EVALUATION AND TREATMENT OF A HETEROGENOUS GROUP OF CHRONIC PAIN PATIENTS: ASSESSING THE EFFECT SIZE OF OUTCOME MEASURES

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DEDICATION

To my family

EVALUATION AND TREATMENT OF A HETEROGENOUS GROUP OF CHRONIC PAIN PATIENTS: ASSESSING THE EFFECT SIZE OF OUTCOME MEASURES

by

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THESIS

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The aim of the present study was to evaluate an array of psychometric tests administered to a heterogeneous group of chronic pain patients at pre- and post- treatment to determine the effect sizes of the measures. The sample included patients (*N*=312) who participated in an interdisciplinary treatment program, which included medical, psychological, psychiatric, and physical therapy components. This sample was narrowed to include only those who completed treatment (*n*=262). Subjects were evaluated on a variety of physical/functional, psychosocial, and coping measures, including the Visual Analog Scale (VAS), Million Visual Analog Scale (MVAS), Oswestry Low Back Pain

Disability Questionnaire (OSW), Pain Medication Questionnaire (PMQ), Medical Outcomes Survey 36-Item Short Form Health Survey (SF-36), Beck Depression Inventory-II (BDI-II), and Multidimensional Pain Inventory (MPI). Paired sample t-tests were conducted to evaluate each measure for pre- to post-treatment change. These measures were further analyzed using Cohen's *d* (1992) to obtain the effect size. Results indicated that the instruments showing the greatest effect size were the VAS (*d*= 1.27) and the MVAS (*d*=0.94), both within the large effect size range. The OSW (*d*=0.67) showed a medium effect size, while the SF-36/PCS (*d*=0.19) had the lowest effect size of the physical measures. Results indicated a medium effect size for psychosocial measures. The PMQ (*d*=0.79) BDI-II (*d*=0.72) and the SF-36/MCS (*d*=0.62). The MPI exhibited an extremely low effect size (*d*=0.03). The heterogeneous population was also broken down into three categories of pain diagnoses including musculoskeletal, all other single pain diagnoses (e.g. headache, neuropathy, reflex sympathetic dystrophy, firbomyalgia), and multiple diagnoses (more than one type of pain). Overall, this study offers information on the effect sizes of different measures in order to facilitate the decision making process when selecting assessment tools to use with chronic pain populations, and supports the use of multiple assessment measures.

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BDI- I and II	Beck Depression Inventory- I and II
CBT	Cognitive Behavioral Therapy
d	Cohen's *d* effect size
df	Degrees of Freedom
IASP	International Association for the Study of Pain
JCAHO	Joint Commission on Accreditation of Health Care Organizations
MPI	West Haven-Yale Multidimensional Pain Inventory
MVAS	Million Visual Analog Scale
NACHD	National Advisory Committee on Health and Disability
OSW	Oswestry Low Back Pain Disability Questionnaire
PMQ	Pain Medication Questionnaire
SF-36/MCS	Medical Outcomes Survey 36-Item Short Form Health Survey/ Mental Component Scale
SF-36/PCS	Medical Outcomes Survey 36-Item Short Form Health Survey/ Physical Component Scale
The Center	The Eugene McDermott Center for Pain Management
VAS	Visual Analog Scale
χ^2	Chi-square

CHAPTER ONE
Introduction

The treatment of chronic pain is one of the most prevalent problems facing the health care system today. In order to accurately diagnose and treat chronic pain, a consistent and standard assessment is essential. Self-reported pain is inherently subjective which, in turn, prohibits the existence of an objective clinical instrument that can precisely measure pain. This basic fact lends itself to endless questions regarding what types of pain treatments are appropriate for which patients. Over the years, a myriad of psychometric measures have been developed to aid in the assessment and treatment of chronic pain patients. However, comprehensive assessments become complicated as the number of instruments utilized in such an assessment grows. As new instruments are developed, each measure is individually evaluated, and reliability and validity are established. However, instead of the newly developed measures replacing those that are out-of-date or less efficient, most are simply added on to some previously established assessment protocol.

Many different tests are used as outcome measures to study the efficacy of chronic pain treatment programs. In conjunction with clinical interviews, various instruments are used to assess chronic pain patients, including self-report measures and more objective clinician-rated scales. For obvious reasons, no single measure is relied upon to assess the efficacy of any given intervention. Psychometric measures provide information that may assist in qualifying the pain presentation or aid in the clinical assessment of patients. However, an over-abundance of administered measures may complicate, rather than clarify, the assessment process.

Clinical researchers run into many obstacles when collecting data: attempting to gain an optimal sample size while maintaining adequate power and statistical significance; and continually accounting for missing data, items not captured, or psychometric tests with invalid results. This problem includes tests or test items that are simply omitted or incapable of being scored accurately secondary to non-adherence to the given directions. This phenomenon of incomplete data collection could be due, in part, to the amount of paperwork and testing procedures patients go through during an evaluation process. Therefore, the appropriateness of examining which of the various tests display the greatest utility and effect size is clear.

The present study will look at an array of psychometric tests administered to a group of chronic pain patients at pre- and post- treatment to determine the effect sizes of each measure. Results of this study will aid in the decision-making process for selecting the best of these measures for more appropriate evaluation of chronic pain patients.

CHAPTER TWO
Review of the Literature

While knowledge in the medical field continues to progress, a great deal remains unknown about the most prevalent symptom that brings most people to medical treatment -- pain. Pain is a primary reason people seek medical assistance from physicians (Woodwell, 2000). Pain management is a growing problem in the United States, with more than 50 million Americans affected by pain issues and losses in productivity with health care costs in excess of $70 billion a year (Mayer, et al. 2000). An estimated one-third of the American population will have chronic pain at some point in their lives, ranking chronic pain as the most common cause of long-term disability (Brookoff, 2000). In a recent study released by the National Center for Health Statistics (2006) with a special feature on pain, it was reported that, “nearly one-third of adults 20 years of age and over who reported pain said that it lasted less than 1 month, 12% reported pain that lasted 3 months to 1 year, and 42% reported pain that lasted more than 1 year”. These findings reveal that a large percentage of adults have to cope with pain for extended periods of time. For some individuals, pain is viewed as an unavoidable part of life that must be endured; however, advances in the theory and understanding of the purpose, process, and origin of pain have uncovered a new realm of possibilities in diagnosis and treatment. Rather than simply enduring pain, some people decide to take a more active role in trying to define and overcome pain.

Pain

Pain has been described as both the oldest medical problem in history and a universal physical affliction of mankind (Merskey, 1979). Yet, little has been understood about the specific physiology of pain until recently. To address any problem, a definition is essential. The International Association for the Study of Pain (IASP) defines pain as: "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" (IASP, 2007). Typically, pain serves as an initial warning sign, indicating the existence of tissue damage in the body. While pain is well intended to protect people from injuring themselves beyond repair, sometimes the pain lasts longer than necessary to alert the body of tissue damage. Enduring, continuous, and persistent stimulation of the pain pathway leads to physiological changes in the neural pathway, which can then result in hypersensitivity to stimuli (Arnst & Licking, 1999). Signals in the body travel through a network of peripheral nerves that run throughout the body to the central nervous system (i.e., the spinal cord and the brain). A structure in the spinal column called the dorsal horn acts as a "clearinghouse" for pain messages. The thalamus, located in the brain, receives and sorts these signals from the dorsal horn, then progresses to the cerebral cortex where the person actually becomes conscious of the pain (Arnst & Licking, 1999).

