability Index are presented in Table 12. From these results, it is shown that the total PDI score was significantly different from zero at initial status ($\beta = 40.35$, $p < 0.01$), but with a significantly negative rate of change ($\beta = -12.24$, $p < 0.01$). Specifically, patients' predicted total pain disability was 40 on the PDI at admission, however, per period, patients were expected to decrease approximately 12 points on the total PDI. Working status ($\beta = -3.12$, $p = 0.005$) was a statistically significant predictor at initial status, suggesting patients who were not working were expected to be 3 points higher on the total PDI (see Figure 21). Gender and age were statistically significant predictors of total PDI ratings at the rate of change, suggesting females were expected to change 1.7 faster on the total pain related disability index than males (see Figure 22) and older patients were expected to experience a total change of 0.12 slower per period (see Figure 23).

Table 12

Individual change analysis results for initial status and rate of change in patients total functioning from the PDI.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	40.35	0.000*	-12.24	0.000*
Gender	-0.02	0.989	1.74	0.036*
Age	-0.06	0.137	0.12	0.001*
Disability	1.28	0.238	0.52	0.530
Working	-3.12	0.005*	0.25	0.766
Support	-0.09	0.937	-1.58	0.076

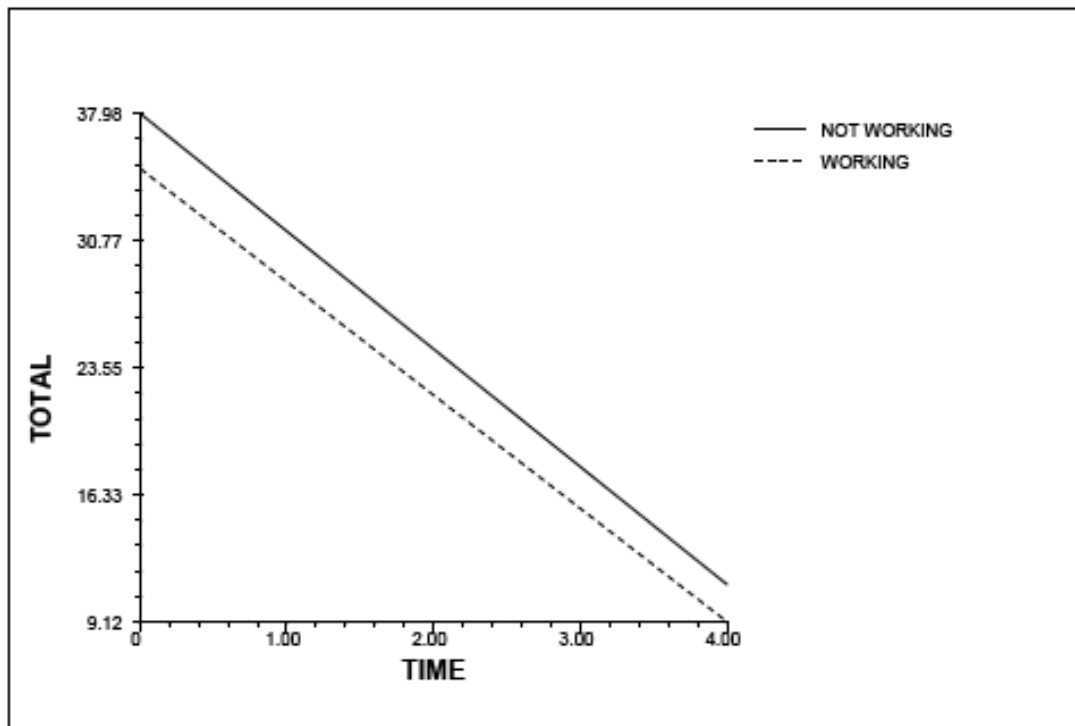


Figure 21. Trends in total functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by working status.

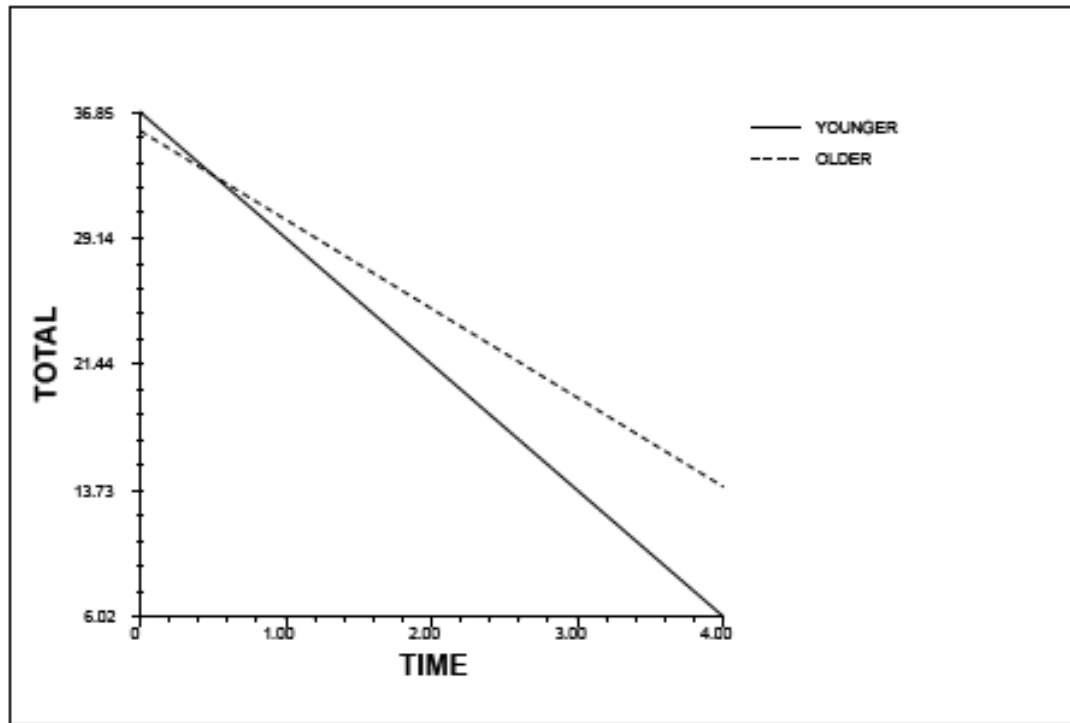


Figure 22. Trends in total functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by age.