While everyone experiences some amount of pain at some point in their lives, the majority of pain is acute and simply acts as a survival aid. Acute pain serves as a biological signal typically identifying an underlying cause that can direct physicians to the origin of the pain. Optimally, well-defined treatment plans and predictable outcomes are then devised. The location, pattern, and description of the pain aids physicians in

assessing acute pain (Gatchel & Epker, 1999). However, chronic pain lacks such a biological purpose and alerts a physician only that something has gone awry. Unfortunately, chronic pain often mimics acute pain in intensity and can, therefore, can confuse patients and physicians alike.

As one of the most costly public health problems in America today, chronic pain patients are five times more likely than patients without chronic pain to utilize healthcare services (Becker, 1997). Over 50 million Americans are affected by pain, creating increases in personal, social, and financial hardships. Healthcare costs due to pain are in the tens of billions of dollars annually, with over 80 % of all physician visits occurring due to complaints of pain (Woodwell, 2000). These costs include direct medical expenses, lost earnings, reduced work-related productivity, and disability or compensation benefits (Gatchel, 2001). Therefore, finding the most efficacious and cost-effective treatments for chronic pain is a high priority due to the ever growing financial expenditures in this country.

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has recognized pain as a major public health problem and created a new standard in the expectations for pain assessment and treatment (JCAHO, 2000). Pain is recognized by these standards as a condition that co-exists with injuries and diseases and requires explicit management. Under JCAHO guidelines, pain is treated as the "fifth vital sign," along with pulse, blood pressure, temperature, and respiration (Lynch, 2001). The standards require that healthcare organizations comply with the following: assess pain in all patients, document patient pain levels with regular re-assessment, establish policies and procedures that support the appropriate prescribing of effective pain medications,

educate patients and their families about effective pain management, and ensure staff competency in pain assessment and management (American Pain Society, 2000). All healthcare organizations must comply with JCAHO standards for pain assessment and management in order to maintain accreditation. Additionally, the American Pain Foundation issued a *pain care bill of rights,* which informs patients of these standards and their rights to proper assessment and treatment of any pain conditions (Gatchel, 2001). Due to these initiatives, medical professionals have been forced to rise to the challenge of successfully assessing and managing all types of pain.

Chronic Pain

When classifying pain as acute or chronic, the primary factor considered is duration. Chronic pain can be defined as pain that persists for longer than three months. While the term "chronic" has been applied as early as six weeks, most pain specialists deem any disabling injury of at least four months as chronic (McGeary, 2006). Chronic pain associated with medical conditions, such as arthritis or certain types of cancer, can cause persistent tissue damage to occur. However, at times, the underlying pathology that causes pain is unidentifiable or vaguely defined, which often concerns both patients and physicians. The presence of pain indicates that an essential body system is under stress. Chronic pain manifests in both physical and psychosocial distress that can result in symptoms of depression, constipation, changes in appetite and, ultimately, will have behavioral consequences (Brookoff, 2000). Pain can have origins in many aspects of a person's life, yet the direct causes of most types of chronic pain are unknown. Therefore, evaluation of such pain becomes an important tool in the appropriate diagnosis and

formulation of treatment plans. When evaluating treatment outcomes for a pain management treatment program, the assessment of the patient's self-report of pain; and various functional, psychosocial, and economic variables are necessary (Mayer et al., 2000). Unfortunately, a large discrepancy in terms of treatment impact is found when treating people with chronic pain. For example some people are able to make accommodations to their lifestyles and carry on with usual activities of daily living despite their chronic pain, while others become severely disabled by their pain. The same type of injury in any two people can result in very different experiences of pain, encompassing areas of severity, sensation, and the location of pain. People with chronic pain also vary widely in their coping skills (Lazarus & Folkman, 1984). Overall, chronic pain is largely an individualized biopsychosocial experience (Gatchel, 2005). Due to this individualized experience, questions arise regarding how to identify which patients are more susceptible to developing chronic problems.

Predictors of Chronic Pain

The motivation for identifying patients who are at greater risk for developing chronic pain has become increasingly important due to the escalating prevalence and the economic consequences chronic pain poses in this country. High self-reported pain and disability have been shown to predict which patients with an acute pain episode will later develop chronic pain (Gatchel, Polatin, & Mayer, 1995; Philips et al., 1991). For example, the severity of acute pain is used as an important predictor in recognizing the potential for chronic pain. Psychosocial factors appear to be closely related to the development of chronic pain as well. A large-scale study of musculoskeletal-related

disability in United States Army personnel was conducted, and results showed a number of risk factors for developing chronic low back pain. In this population, factors such as interpersonal stressors, role conflict, and repetitive work contributed to the development of chronic back pain (Feuerstein et al., 1997). A summary of psychosocial risk variables was developed by The National Advisory Committee on Health and Disability (NACHD, 1997). The predictive variables identified as psychosocial risk factors for long-term pain, disability, and work loss included: maladaptive attitudes and beliefs about pain; display of frequent pain behaviors; reinforcement of pain behaviors by family members; lack of social support; compensation issues; heightened emotional reactivity; and job dissatisfaction (NACHD, 1997). Another study used pain intensity rating at pre-treatment to predict rehabilitation outcome (McGeary, 2006). This research showed that patients with higher pre-treatment pain ratings on a visual analog scale were at greater risk for dropping out of treatment or having poor outcomes, including higher rates of pain, depression, and disability (McGeary, 2006).

Other studies have focused on the financial implications of chronic pain. Wage earnings, compensation, and pending litigation all appear to be contributing factors to the development of chronic pain (Barnes et al., 1989). Patients earning less than $1,000 a month were twice as likely to develop chronic low back pain compared to patients who earned more than $1,000 a month (Gatchel & Gardea, 1999). Mayer (1999) suggested that chronic pain patients who received financial compensation were not as highly motivated to return-to-work. Chronic pain patients receiving financial compensation reported an overall increase in levels of pain, depression, disability, as well as decreased prognosis and productivity (Gatchel & Gardea,1999). Other variables have also

successfully predicted the progression of acute to chronic low back pain. One study showed that patients age 40 or older were twice as likely to report chronic pain than patients who were under the age of 25 (Volinn et al., 1991). Another study used family status as a potential factor in assessing chronic pain. This study found that married patients returned to work significantly sooner than single patients with no children (Lampe, 1998).

Others have theorized that psychological problems predispose individuals to chronic pain. A significant comorbidity of psychological disturbances and physical disorders are found within the chronic pain population (Dworkin et al., 1990). Debates remain as to which factor is the primary cause: the physical illness or the psychological disturbance. One study showed that, when common medical treatments provided no relief for patients' pain complaints, many developed psychopathology (Dworkin et al., 1990). However, another study showed that a significant number of chronic pain patients experienced psychological problems prior to their pain experience (Polatin et al., 1993). The enduring "chicken or egg" argument is perpetuated by these types of conflicting studies. The idea that one causes the other is perhaps too simplistic since a great many factors have been shown to influence the development of both psychological disturbances and chronic pain.

The vast scope of these studies shows that a great many factors must be considered when assessing chronic pain. As with any problem for which assessment in necessary, a theoretical perspective must be established by which the pain process is understood. The particular theory by which pain is assessed largely influences the type of

information gathered for the assessment process. Over the years, a number of theories about the pain process have developed and new understandings have emerged as a result.

Theories of Pain

Conceptualizing pain is difficult for many reasons. Pain spans across age, gender, culture, and socio-economic levels. This complex entity varies in incidence, prevalence, scope, nature, and clinical significance. The phenomenon of pain has long been an area of interest for many disciplines throughout the years. New models arise as an increased understanding of pain develops. Accordingly, theoretical concepts must be examined and amended as knowledge about the subject evolves. Perhaps the first understanding of pain was the idea that those afflicted were receiving some type of "punishment from the gods." The Greek physician, Hippocrates, formulated a hypothesis about the existence of four bodily humors or fluids that were responsible for various physical or mental illnesses (Meldrum, 2003). This theory, though rudimentary, gave way for certain understandings of human affliction and led the way for other theories to develop. History is filled with philosophical, political, and religious understandings of pain and the meanings behind human suffering. In Judeo-Christian thought, pain is the central metaphor for many stories including the test of faith in the story of Job, and the sacrificial redemption of the Crucifixion (Meldrum, 2003). The balance of pleasure against pain to determine the good of society was seen in the utilitarian dialectic of the 18th and 19th centuries.

In the 18th century, Rene Descartes attempted to distinguish the physical and psychological components of pain. He was one of the first to describe pain as sensory signals originating from a stimulus that travels up the spinal pathway and into a pain

center in the brain (Melzack, 1993). Descartes proposed that the psychological manifestation of pain directly correlated to physical injury. As advances were made, his theory was later criticized for creating an artificial distinction between mind and body (Turk & Flor, 1999). Over the years, scientists and clinicians have struggled to accurately identify the various types of pain, the origins of such pain, and its treatments. However, limitations to categorizing pain in a dichotomous fashion (i.e., biomedical versus psychogenic) abound (Sternbach, 1974). Chronic pain has been described as a complex psychophysiological behavior pattern that cannot be broken down into distinct psychological and physical components (Gatchel & Turk,1996). Due to the advances in knowledge of both anatomy and sensory physiology, theories in the 19th century began to show increasing promise.

It is important to understand the various models used in the treatment approach to pain management. Comprehension of the differing theoretic perspectives used in assessment is essential. The models discussed in this paper include the Biomedical, Gate Control Theory, and the Biopsychosocial models.

Biomedical Model

The biomedical model of pain hypothesizes that a patient's report of pain is a direct result of pathophysiology. This model dates back to ancient Greek's understanding of pain in respect to the concept that a specific disease state causes biological disorders (Meldrum, 2003). Theories reflecting a biomedical model of causation focus solely on the role of external stimuli. Receptors in the peripheral nervous system transmit information from the periphery to the central nervous system. Endpoints of various regions are

located within the brain where the sensory information triggers a signal that is experienced as pain (Turk & Flor 1999). Biomedical concepts remain widely accepted as an explanatory model of the pain phenomenon. However, this model does not account for pain that exists in the absence of pathology (Turk, 1999). Medical interventions are intended to correct organic dysfunction. However, studies have shown that identified physical pathology does not predict pain severity or level of disability (Turk & Monarch, 2002). The biomedical model views associated characteristics of pain conditions as secondary reactions that are of minimal importance. Symptoms, including depression, sleep disturbance, and psychosocial dysfunction, are assumed to be reactions to pain and expected to dissipate as the organic cause of the disease resolves (Gatchel, 1996). When these symptoms do not resolve as anticipated, they are considered to be of "psychogenic" origin. Therefore, a dichotomy is created by these situations. The traditional medical model views symptoms as either strictly physical or strictly psychological in nature, without considering the relationship of psychological and social variables in disease states (Turk & Monarch, 2002).

Gate Control Theory

Physical and psychological processes have been used to illustrate a more comprehensive understanding of pain. Melzack and Wall (1965) were the first to introduce the gate control theory of pain. A number of structures within the central nervous system were shown to contribute to the perception of pain. This theory suggested that a structure located in the dorsal horn of the spinal cord acts as a gating mechanism that inhibits or facilitates transmission of nerve impulses, which then regulates the

transmission and intensity of nerve signals from peripheral fibers to the central nervous system. They proposed that this spinal gating mechanism is influenced not only by peripheral stimuli that ascend to the brain, but also by neural impulses that descend from the brain. Basically, as pain is experienced, gates are opened to allow for the perception of pain to travel to the brain and, in turn, impulses are sent back from the brain; ideally, as the pain stimuli are removed, the gates close and the pain subsides. However, evidence supports that these gates can remain open in the absence of physical stimuli when other psychosocial variables are present, such as mood and anxiety (Turk, 1996).

Alternate conceptualizations that highlight the importance of psychosocial factors in the development and maintenance of pain came to the foreground when the biomedical model was unable to produce treatments that alleviated chronic pain (Engel, 1959). While pain may originally develop from an external source, the development of pain as a psychosocial phenomenon has been hypothesized and supported by recent research. Characteristics such as significant guilt and unsatisfied aggressive impulses are believed to predispose certain individuals to chronic pain (Melzack, 1999). It has been further theorized that pain stemmed from memories formed during childhood and, that as various stressors were introduced later in life, memories could be reactivated. Melzack proposed that such pain has a greater underlying pathology (1999).

Biopsychosocial Model

The complexity of interactions involved in the pain process, as well as the limitations found in the biomedical model, provided an impetus for the development of additional theories. In the absence of a purely biomedical understanding of pain, research

has focused on identifying the biological, psychological, and social factors that contribute to pain. The interrelationship among biological changes, psychological status, and social and cultural contexts is commonly known as the "biopsychosocial model of pain" (Engel, 1977; Turk & Rudy, 1987). This model of pain has emerged as the most comprehensive method for assessing, conceptualizing, and treating pain syndromes. The biopsychosocial model of pain recognizes the importance of taking into account a patient's physiological, biological, cognitive, affective, genetic, behavioral, developmental, cultural, and social factors, all interrelated, in an attempt to understand the reported pain (Gatchel & Gardea, 1999).