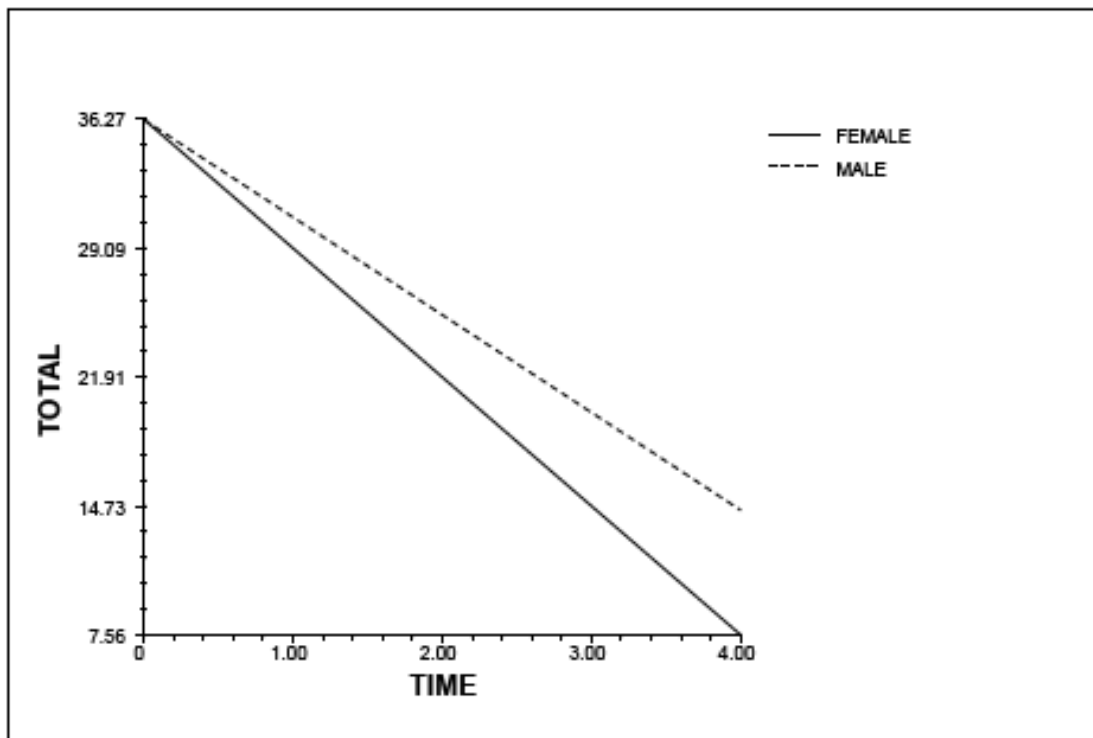


Figure 23. Trends in total functioning of patients' for admission, discharge, 6-month and 12-month follow-ups by gender.

Pain Intensity

Pain intensity. Individual change model results for Pain Intensity scores are presented in Table 13. From these results, we note that pain intensity was significantly different from zero at initial status ($\beta = 5.75$, $p < 0.01$) but was significantly negative at the rate of change ($\beta = -0.84$, $p < 0.01$). Specifically, patients' pain intensity at admission was predicted to be 5.75 on a 10 point-Likert scale at initial status, but was predicted to decrease approximately 0.8 points per period. Support ($\beta = -0.45$, $p = 0.037$) was a statistically significant predictor of pain intensity at initial status, suggesting patients who do not have support were expected to have 0.45 greater pain intensity (see Figure 24). Finally, age ($\beta = 0.01$, $p = 0.011$) was a statistically significant predictor of rate of change. One year older was predicted to correspond to 0.011 slower change in pain intensity per period (see Figure 25).

Table 13

Individual change analysis results for initial status and rate of change in patients total functioning from the Pain Likert Scale.

	Initial Status (π_0)		Rate of Change (π_1)	
	Coefficient	P-Value	Coefficient	P-Value
Overall	5.75	0.000*	-0.84	0.000*
Gender	-0.14	0.478	0.14	0.212
Age	0.00	0.794	0.01	0.011*
Disability	0.33	0.096	-0.06	0.581
Working	-0.22	0.268	-0.18	0.116
Support	-0.45	0.037*	-0.16	0.211