As mentioned previously, the experience of chronic pain can lead to a number of problems including job loss, financial difficulties, relationship difficulties, depression, anxiety, sleep disturbance, and a decrease in usual activity (Gatchel & Turk, 1996). Gatchel (1996) described a phenomenon in which behavioral and psychological problems overlay the original pain experience. A three-stage model was proposed to account for the progression of acute to chronic pain. Stage 1, the acute stage, is distinguished by the patient's expected natural responses to perceived pain. Initial responses of concern, fear, and anxiety are common and accompany attempts to remove pain-provoking stimuli whenever possible. These feelings typically subside as the pain subsides. The patient progresses to the next stage if the pain persists past a two to four month period, which is considered to be beyond the duration of the typical healing process. Thus, in Stage 2, the sub-acute phase, the patient's psychological and behavioral responses intensify. Anger, learned helplessness, and somatization are common experienced symptoms. The severity of these symptoms depends on a number of factors including pre-existing personality

structure, psychological traits, and socioeconomic and environmental factors. The stress an individual endures when experiencing pain for an extended period of time exacerbates any underlying personality characteristics. Stage 3 of this model represents the chronic phase in which the interaction of the physical, psychological, and social progress in complexity. At this point, patients tend to adopt a role that allows them to avoid responsibilities and social obligations. This "sick role," in turn, reinforces patients' dependent behaviors. The degree of suffering and functional disability associated with the pain may be significantly increased if patients have persistent pain and continue to use maladaptive cognitive and behavioral coping strategies. Once a patient reaches this chronic stage, additional questions arise surrounding which interventions are most appropriate to treat this pain type (Gatchel, 1996).

The biopsychosocial model of pain was introduced as a part of the gate control theory in the 1960's by Melzack and colleagues (Melzack & Wall, 1965; Melzack & Casey, 1968). However, further advances arose in the 1980's when a more comprehensive, multidimensional biopsychosocial model of pain was proposed (Turk & Rudy, 1987). Turk and Rudy were the first to consider physiological, biological, cognitive, affective, behavioral, and social factors when assessing chronic pain. These factors were conceptualized as interdependent and dynamic with reciprocal interactions. The biopsychosocial model explained the role that psychosocial factors play in exacerbating and perpetuating pain behavior as an episode of pain progresses from the acute to chronic phase. Longitudinal studies examined this complex progressive process. Initially, in the acute phase of an illness, biological factors typically take precedence. Over time, symptoms can be exacerbated by the psychological and social factors, which

are incorporated in an increasingly significant manner. Certain personality factors are believed to influence a patient's perception of pain, as well as other psychological, vocational, and cultural variables. Research has identified psychosocial factors that consistently and significantly affect the severity, maintenance, and exacerbation of pain (Fishbain et al., 1986; Fordyce, 1976; Flor & Turk, 1984; Katon et al., 1985; Polatin et al., 1993). A patient's response to treatment, temperament, and interaction with significant others are just some areas that can be affected by the presence of chronic pain, to name a few (Turk & Monarch, 2002).

The theory by which pain is understood greatly influences the treatment of chronic pain. The biopsychosocial model is now a widely accepted theory and sets a precedence for the manner in which pain is assessed and treated. The following section will discuss the treatment implications related to chronic pain.

Treatment Implications

When clinicians find a method of assessing pain the next step is naturally deciding how to treat it. Medication treatments have been the longstanding first line treatment for pain problems. However, secondary to the nature of some chronic pain conditions, including unknown causes, physicians may be hesitant to prescribe common pain medications, such as opioids. Concerns regarding long-term treatments, potential abuse, and regulations of controlled substances cause questions about the appropriate use of opioids to treat chronic pain (Portenoy, 1990). Therefore, investigating alternative or adjunctive treatments for chronic pain is essential.

When treating chronic pain, most clinicians have learned that utilizing a strictly medical model is not sufficient. Key components in the IASP's definition of pain includes the psychosocial terms "unpleasant" and "emotional experience" (IASP, 2007). The presence of such words, to describe what for years had been thought of as an entirely medical problem, broadened the scope to include the importance of psychosocial factors (Sharp, 2001). Studies have kept pace with this understanding of chronic pain by incorporating cognitive and behavioral interventions into treatment models.

Cognitive Behavioral Therapy for Chronic Pain

Early applications of behavioral interventions for chronic pain patients were based primarily on operant theory (Sharp, 2001). These theories have been highlighted in studies conducted by Cairns and Pasino (1977) and Block, (Block et al., 1980), as well as a series of studies by Romano and colleagues (Romano et al., 1992; Romano et al., 1995). Many of these studies claimed success by a reduction in pain behaviors through environmental changes that support the principles of the operant model. However, theses studies may not adequately emphasize the importance of the patient's interpretations of such environmental changes, thus missing the role cognitive changes play. Turk (1996) outlined a number of concerns with the utilization of operant theory, including questions about validity and specificity of pain behavior constructs, as well as concerns about the effectiveness of such treatment for all patients.

Since the 1970's, a trend to apply Cognitive Behavioral Therapy (CBT) to an increasingly wider spectrum of disorders has been observed (Beck, 1997). Among the first to develop a cognitive behavioral model for pain were Turk, Meichenbaum, and

collegues (1983). Using the work of Beck, and drawing from other researchers, they incorporated the idea that cognitions influence reports of pain, coping abilities, mood, and pain-related disability (Sharp, 2001). CBT has been applied to, and studied in, patients with long-standing chronic pain. Several studies have suggested a potential value of providing CBT interventions to patients early in the course of treating pain problems (Loeser, 2001; Sharp, 2001; Turk et al., 1983). An increase in patients' confidence in their ability to self-manage many symptoms, reduce unnecessary healthcare utilization, and decrease physical and psychological dysfunction have been found with an early CBT intervention (Loeser, 2001).

CBT is now considered an empirically-validated treatment for chronic pain problems. The efficacy of CBT for diverse chronic pain problems has come from randomized clinical trials that have generated substantial scientific evidence that shows benefits for using such interventions (Gatchel, 1996; Mayer & Gatchel, 1988) However, CBT interventions are only a part of multimodal treatment packages that combine education about pain and training in a variety of coping skills. Therefore, CBT cannot be given sole credit for positive outcomes of such studies. Few data exist concerning which components are necessary, sufficient, or most important. Thus, attention has been called to the need for matching patients to treatments. For example, patients with greater physical and psychosocial dysfunction may require longer, more intensive, and more individualized treatment plans (Loeser, 2001).

Morley, Eccleston, and Williams (1999) reviewed 25 randomized controlled trials of CBT and behavior therapy in a meta-analysis. The effectiveness of cognitive treatments for pain was compared to wait list and alternative control conditions.

Dependent measures were categorized into domains including: pain experience, mood, cognitive coping and appraisal, pain behavior/reduced activity, and social role functioning. All domains, except the expression of pain behavior, showed that the cognitive treatment group was significantly superior to the wait list control group. There were fewer trials with behavior therapy, but across domains, the effect sizes for cognitive treatments were generally larger than those for behavior therapy. Studies using biofeedback were too small to make statistical comparisons of effect sizes with CBT. However, based on the reported effect sizes for biofeedback, this intervention could be potentially promising for chronic pain patients (Morley, Eccleston, & Williams, 1999). Additional studies using a meta-analysis found CBT to be superior in reducing pain experience, increasing positive cognitive coping and appraisal, and reducing behavioral expression of pain, when compared to a collection of alternative treatments; excluding behavior therapy or biofeedback. Long-term effectiveness of treatment was not reported (Butler, 2006).