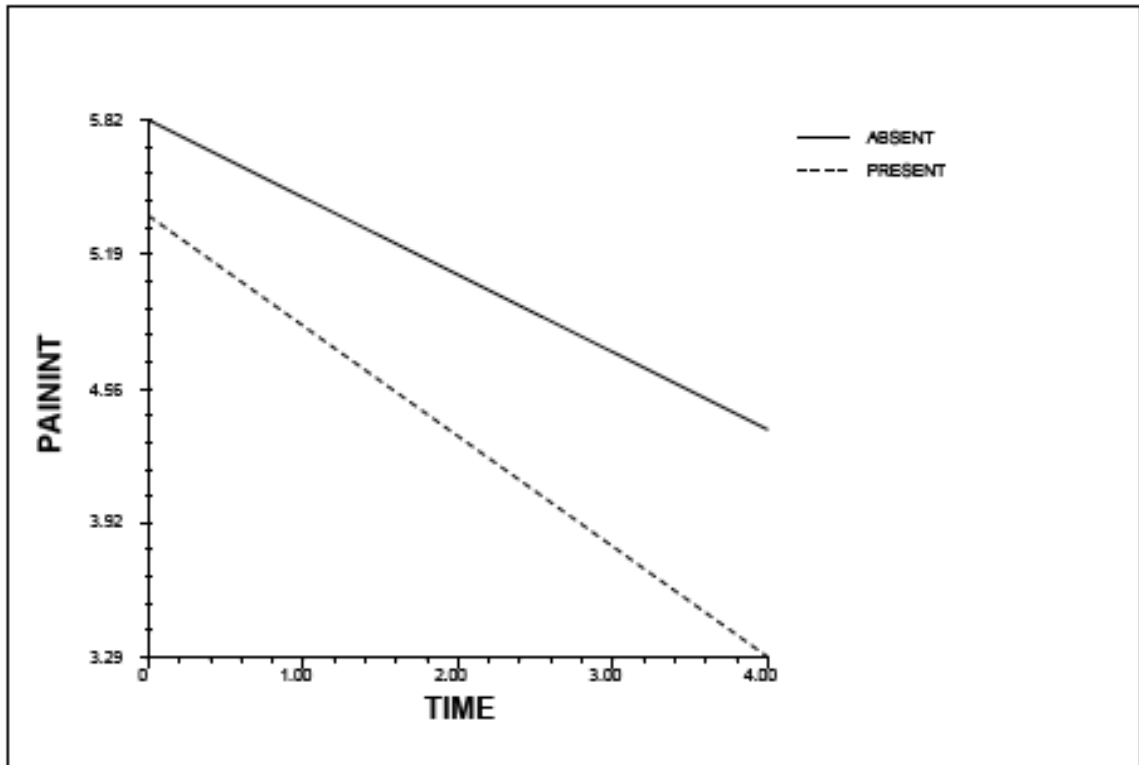


Figure 24. Trends in pain intensity of patients' for admission, discharge, 6-month and 12-month follow-ups by support.

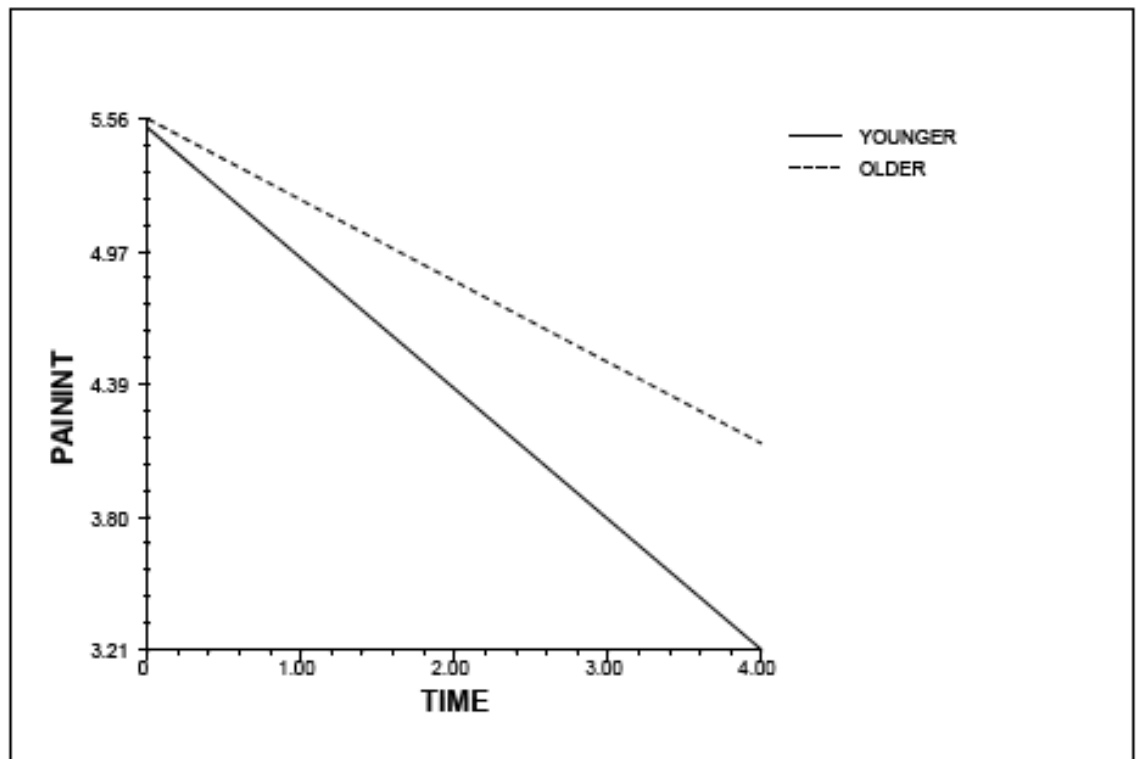


Figure 25. Trends in pain intensity of patients' for admission, discharge, 6-month and 12-month follow-ups by age.

Overall, the individual change models revealed that pain, mood and function were statistically significant from zero at admission. In addition, the rate of change for all outcomes (including pain, mood and function) was statistically significant, regardless of patient characteristics. The following table provides information regarding the adequacy of the individual change models by outcome.

Adequacy of the Individual Change Model

The adequacy of the model was examined to find out if a Type I error has been made. The conditional model examines the variability within the model while accounting for the impact of the variables (Mitchell, 2001). The intra-class correlation, denoted by ρ is considered a measure of model adequacy in the study. The index is calculated for each individual change model using the formula:

$$\rho = \frac{\tau}{\sigma^2 + \tau}$$

Where τ is the inter-class variance (between individual patients) and σ^2 is the intra-class variance (within individual patient trajectory). The intra-class correlation then represents the proportion of variance in the outcome that is between participants (Raudenbusch, 1987).

Table 14

Calculations for the Adequacy of the Individual Change Model.

Outcome	τ	σ^2	ρ
Depression	37.46	87.34	0.300
Anxiety	27.12	46.19	0.370
Stress	33.07	81.89	0.289
Pain	1.34	6.88	0.195
Family/Home	0.43	5.67	0.07
Recreation	0.64	6.28	0.09
Social	0.625	6.75	0.085
Occupation	1.62	7.23	0.183
Sexual	3.097	7.79	0.284
Self Care	1.53	4.91	0.238
Life Support	1.41	5.54	1.66
Total PDI	29.96	212.11	0.124

Table 14 shows that the proportion of variance in depression that was between participants was 0.300. This suggests that the variables in the model (including gender, age, working status, disability compensation status, and support) accounted for 30% of the proportion of variance in depression. Likewise, the proportion of variance in anxiety and stress were 37% and 29% respectively.

The proportion of variance for functioning is also presented in Table 14. The variables in the model accounted for greater variance in sexual functioning (0.284) and

self-care (0.238) than the other functioning outcomes. This suggests that the variables in the model accounted for approximately 28% and 24% of the proportion of variance for sexual functioning and self-care, respectively. The proportion of variance for occupational functioning was 0.183, suggesting the variables in the model accounted for approximately 18% of occupational functioning. The variables in family and home functioning (0.07), social functioning (0.085), and recreational functioning (0.09) each accounted for less than 10% of the proportion of variance in the models. Specifically, variables in the model for family and home functioning accounted for approximately 7% of the proportion of variances and approximately 9% of the proportion of variance for both social and recreational functioning. Variables in the model accounted for approximately 16% of the variance in the domain of life support (1.66). Finally, the proportion of variance in pain levels was 0.195. This suggests that the variables in the model accounted for approximately 20% of the proportion of variance for pain levels.

Overall, the adequacy of the models suggests that individual characteristics do not make a difference in change in pain outcomes. Furthermore, this suggests that treatment in the program was effective, regardless of individual characteristics.

CHAPTER V

SUMMARY, DISCUSSION, LIMITATIONS, AND RECOMMENDATIONS

Overview of the Study

The purpose of this study was to investigate if participating in a Chronic Pain Rehabilitation Program (CPRP) improves patients' mood, increases their level of physical functioning, and improves their perception of pain. An individual growth model (Bryk & Raudenbush, 1987; Raudenbush & Byrk, 2002) was utilized to examine if treatment in the program would predict patients' initial pain conditions (including pain, mood and function) and the patients' rate of change for pain, mood and function per period. Overall, treatment in a comprehensive interdisciplinary rehabilitation program was successful at improving pain levels, mood, and function for patients living with chronic low back pain. At admission, patients appeared to experience greater distress that differed significantly from baseline or zero. This suggests patients enter the program already in distress, experiencing marked deficits in their mood, pain levels, and physical functioning. However, compliant treatment in an interdisciplinary program improved a patient's experience of pain levels, physical functioning and overall mood regardless of individual circumstance.

Based on these findings, age played a significant role in patients' outcomes per period. In general, for every year older, it was predicted that patients would see changes in their mood, pain levels and functioning at a slower rate than younger patients. Females were also predicted to make faster progress compared to males. Patients who had some form of spousal support were predicted to make faster progress per period than individuals who did not have support. Patients who were not working were predicted to experience a slower progression through treatment per period, suggesting patients who were working were predicted to make change at a quicker rate than non-workers. Finally, disability status was an important predictor for Occupational functioning, only. This suggested that patients who were receiving some form of disability compensation were less likely to make steady progress per period when compared to non-disability patients.

Summary of the Findings

The following five points provide a summary of the main findings in this dissertation study.

1. **Pain Outcomes at Admission.** Table 15 shows the various pain outcomes at the initial status or admission. As expected, patients sought treatment in the interdisciplinary rehabilitation program because of substantial difficulties in pain, mood and functioning. Patients entered the program at admission with significant or debilitating levels of mood, including depression, anxiety and stress. In addition, patients' self-reported levels of pain-related disability were significantly different from zero on a 10-point Likert scale on all scales within the Pain Disability Index. Finally, patients' pain levels were also elevated at

admission, reporting approximately 6 points of perceived pain on a 10-point Likert scale.

2. Rate of Change During the Duration of Treatment. As previously noted, the presence of all pain outcomes was significant at admission. However, as treatment progressed, there was significant improvement over time. On all aspects of mood, patients were expected to decrease their levels of depression, anxiety and stress by approximately 3 to 4 points per period. For example, if a patient entered the program with a depression level of approximately 17, that same patient can be expected to decrease their self-reported levels of depression by 3 points per period, resulting in an expected depression level of 5 at the 12- month follow up. This shows not only statistical significance, but also shows clinical significance. A patient entering the program with a depression score of 17 fall in the moderate range or clinical significance. By the 12-month follow up, the depression level of 5 falls in the normal clinical range. Similarly, patients were expected to improve their perceived level of physical functioning in all domains including: family/home, recreation, social, occupation, sexual, self-care, life support, and total pain disability. In the family/home functioning domain, patients were expected to decrease their reported disability by approximately 2 points per period. Patients in the recreation, social, and occupational functioning domains were expected to decrease their reported disability in those domains by approximately 2 points per period. It was expected that patients in the sexual functioning domain decrease their reported disability by approximately 1.5 points per period. In

the self-care and life-support domains, patients were expected to decrease their reported levels of disability by approximately 1 point and 1.5 points per period, respectively. Patients were also expected to decrease their total PDI score by approximately 12 points per period. Self-reported levels of pain were also expected to decrease by approximately 1 point per period.