Studies have shown that, when utilizing a CBT approach with chronic pain patients, substantial patient investment in learning and applying the skills taught is important in yielding a positive outcome (McCracken & Turk, 2002; Linton, 2006; Sharp, 2001). This factor may be a barrier to its use with some patients. Nonetheless, strong evidence now suggests that such interventions can be a valuable treatment modality for many patients with chronic pain problems (Butler, 2006). Overall, when CBT was used as an intervention in the treatment of chronic pain, improvements were seen in daily functioning, pain behaviors, distress, and patients' reported pain levels (McCracken & Turk, 2002). Researchers continue to evaluate the long-term effects of

CBT, and the effects of CBT as compared to alternative treatments. A five-year follow-up evaluation of health and economic consequences of an early CBT intervention for back pain showed this treatment produced long-term health and economic benefits (Linton, 2006). These findings illustrate promising results for the use of CBT in treating chronic pain patients, both short- and long-term. Many patients have found behavioral conditioning or modification programs to be helpful. Although these modalities can be expensive and time consuming, many have been replaced or augmented in multidisciplinary and interdisciplinary pain programs by incorporating cognitive-behavioral methods, which emphasize the teaching of active coping skills (Sharp, 2001).

Interdisciplinary Treatment for Chronic Pain

With CBT treatments joining medical treatments, progress was seen, but an essential linking component was still missing. An interdisciplinary approach brings treatment together in a comprehensive and cohesive manner. This concept is consistent with a biopsychosocial model of pain (Deschner & Polatin, 2000). The link between pain and psychosocial factors has been discussed, and evidence has shown that psychological and socioenvironmental factors can influence the perception of pain and response to treatment. By acknowledging that a patient's perceptions can influence treatment, mood states, and interactions with significant others, providers should incorporate the interrelationships among biological, psychological, and social factors into any treatment plan (Turk & Monarch, 2002). The complexity of the variables that influence pain need to be addressed in a consistent manner by a group of providers who share an understanding of the rehabilitation philosophy (Turk & Gatchel, 1999). This treatment

modality addresses underlying somatic causes, yet does not ignore the presence of medically necessary treatments. Instead, the patient's unique situation is addressed and, in a collaborative effort, treatment plans are made.

Interdisciplinary treatment consists of different providers creating an ongoing open communication to coordinate treatment plans and create individualized goals for patients (Deschner & Polatin, 2000). The providers in an interdisciplinary team usually consist of a physician, nurse, psychologist, physical therapist, occupational therapist, and a medical-disability case manager (Wright & Gatchel, 2002). Four features of a successful interdisciplinary pain management program have been outlined and include: (1) regular interdisciplinary team meetings to maximize communication among providers and reinforce patient goals; (2) respect for each provider's skills and mutual reinforcement for one another's roles and efforts; (3) systematic tracking of patient progress and treatment outcomes; and (4) understanding and acceptance of the treatment philosophy by all team providers (Gardea & Gatchel 2000). Some goals for this type of treatment focus on maximizing function while minimizing pain, as well as improving coping, reducing number of medications, reducing future healthcare utilization, increasing productivity, increasing functioning in activities of daily living, returning patient to work, increasing physical activity, avoiding recurrence of injury, and helping the patient to assume the responsibility for progress in reaching these goals (Deschner & Polatin, 2000).

The efficacy of multidisciplinary treatment programs has been demonstrated for a wide range of patient populations. Flor, Fydrich, and Turk (1992) conducted a meta-

analysis of 65 published studies. Treatment outcomes were measured by variables such as return-to-work, reduced pain levels, improved mood, and decreased healthcare utilization. This analysis showed a significant improvement for those who received multidisciplinary treatment programs when compared to no treatment, wait list control, and single-discipline treatment groups. Another study (Bendix et al., 1996) examined treatment outcomes of patients who experienced at least six months of pain, and were assigned to either three weeks of an interdisciplinary treatment (called functional restoration) or a control group receiving no treatment. Results indicated that, at follow-up, 64% of patients in the treatment group had returned to work, compared with only 29% in the no treatment control group. Patients who received interdisciplinary treatment also had significantly lower pain scores and disability ratings, fewer sick days, and decreased healthcare utilization (Bendix et al., 1996). Such studies support the notion that a dynamic use of treatment incorporating the biological, psychological, and social factors of pain is effective.

As discussed, when treating any pain condition, it is necessary to have a theoretical perspective by which to work, as well as a treatment plan supported by empirically sound interventions. However, before implementing these interventions it is essential to adequately assess the patient. Yet questions remain about the most effective and efficient means of making such an assessment.

Assessment

The increasing amounts of forms and paperwork that most medical patients have to complete prior to any initial physical evaluation require clinicians to consider the issue

of incremental validity, and the extent to which an instrument contributes additional useful and accurate information toward answering a clinical question (Robinson, 2001). While screening tools are helpful in many instances, they are not diagnostic in and of themselves. The elusive search for the perfect assessment tool and outcome measure remains. Ongoing debates regarding how to best measure outcomes, and what the targeted desired outcome actually is for the treatment of chronic pain continues. Outcomes are judged on a number of factors, including the patient's reported pain level or return-to-work rates. Some experts argue that level of functioning is the most important outcome to consider (Clark & Sees 1993).

The importance of measuring the efficacy of treatments has become a huge issue as more diverse treatments for chronic pain emerge. Increasing amounts of assessment measures have been developed in attempts to validate such treatments. Specifically, patient-reported measures have gained popularity in recent years (Dorwick et al., 2005). Research studies are constantly testing and re-testing various measures to prove or disprove their reliabilities and analyze their predictive validities. The reliability of any measure over time is crucial since measures are typically utilized to evaluate patients undergoing active treatment. The issue of sensitivity, which is an aspect of validity, can create problems in the reliability of a measure over time (Matheson, 2006). Meta-analyses have been utilized to summarize the data from individual studies; however, inconsistencies have been found when analyzing chronic pain studies. Fishbain, Cutler, and colleagues (2000) conducted a meta-analysis of chronic pain treatment and found that, while some meta-analytic procedures were interpreted to be inadequate, the effect size of different meta-analysis subgroups demonstrated consistency.

As discussed, comprehensive assessments are useful and meta-analyses that incorporate effect size aid in comparing different studies. However, a broader understanding can be gained by looking at the individual assessment measures commonly used in pain management settings.

Assessment Measures

There are a number of measures commonly used in the assessment process of evaluating and treating chronic pain including: a visual analog scale, the Million Visual Analog Scale (MVAS), the Oswestry Pain Disability Questionnaire (OSW), the Medical Outcomes Survey 36-Item Short Form Health Survey (SF-36), the Pain Medication Questionnaire (PMQ), and the Multidimentional Pain Inventory (MPI). Others measures of interest include: The Pain Disability Questionnaire, the Roland Morris Disability Questionnaire, the Waddell Disability Index, the Low Back Outcome Score, the Quebec Back Pain Disability Scale, and the Functional Rating Index. Looking at the individual measures can give further insight into the decision making process of choosing measures to incorporate into a comprehensive pain assessment. Below is a review of the aforementioned measures.