Table 15

Summary of pain outcomes showing predicted initial status and rate of change.

Pain Outcome	Initial Status	Rate of Change
Depression	16.7	-3.02
Anxiety	14.6	-3.14
Stress	22.4	-3.61
Pain	5.75	-0.84
Family/Home	6.0	-1.66
Recreation	7.18	-2.07
Social	6.09	-1.79
Occupation	8.46	-2.17
Sexual	4.46	-1.51
Self Care	3.64	-1.34
Life Support	4.13	-1.50
Total PDI	40.4	-12.24

3. Pain Outcomes at Admission as a Function of Individual Characteristics.

Table 16 shows the change in pain outcomes at initial status. At admission, gender did not make a difference on any of the pain outcomes. However, age, disability compensation status, working status, and support were significant predictors on various pain outcomes at admission. Age was a significant predictor for the following pain outcomes including anxiety, stress, and occupational functioning. This suggests that, at initial status, younger patients were predicted to experience 0.05 points greater level of anxiety and 0.11 points greater level of stress than older patients. Age was also a significant predictor of occupational functioning at initial status, suggesting younger patients were predicted to experience 0.04 points greater pain related disability in the occupational functioning domain.

Disability compensation status was a significant predictor of occupational functioning at initial status, only. This suggests that patients who had some form of disability compensation were predicted to have approximately 0.6 points higher pain related disability in the occupational functioning domain.

Working was a significant predictor of depression, recreational functioning, occupational functioning, and total pain disability index functioning. Patients who were working at admission were predicted to experience approximately 2.5 points less depression than their nonworking counterparts. In addition, aspects of functioning were influenced by a working status. Patients who were not working at admission were predicted to be 0.38 points higher in terms of recreational functioning or disability. Similarly, patients who were not working at admission were predicted to experience 0.92

points greater pain related disability in the occupational domain. Finally, working status was a significant predictor of total pain disability scores, suggesting patients who were not working at admission were expected to be 3 points higher in terms of total pain disability.

The final predictor of pain outcomes at admission was support. Specifically, support was a significant predictor of sexual functioning and self-care. Patients who reportedly have a form of support were predicted to experience 0.41 less disability in the sexual functioning domain. Patients without support were expected to experience 0.69 greater disability in the self-care domain. Finally, patients without support were predicted to have 0.45 points greater pain intensity at admission.

Table 16

Change in Pain Outcomes at Initial Status by Significant Predictors

	Initial Status (π_0)			
	Age	Disability	Working	Support
Depression	NS	NS	-2.48	NS
Anxiety	0.046	NS	NS	NS
Stress	-0.109	NS	NS	NS
Recreation	NS	NS	-0.38	NS
Occupation	-0.04	0.63	-0.92	NS
Sexual	NS	NS	NS	1.29
Self-Care	NS	NS	NS	1.29
Total PDI	NS	NS	-3.12	NS
Pain	NS	NS	NS	-0.45

*NS denotes that the pain outcome was not significant

4. Change in Pain Outcomes as a Function of Individual Characteristics. Table 17 shows the change in pain outcomes as a function of individual characteristics. For the rate of change, disability compensation status and working status were not significant predictors. However, gender, age, and support were significant predictors of the rate of change for a variety of pain outcomes.

Gender was a significant predictor of anxiety levels, self-care, life-support, and total pain disability. Specifically, females were predicted to experience less anxiety per period. This suggests they improved anxiety levels at a rate of approximately 1 point faster per period than males. Females were also expected to improve self-care functioning at a faster rate than males, at approximately 0.4 points faster per period. Females were also predicted to change 0.323 points faster per period than males in the life support domain. Finally, females were predicted to change approximately 2 points faster per period on the total pain disability index.

Age was a significant predictor of anxiety levels as well as several domains of functioning including family and home, recreational, social, occupational, sexual, self-care, life support, total pain disability, and pain intensity. Younger patients improved anxiety levels at a faster rate than older patients, approximately 0.04 points per period. In addition, younger patients improved faster per period, approximately 0.02 points, in the following domains: family and home functioning, recreational functioning, social functioning, occupational functioning, and sexual functioning. Similarly, younger patients improved at a faster rate, approximately 0.012 points per period, for self-care and

0.013 for sexual functioning. Finally, age predicted pain intensity, suggesting younger patients were predicted to improve pain intensities at a faster rate than older patients.

Support was the last significant predictor for the rate of change. Accordingly, support significantly predicted family and home functioning, social functioning, and sexual functioning. Patients who had support improved at a faster rate in the family and home functioning domain and the social domain, at approximately 0.32 and 0.35 respectively. However, patients without support were expected to experience 0.41 more sexual related disability than patients who had support.

Table 17

Pain Outcomes for the Rate of Change by Significant Predictors

	Rate of Change (π_1)		
	Gender	Age	Support
Anxiety	0.76	0.04	NS
Family/Home	NS	0.02	-0.32
Recreation	NS	0.02	NS
Social	NS	0.02	-0.35
Occupation	NS	0.02	NS
Sexual	NS	0.02	-0.41
Self-Care	0.37	0.012	NS
Life Support	0.323	0.013	NS
Total PDI	1.74	0.12	NS
Pain	NS	0.011	NS

*NS denotes that the pain outcome was not significant

5. Model Adequacy. In examining the adequacy of the models, it is determined that individual characteristics did not make a significant difference in change. This suggests that the predictor variables did not adequately contribute to the models. Thus, treatment in an interdisciplinary rehabilitation program is effective regardless of individual characteristics including gender, age, working status, disability compensation status, and support.

Discussion

As expected, patients sought treatment in an interdisciplinary rehabilitation program because of substantial dysfunction in pain, mood and functioning. This study revealed that, in the course of treatment, the pain outcomes changed in all aspects. The program met its objectives of improving the lives of chronic low back pain patients, because patients successfully completed treatment and were expected to improve in pain, mood and functioning.

This dissertation study was one of the first to examine pain, mood and function of individuals living with chronic low back pain treated in a rehabilitation program utilizing an individual change model. While the individual change model can be used to predict future function, it is overreaching to assume this model can be used to predict future status (beyond 12 months). For example, based on the model, the pain intensity outcome could essentially decrease to zero for all patients on a 10-point Likert scale over a time period. Given the chronic pain literature, this is not realistic because this treatment attempts to manage the pain, not cure the course of chronic pain.

Chronic pain, particularly chronic low back pain, is a widespread condition in the world's population (Wolter et al., 2011). Most individuals living with CLBP do not seek

treatment, but the impact of CLBP is immense on not only the individual but also on health care costs, resulting in the primary reason people seek medical care (May, 2012). As cited by May (2012), many researchers (Blyth, March, Nicholas & Cousins, 2005; Hillman et al., 1996; Jzelenberg & Burdoff 2004 ; Lim, Jacobs, & Klarenbach, 2006; Walker, Muller, & Grant, 2004) have noted psychological distress, functional disability, and reported pain levels are all factors that contribute to a poor prognosis for individuals living with CLBP. Treatment in an interdisciplinary chronic pain rehabilitation program is beneficial for individuals living with chronic low back pain (Flor et al., 1992; Weiner & Nordin, 2010).

Individuals with CLBP whom participate in an intense, outpatient program are likely to experience improvements in their mood, pain, and physical function. The results of this dissertation study were consistent with previous research supporting patient improvement on all outcomes regardless of predicting variables including age, gender, support, disability status, and working status. This illustrates the effectiveness of interdisciplinary programs at treating the psychological and emotional factors associated with chronic pain conditions. Individuals are better able to cope with their pain and engage in daily activities of living as a result of implementing various interventions provided throughout interdisciplinary programs, in spite of their perceived pain levels.

Pain. Patients who entered the interdisciplinary program began with severe and debilitating levels of pain. However, treatment in the interdisciplinary rehabilitation program (investigated for the purposes of this dissertation research) demonstrated improved pain levels per period, regardless of individual characteristics. This is interesting and important to note since chronic pain is often a life long condition. A

person living with any chronic pain condition may not rid himself or herself of pain or ameliorate the experience of pain. However, treatment in the program was likely to assist them in better coping and living with the pain condition, ultimately making their pain experience more tolerable and livable.

Mood. Patients with CLBP treated in the interdisciplinary chronic pain rehabilitation program (investigated for the purposes of this dissertation research) were expected to experience improvements in their overall mood, including depression, anxiety, and stress. In addition, CLBP patients' depression levels at initial status were related to whether or not they are working. Patients who were not working at admission or initial status reported greater levels of depression. Working serves the function of providing fulfillment and meaning in one's life. Patients who are unable to serve the life role of working may experience greater levels of sadness, withdrawal, and depression. Consistent with Kuijer's (2005) work, CLBP sufferers who are not working are more likely to experience depressed mood and difficulties in their everyday functioning.

Previous research has provided inconclusive results regarding the role of gender in chronic pain experiences. Some studies (Sagmanli et al., 2009) have revealed that women experience greater levels of pain, possibly related to their perception of pain, but also related to their mood and physiological experiences. Finally, age plays a role in the rate of change of patients' anxiety and stress. In this dissertation study, younger patients were more likely to improve their anxiety levels at a quicker rate than older patients, while older patients were more likely to improve their stress levels at a quicker rate than younger patients. Of importance, however, is that all patients regardless of age, were

able to successfully decrease anxiety and stress levels with treatment in this interdisciplinary rehabilitative treatment program.

Function. Patients treated in the interdisciplinary chronic pain rehabilitation program (investigated for the purposes of this dissertation research) were expected to improve their perceived level of functioning in all areas, including: family/home functioning, recreational functioning, social functioning, occupational functioning, sexual functioning, self-care, and life support. Patients improved in all areas regardless of circumstances, which supports the effectiveness of comprehensive treatment.

Why is the Program Working?

As previously mentioned, the chronic pain interdisciplinary rehabilitation program utilizes all components of effective noninvasive treatments including but not limited to pharmacological management, psychotherapy (utilizing CBT and biofeedback), and physical and occupational therapy. While it is not clear which components of treatment are most effective, this study supports the extant literature suggesting that interdisciplinary treatment works. Interdisciplinary rehabilitation programs should be encouraged for the treatment of chronic pain conditions. In addition, already established programs might benefit from paying particular attention to demographic and personal characteristics of patients treated in the program as certain patients appear to make progress faster than other patients.

Limitations

There were several limitations to this dissertation study.

1. The first limitation being that this was a retrospective research study.

Retrospective studies limit the extent to which the analyzing researcher can

examine or manipulate variables. In addition, it is unknown to this researcher if certain aspects of the rehabilitation program were more effective than others. For example, it is unclear if the Cognitive Behavioral Therapy group had a greater impact on individual change when compared to the physical therapy component. This study looked at the program as a whole and was unable to determine if there were differences in the various components of treatment.