Physical/Functional Measures

The Visual Analogue Scale (VAS) consists of a 10-centimeter horizontal line dashed at 2-point intervals. Patients self-report their degree of pain on a scale from 0 to 10, ranging from “no pain” to “worst possible pain.” Patients are asked to mark an “X” on the line to represent their current level of pain. Studies evaluating chronic pain

patients have often used the VAS, which has consistently demonstrated good psychometric properties (Rissanen et al., 1994; Gallagher, Bijur, Latimer, & Silver, 2002). A previous study indicated that a patient's self-report was the best measure of pain (Bodian et al., 2001). However, it can not be concluded that the VAS is the *only* measure needed to assess outcomes of interdisciplinary treatment for chronic pain patients. Although visual analog scales are a widely used tool to measure pain, controversy still exists regarding whether the VAS score is ratio or ordinal data (Hall, 1981). The difference between ratio and ordinal data is important to consider when using this instrument as an outcome measure because the way the scores are interpreted, and the actual meaning of the measure, is in question. If the VAS represents ratio data, then when a mark on the line at the beginning of treatment measures 10 cm and, at the end of treatment measures, 5 cm, that would mean not only that pain intensity decreased, but that it decreased to half of what it was at pre-treatment. It has been suggested that VAS scores are ratio data because 0 cm represents a true zero, indicates the absence of pain, and has other linear scale properties (Ludington, & Dexter 1998).

Other researchers have questioned which statistical tests should be used when analyzing VAS data (Philip, 1990; Mantha et al., 1993; Dexter & Chestnut, 1995). One study concluded that using parametric tests when analyzing VAS scores lowers the risk of Type II errors, or false negative conclusions (Philip, 1990). Another study demonstrated a multiple re-sampling method when collecting VAS data and concluded that the use of parametric tests was better able to detect differences among groups without increasing Type I errors (Dexter & Chestnut, 1995). It has also been shown that

the VAS is a linear scale and that changes in the scores are representative of a relative change in the level of pain (Myles et al., 1999).

The VAS has been largely supported as a valid and reliable measure of pain that is sensitive to treatment effects (Von Kroff, 2000). This previous study supports the use of the VAS when analyzing patient self-reported pain. However, the limitations of using this measure must be considered when treating a patient using a biopsychosocial model. The VAS is a unimodal measure of pain intensity and cannot adequately represent all aspects of pain perception. Further limitations of the VAS have been discussed and one study concluded that pre- and post-treatment differences in pain intensity ratings may be largely due to regression to the mean (Whitney & Von Korff, 1992). Information about pain perception has shown to be a valuable tool in assessing and treating the chronic pain population, and can be gained in the use of the VAS despite its limitations.

This measure is one of the most widely used in the assessment and treatments of pain, yet few studies have looked at its predictive value when studying treatment outcomes (Zanoli, Stromqvist, Jonsson, 2001). McGeary, Mayer, and Gatchel (2006) conducted a comprehensive investigation of the VAS as it related to treatment outcomes, specifically socioeconomic outcomes. They divided the scale into categories according to pain intensity with 0 to 3 categorized as mild pain, 4 to 5 as moderate pain, 6 to 7 as severe pain, and 8 to 10 as extreme pain. This study found that the level of pain intensity reported at pre- and post- treatment had significant influences on treatment outcome, with higher pain ratings at pre-treatment indicating increased drop out rates, and higher pain

intensity ratings at post-treatment showing greater risk for poor socioeconomic outcomes. This study highlights the utility of the VAS as an assessment tool and outcome measure.

The Million Visual Analog Scale (MVAS; Million, Haavik-Nilsen, Jayson, & Baker, 1981) is a self-report questionnaire that addresses the domains of pain and disability. The MVAS is a 15-item analogue scale on which patients respond by indicating, on a 10-cm line, their level of pain associated with each domain. The total score is comprised of all the responses added together. Scores ranging from 0-39 indicate mildly disabling pain; 40-84 indicate moderately disabling pain; and scores 85 and over indicate severely disabling pain. The MVAS is particularly useful in instances when patients' self-report of pain exceeds that which would be projected given physical findings; the psychosocial components are considered in the patient's disability (Capra et al., 1985). This measure was originally designed to assess physical functioning and disability related primarily to patients with chronic low back pain. While few studies have specifically focused on the psychometric properties of this measure, the research that has been done shows promising results (Alaranta et al., 1994; Million et al., 1982). A previous study of the MVAS demonstrated the effectiveness of this measure as a simple disability rating scale, and its utility in predicting treatment outcomes for patients with chronic disabling spinal disorder (Anagnostis*,* Mayer, Gatchel, & Proctor, 2003).

The Oswestry Low Back Pain Disability Questionnaire (OSW; Fairbank et al., 1980) is a 10-item, self-rated measure that assesses limitations of various activities of daily living secondary to pain, specifically designed for assessment of low back pain. Each item is scored on a 0-5 point scale, with a potential range of total scores from 0 to 50, with higher scores indicating increasing levels of disability. A previous study

demonstrated adequate validity and reliability, with test-retest reliability found to be .99 with 24 hours between administrations (Leclaire, Blier, Fortin, & Proulx, 1997). When used to assess change in treatment outcomes for chronic pain patients, this measure is considered a good index of functional limitations within the context of a pain population (Kaplan, Wurtele, & Gillis, 1996; Leclaire, Blier, Fortin, & Proulx, 1997). This measure was designed to measure functional status and disability, as disturbances in activities of daily living are often caused by chronic low back pain. The Oswestry and has been widely used, thoroughly researched, and shown to possess strong psychometric properties (Fairbank et al., 1980; Beurskens et al., 1995; Roland & Fairbank, 2000; Kopec, 2000; Fisher & Johnson, 1997; Gronbald, Hupli, & Wennerstrand, 1993).

The Medical Outcomes Survey 36-Item Short Form Health Survey (SF-36; Ware et al., 1993) is a 36-item multipurpose health survey used to assesses quality of life related to health status, and is reported to have high test-retest reliability coefficients with good internal consistency (Ware et al., 1993). This measure is widely used for routine monitoring and assessment of healthcare treatment outcomes, assessing both physical and mental components. While it was not originally developed specifically for a pain population, it has been used as an outcome measure in a number of studies focused on the treatment of pain (Gatchel et al, 1999; Gatchel et al, 1998; Taylor et al., 1999). The SF-36 contains eight scales, as well as two standardized summary scales that correspond to patients' overall sense of physical and mental well-being - - the Mental Component Scale (MCS) and the Physical Component Scale (PCS). The availability of population-based normative data from various medical populations (such as a spinal population) makes the SF-36 useful for comparative purposes. However, questions remain about its clinical

application for assessing outcomes of individual patients. One study's examination of chronically disabled back pain patients demonstrated the measures utility in comparing group changes overtime, but indicated shortcomings when used for individual patient assessment (Gatchel et al., 1998).

It can be noted that the mental component of this measure incorporates additional information missing in other strictly physical assessment measures. A previous study found the SF-36/MCS to yield a moderate effect size of $d = 0.73$ (Anagnostis, Gatchel, & Mayer, 2004). The mental well-being component has been consistently indicated as a factor in the assessment of pain management patients and has been replicated in many studies (Katz, 2002; Anagnostis, Gatchel, & Mayer, 2004; Gureje et al., 1998). For the purposes of this study the mental component scale of this measure (SF-36/MCS) will be discussed as a psychosocial measure.

Psychosocial Measures

The Beck Depression Inventory-II (BDI-II; Beck et al., 1996) is a 21-item self-report inventory designed to assess the severity of depressive symptoms. Each item is scored from 0 to 3, with a potential range of total scores from 0 to 63. The BDI was originally developed by Beck and colleagues in 1961, and revised in 1996 (Beck et al. 1961; Beck et al. 1996). This instrument offers a reliable and valid measure of the presence and/or severity of depression (Romano & Turner 1985). The original BDI indicated that a total score of 0 - 9 is considered normal; 10 - 15 is mild depression; 16 - 19 represents mild to moderate depression; 20 - 29 reflects moderate to severe depression; and scores over 30 indicate severe depression (Beck et al., 1988). The BDI-II

has slightly different categorical divisions with 0 - 13 considered to be minimal depression; 14 - 19 is mild depression; 20 - 28 is moderate depression, and 29 - 63 indicates severe depression (Beck et al., 1996). The BDI-II has been demonstrated to be a valid measure of depression in chronic pain patients and is a widely used measure for assessing depression levels in a variety of settings (Beck et al., 1996). Researchers have discussed the relationship between pain and depression, and the two are thought to be closely related. A previous study of participants being treated for various psychiatric disorders found BDI-II effect size ranges from 0.87-1.67 (Reisch, Thommen, Tschacher, & Hirsbrunner, 2001).

The Pain Medication Questionnaire (PMQ*;* Adams et al., 2004) is a self-report screening measure containing 26-items based on behavioral correlates and attitudes suggestive of opioid misuse. The PMQ is constructed on a 5-point Likert scale, ranging from 0 - 4 with various interments that range from "Disagree" to "Agree," and some items are reverse scored. The PMQ was found to be psychometrically sound, with test-retest reliability and examination of internal consistency. Greater potential risk of opioid misuse is reflected by an overall higher score (Adams et al., 2004). This test is a relatively new tool, and thus limited research is available. The use of this measure has greater implications as the current focus of many pain management programs address the concern of identifying and treating opioid misuse in chronic pain patients (Bernstein et al., 2007).

Coping Measure

The West-Haven-Yale Multidimensional Pain Inventory (MPI*;* Kerns et al., 1985) is a 61-item, self-report measure that utilizes a cognitive-behavioral perspective to examine how patients evaluate and manage their pain. This assessment evaluates a patient's perception of pain and results in several coping styles: Adaptive, Interpersonally Distressed, Dysfunctional, Anomalous, Hybrid, or Unanalyzable. A normative sample of chronic pain patients was used in the development of this measure with good internal consistency reliability demonstrated (Kerns et al., 1985). This instrument was originally developed and intended to be used for pre-treatment evaluation, not as a measure of treatment outcome. A previous study indicated concerns regarding the ability of the MPI to predict outcomes in a chronic pain population (Ravani, 2005). In one study that evaluated the effectiveness of the MPI in predicting response to interdisciplinary treatment in a heterogeneous group of patients with chronic pain, it was found that the MPI subgroup classification did not significantly predict the degree of positive treatment outcomes (Davis, Reeves, Graff-Radford, Hastie, & Naliboff, 2003). Another study expressed concern regarding the MPI and its ability to predict treatment outcomes in a chronic pain population, even though the measure was specifically designed for that population (Ravani, 2005).

Additional Measures of Interest

The Pain Disability Questionnaire (Anagnostis, Gatchel, & Mayer, 2004) is a 15-item questionnaire developed from a collaboration of experienced professionals and a number of drafts that incorporated various dimensions of other instruments (such as the

SF-36, MVAS, MPI and the Roland-Morris Disability Questionnaire) used in assessing disability status related to pain. Each question presents an analogue scale on which patients respond by indicating, on a 10-cm line, their level of pain associated with each domain. The PDQ contains two factors: a Functional Status Component and a Psychosocial Component. The individual items attributed to each factor are added to generate the score for the two different components, and the total score is comprised of all the responses added together. This measure has demonstrated solid psychometric properties including validity, reliability, and responsiveness to change (Anagnostis, Gatchel, & Mayer, 2004).

The Roland-Morris Disability Questionnaire (Roland & Morris, 1983) is a 24-item instrument consisting of yes/no questions. The questions included in this measure focus primarily on physical functioning (e.g., dressing, walking, and lifting) as a way to evaluate disability. This measure was originally developed for research purposes, but has been found to have clinical relevance (Roland & Fairbank, 2000). The validity and reliability have been well studied and consistently proven (Roland & Morris, 1983; Johansson & Lindberg, 1998; Kopec & Esdaile, 1995; Stratford & Binkley, 1997). However, one study questioned the responsiveness of this measure and its ability to measure clinically relevant change (Kopec & Esdaile, 1995). When used to assess individuals classified as having severe disability, this measure has been shown to be less sensitive in detecting change, due in part to the yes/no format of the measure (Roland & Fairbank, 2000; Kopec & Esdaile, 1995).

The Waddel Disability Index (Waddell & Main, 1984) consists of nine yes/no questions. This measure focuses on physical functioning, such as dressing, walking,

sitting, lifting, sleeping, as well as psychosocial factors such as social activity and sexual activity. This measure has little research supporting its utility and psychometric properties (Beurskens et al, 1995).

The Low Back Outcome Score (LBOS; Greenough & Fraser, 1992) is a 13-item questionnaire designed to evaluate patients with back pain with weighted questions that inquire about current pain, physical activities, employment, medication usage, sexual functioning, and daily activities. The reliability of this measure has not yet been determined, as only a few studies have examined its effectiveness (Taylor et al., 1999; Kopec & Esdaile, 1995; Kopec, 2000). The original publication of this measure indicated strong correlations with the Oswestry (.87) and the Waddell Disability Index (.74) evidencing the potential validity if the measure. One study examined the predictive validity of this measure and compared the responsiveness of the LBOS with the Oswestry and the SF-36, and found that the LBOS was more responsive than the SF-36, but less responsive than the Oswestry (Taylor et al., 1999). The limitations of this measure include the lack of psychometric information available, and its exclusive focus on the low back pain population.

The Quebec Back Pain Disability Scale (Kopec et al., 1995) is a 20-item self-report scale designed to evaluate the functional disability of patients with low back pain. The items included in this measure focus almost exclusively on physical functioning; addressing activities, such as bending, stooping, and lifting. This scale has been shown to be a valid and reliable measure with good psychometric properties (Gatchel, 2000). This measure has also demonstrated sensitivity to change, as its responsiveness has been compared to other measure such as the Oswestry Low Back Pain Disability

Questionnaire, the SF-36, and the Roland Morris Questionnaire (Kopec et al., 1996). The primary limitation of this measure is the limited research available.

The Functional Rating Index (FRI; Feise & Menke, 2001) is a 10-item instrument designed to measure the subjective perception of function and pain. This measure was developed specifically for use in a clinical setting to evaluate patients with spinal musculoskeletal pain. The original publication of this measure is the only literature available to validate its utility. However, the authors of the measure indicated good test-retest reliability, and validity with strong correlations found with the SF-36 Physical Component Scale. The limitations of this measure include its lack of supporting literature, as well as the limits imposed by its exclusive focus on physical capacity, despite the fact that research exists supporting the importance of psychosocial factors in musculoskeletal pain.