2. Archived data limits analyses to include only the measures and variables already established by previous researchers. For example, although the primary database included years 1999 to 2013, for the purposes of this study, only years 2008 to 2012 were utilized. Data in the formative years, from 1999 to 2007 collected variables on mood (including depression) on the outcomes from the Beck Depression Inventory (BDI) and did not transition to the DASS until 2008. In order to be consistent in the way mood was assessed, this study only included the time span where the DASS was utilized to assess mood.
3. Another major limitation to this study was the lack of a control group. An optimal study would have compared CLBP patients treated and CLBP patients who were not treated in an interdisciplinary program. However, the individual change model treats each patient or participant as their own control, assessing initial status and their own predicted rate of change over time. The downside is that the model does not provide an actual treatment effect size.
4. In addition, the results of this study can only be generalized to patients treated in a northeast Ohio interdisciplinary rehabilitation program. This study did not

account for variables that may be pertinent to this region including urbanicity, socioeconomic status, education level, and ethnicity. Of equal importance, this study could not control for other pain conditions or psychological experiences occurring simultaneously during treatment. This prevents the researcher from controlling for patients co-morbid conditions or diagnoses, which may include, but not limited to, major depression or other chronic pain conditions.

5. Finally, individual change modeling allows for the observations of repeated measures over time to predict individual change. This study analyzed four waves of treatment (admission, discharge, and 6 month and 12 month follow-ups). Time spent in the program may vary by a week or two for some patients. It would have been optimal to have a mid-treatment wave.

Further research may warrant an examination on the differences of the two outcome measures utilized in this program, including the BDI and the DASS. In addition, the sample size was largely affected due to attrition rates and variable response rates of patients treated within the program. The admission and discharge data was significantly more complete than that follow-up data at 6 and 12 months. Finally, since this was a retrospective study, the researcher was unable to account for missing data. The database utilized for this dissertation study was extracted data from one of the largest chronic pain database in the country.

Implications for Practice

Chronic pain is a widespread problem expected to become more prevalent with the aging of America. As the baby boomers age into their late 60's, the rise of chronic pain will simultaneously increase, with added health care costs and related disability

(Gatchel et al., 2014). While many documented interventions for pain management have provided pain relief, including pharmaceutical, behavioral, and surgical, the relief is short-term and not as cost effective as interdisciplinary treatment. With the simultaneous rising cost in health care and chronic pain conditions, the effectiveness of interdisciplinary treatment continues to be supported in the literature.

Psychology and psychologists play a vital role in understanding and treating chronic pain conditions. The fundamental underpinnings of the biological, psychological, and social frameworks are major contributors to understanding and treating chronic pain conditions. Psychologists well versed in cognitive behavioral therapy including operant conditions, behavioral reinforcing, and acceptance and commitment therapy can provide continual psychological and physical growth for patients living with chronic pain conditions treated in a rehabilitation program.

Recommendations for Future Research

The opportunity for future research studies are endless and can vary by diagnoses and other predictor variables. For example, research designed to include a control group of depressed CLBP patients not being treated in an interdisciplinary rehabilitation program may further demonstrate the effectiveness of participation in a program. In addition, a future study may also analyze individual change in pain, mood and function of patients with another specific pain condition, a fibromyalgia diagnosis, for example. Analyzing individual change in specific diagnoses may be of interest, but also comparing predicted change of CLBP and fibromyalgia, for example, may be helpful in understanding if certain diagnoses are predicted to change at different rates.

Individualized treatments, including only medication or physical therapy, are still a common means of treating patients with chronic pain. Future researchers may be interested in comparing the effectiveness of this particular interdisciplinary rehabilitation program to only medication or physical therapy, alone.

Future chronic low back pain research may benefit from including additional demographic variables that are of interest to each researcher, possibly extending beyond the typical demographic data. For example, future studies may want to collect data on urban variables including socio-economic status or level of education. It will be interesting to determine which diagnoses are expected to make greater change under the time period in question.

Finally, treatment in the rehabilitation program has proven to be effective and individuals treated within the program would benefit from engaging in the various aftercare programs provided by this institution. Aftercare programming is designed to continue the rewarding benefits of principles and practices learned during the program. This programming includes medication management, access to individual counseling and physical therapy, and access to support groups with other patients treated in the program. Future studies would benefit from examining what factors are most effective post-treatment. This will assist in determining how to sustain the change and benefits of treatment in the program after 12 months.

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APPENDICES

APPENDIX A
IRB APPROVAL



Memorandum

Institutional Review Board

To: Sarah Toman
CASAL

From: Diana Dubinsky
Interim Director 
Office of Sponsored Programs & Research

Date: October 24, 2013

Re: Results of IRB Review of your project number: #29893-TOM-HS
Co-Investigators: Sarah Rispinto, Student
Title: Dissertation: Pain, Mood, and Function of Individuals with Chronic Low Back Pain Treated in Rehabilitation Program

The IRB has reviewed and approved your application for the above named project, under the category noted below. It has been determined that the research being performed under this protocol is Exempt. This determination does not expire and does not require an annual review.

However, by accepting this decision, you agree to notify the IRB of: (1) any additions to or changes in procedures for your study that modify the subjects' risk in any way; and (2) any events that affect that safety or well-being of subjects. Notify the IRB of any revisions to the protocol, including the addition of researchers, prior to implementation.

Thank you for your efforts to maintain compliance with the federal regulations for the protection of human subjects.

Approval Category:

Approval Date: October 18, 2013

 X **Exempt (b4)**

cc: Project file

APPENDIX B
SITE APPROVAL



Judith Scheman Ph.D.

Director of Psychology

Training Director

Neurological Center for Pain

April 19, 2013

Sara Michalos

michalossesm@gmail.com

To Whom It May Concern:

I'm writing to grant permission to Sarah Rispinto to access and use the Cleveland Clinic Chronic Pain Rehabilitation Program IRB approved data registry for use in her dissertation research. I confirm that Ms. Rispinto has completed all required research courses through CITI training and has been added to the Cleveland Clinic Institutional Review Board (IRB) accordingly. Please do not hesitate to contact me with any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Judith Scheman", with a stylized, flowing script.

Judith Scheman Ph.D.

APPENDIX C

<h1 style="margin: 0;">DASS</h1>	<i>Name:</i> _____	<i>Date:</i> _____																																																																															
<p>Please read each statement and circle a number 0, 1, 2 or 3 that indicates how much the statement applied to you <i>over the past week</i>. There are no right or wrong answers. Do not spend too much time on any statement.</p> <p><i>The rating scale is as follows:</i></p> <p>0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree, or a good part of time 3 Applied to me very much, or most of the time</p>																																																																																	
<ol style="list-style-type: none"> 1 I found myself getting upset by quite trivial things 2 I was aware of dryness of my mouth 3 I couldn't seem to experience any positive feeling at all 4 I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion) 5 I just couldn't seem to get going 6 I tended to over-react to situations 7 I had a feeling of shakiness (eg, legs going to give way) 8 I found it difficult to relax 9 I found myself in situations that made me so anxious I was most relieved when they ended 10 I felt that I had nothing to look forward to 11 I found myself getting upset rather easily 12 I felt that I was using a lot of nervous energy 13 I felt sad and depressed 14 I found myself getting impatient when I was delayed in any way (eg, elevators, traffic lights, being kept waiting) 15 I had a feeling of faintness 16 I felt that I had lost interest in just about everything 17 I felt I wasn't worth much as a person 18 I felt that I was rather touchy 19 I perspired noticeably (eg, hands sweaty) in the absence of high temperatures or physical exertion 20 I felt scared without any good reason 21 I felt that life wasn't worthwhile 	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 10%; text-align: right;">0</td><td style="width: 10%; text-align: right;">1</td><td style="width: 10%; text-align: right;">2</td><td style="width: 10%; text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> <tr><td style="text-align: right;">0</td><td style="text-align: right;">1</td><td style="text-align: right;">2</td><td style="text-align: right;">3</td></tr> </table>	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3
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DASS SURVEY

Please turn the page ➞

Reminder of rating scale:

- 0 Did not apply to me at all
- 1 Applied to me to some degree, or some of the time
- 2 Applied to me to a considerable degree, or a good part of time
- 3 Applied to me very much, or most of the time

22	I found it hard to wind down	0	1	2	3
23	I had difficulty in swallowing	0	1	2	3
24	I couldn't seem to get any enjoyment out of the things I did	0	1	2	3
25	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
26	I felt down-hearted and blue	0	1	2	3
27	I found that I was very irritable	0	1	2	3
28	I felt I was close to panic	0	1	2	3
29	I found it hard to calm down after something upset me	0	1	2	3
30	I feared that I would be "thrown" by some trivial but unfamiliar task	0	1	2	3
31	I was unable to become enthusiastic about anything	0	1	2	3
32	I found it difficult to tolerate interruptions to what I was doing	0	1	2	3
33	I was in a state of nervous tension	0	1	2	3
34	I felt I was pretty worthless	0	1	2	3
35	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
36	I felt terrified	0	1	2	3
37	I could see nothing in the future to be hopeful about	0	1	2	3
38	I felt that life was meaningless	0	1	2	3
39	I found myself getting agitated	0	1	2	3
40	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
41	I experienced trembling (eg, in the hands)	0	1	2	3
42	I found it difficult to work up the initiative to do things	0	1	2	3

APPENDIX D

PAIN DISABILITY INDEX

Pain Disability Index: The rating scales below are designed to measure the degree to which aspects of your life are disrupted by chronic pain. In other words, we would like to know how much pain is preventing you from doing what you would normally do or from doing it as well as you normally would. Respond to each category indicating the overall impact of pain in your life, not just when pain is at its worst.

For each of the 7 categories of life activity listed, please circle the number on the scale that describes the level of disability you typically experience. A score of 0 means no disability at all, and a score of 10 signifies that all of the activities in which you would normally be involved have been totally disrupted or prevented by your pain.

Family/Home Responsibilities: This category refers to activities of the home or family. It includes chores or duties performed around the house (e.g. yard work) and errands or favors for other family members (e.g. driving the children to school).

No Disability 0__ 1__ 2__ 3__ 4__ 5__ 6__ 7__ 8__ 9__ 10__ Worst Disability

Recreation: This disability includes hobbies, sports, and other similar leisure time activities.

No Disability 0__ 1__ 2__ 3__ 4__ 5__ 6__ 7__ 8__ 9__ 10__ Worst Disability

Social Activity: This category refers to activities, which involve participation with friends and acquaintances other than family members. It includes parties, theater, concerts, dining out, and other social functions.

No Disability 0__ 1__ 2__ 3__ 4__ 5__ 6__ 7__ 8__ 9__ 10__ Worst Disability

Occupation: This category refers to activities that are part of or directly related to one's job. This includes non-paying jobs as well, such as that of a housewife or volunteer.

No Disability 0__ 1__ 2__ 3__ 4__ 5__ 6__ 7__ 8__ 9__ 10__ Worst Disability

Sexual Behavior: This category refers to the frequency and quality of one's sex life.

No Disability 0__ 1__ 2__ 3__ 4__ 5__ 6__ 7__ 8__ 9__ 10__ Worst Disability

Self Care: This category includes activities, which involve personal maintenance and independent daily living (e.g. taking a shower, driving, getting dressed, etc.)

No Disability 0__ 1__ 2__ 3__ 4__ 5__ 6__ 7__ 8__ 9__ 10__ Worst Disability

Life-Support Activities: This category refers to basic life supporting behaviors such as eating, sleeping and breathing.

No Disability 0__. 1__. 2__. 3__. 4__. 5__. 6__. 7 __. 8__. 9__. 10__. Worst Disabilities

Signature_____ **Please Print**_____ **Date** _____