Effect Size

Historically, clinical measures have been used to assess treatment outcome, and have focused primarily on reliability and validity. The issue of the sensitivity of a measures' ability to detect clinically significant change is less widely studied. Many measures aid in clinical assessment and help illustrate any changes over a period of time or treatment; however, it is important to look at how those changes are interpreted. Effect size is one way to interpret and communicate relevant changes across the course of treatment. To provide a clearer understanding of results, effect sizes are used to translate

the “before-and-after” changes of a group, into a standard unit of measurement (Kazis, Anderson, & Meenan, 1989).

Effect size is a way of quantifying the difference between two groups, or a measure of the strength of the relationship between two variables (Grimm & Yarnold, 1998). Most studies strive to determine if a treatment has a statistically significant effect, but the importance of the size of such an effect must be considered as well. Clinical researchers may report significant findings; however, simply reporting the level of statistical significance is not always comparable to clinical significance, and does not necessarily carry across to other findings. Effect size: reflects the relative magnitude of effect in a common term; is used to determine whether a change is clinically relevant; and permits comparison with other instruments, interventions, or studies (Guyatt, Walter, & Norman, 1987).

When considering the effect size of a given measure, within the context of the same treatment outcome, opportunities for the practical application of findings are revealed. While reliability is an important attribute of psychometric measures, instruments may possibly be reliable, but unresponsive to change. The usefulness of instruments designed to measure change over time can be determined by measuring the effect size. Guyatt and colleagues (1987) discuss the importance of effect size, stating “this statistic, which relates the minimal clinically important difference to the variability in stable subjects, has direct sample size implications” (p.173). Power in a statistical hypothesis is determined by effect size, sample size (*N)*, and the a priori critical alpha level. The elements that determine power reveal the important role that effect size plays in all studies, and the measurement of effect size can be conducted in a variety of ways.

A number of different formulas are used to measure effect size, typically in two ways: as the standardized difference between two means and as the correlation between the independent variable classification and the individual scores on the dependent variable (Rosnow & Rosenthal, 1996). The variety of ways that effect size can be computed include Cohen's *d*, Hedges's *g*, Glass's Δ , and various effect size correlations (e.g., point-biserial correlation). A review of the types of effect size follows, and the effect size computation that was used in this study will be discussed.

Cohen's *d* is the effect size measure used in the context of *t*-test means. Cohen's *d* is defined as the difference between the group means, divided by the standard deviation of either group. The standard deviation of either group can be used when the variance of the two groups are homogenous (Cohen, 1988). The formula is $d = M_1\text{-}M_2 / \sigma$. The use of a pooled standard deviation is commonly used when calculating Cohen's *d* (Rosnow & Rosenthal, 1996), and is calculated by finding the square root of the average of the squared standard deviations (i.e., $d = M_1\text{-}M_2 / \sigma_{pooled}$; $\sigma_{pooled} = \sqrt{[(\sigma_1^{\,2} - \sigma_2^{\,2})/2]}$; Cohen, 1988). However, when the two standard deviations are similar, the root mean square will not differ much from a simple average of the two variances. This is the calculation that was used in the present study.

Other formulas that can be used when calculating Cohen's *d* include; $d = 2t / \sqrt{(df)}$, which is computed from the value of the *t*-test differences between two groups (Rosenthal & Rosnow, 1991); $d = 2r / \sqrt{(1\text{-}r^2)}$, which is computed from the effect size correlation, *r*; and $d = g / \sqrt{(N / df)}$ that can be computed from Hedges's *g*. The method for obtaining Hedges' *g* is discussed below.

Hedges' *g* is another means of computing effect size and differs from Cohen's *d* in that it incorporates sample size as a part of the overall calculation of effect size. As an inferential measure, Hedges' *g* is normally calculated using the square root of the mean square error from the analysis of variance tests for differences between two groups. ($g=M_1-M_2$ / S pooled; $S= \sqrt{[\sum(X-M)^2 / N-1]}$). Hedges' *g* can also be computed using the value of the *t*-test of the differences between two groups ($g = t \sqrt{(n_1-n_2)}/\sqrt{(n_1 n_2)}$; or $g= 2t / \sqrt{N}$ when the *n*'s are equal; Rosenthal & Rosnow, 1991). Hedges's *g* can also be computed from Cohen's *d* ($g= d/ \sqrt{(N/ df)}$), and the effect size correlation *r* ($g=[r/\sqrt{(1- r^2)}] / \sqrt{[df(n_1+n_2)/\sqrt{(n_1 n_2)}]}$).

Glass's Δ is a less common way of calculating effect size and is defined as the mean difference between the experimental and control group divided by the standard deviation of the control group. The formula for this computation is $\Delta=M_1 - M_2 / \sigma_{control}$. This calculation is used when there is a specific experimental group being compared to a control group.

Effect size correlation can be computed directly as the point-biserial correlation between two dichotomous independent variables and the continuous dependent variable ($r_{Y\lambda} = r_{dv,iv}$). The point-biserial has been described as a short-hand method for computing a Pearson product-moment correlation (Nunnally, 1978). This calculation can be computed a number of ways as well, including from Cohen's *d* ($r_{Y\lambda} = d/ \sqrt{(d^2+4)}$) and Hedges *g* ($r_{Y\lambda} = \sqrt{\{(g2\ n_1 n_2)/[g1\ n_1 n_2 + (n_1+n_2)\ df]\}}$).

Not only are there a number of types of effect size measures, but there are also debates on the meaning of effect size when calculated (Grimm, 1998). According to

Cohen (1992), the level of effect size can be interpreted as a small effect at the 0.2 level, with 0.5 being indicative of a moderate effect, and 0.8 a large effect size. Generally, this calculation is performed by measuring the difference between the means of pre-treatment scores and the mean of post-treatment scores, and dividing that by the standard deviation of the scores (Grimm, 1998).

The effect size statistic is perhaps most commonly seen in meta-analysis, which is a summary of previous research that uses quantitative methods to compare outcomes across a wide range of studies. Effect size, specifically Cohen's *d,* is commonly used in meta-analysis because effect size estimates are not influenced by sample size, and are therefore useful in comparing studies with varying sample sizes. Aside from meta-analysis studies, few researchers carry their analysis through to the point of directly calculating effect size. However, Anagnostis and colleges (2004) included the effect size statistic when comparing the responsiveness of functional status measures from pre- to post-treatment for a group of patients experiencing chronic musculoskeletal pain. This study used four different groups to evaluate the psychometric properties of one particular measure of functional status, the Pain Disability Questionnaire (PDQ), and compared its validity and responsiveness to a variety of other measures including the Oswestry, the Million Visual Analog Scale, and the SF-36. The groups used included a normative group who had no injuries or symptoms, a group of patients who had acute musculoskeletal pain, a group of worker's compensation patients with musculoskeletal pain who all had work absence at the time of treatment with most receiving disability payments, and a heterogeneous pain group similar to the group assessed in the present study. Anagnostis reported effect size of the different measures given to the worker's compensation

population as well as the heterogeneous pain population, and found the PDQ had a large effect size in both populations. The other instruments displayed moderate to large effect sizes in the worker's compensation population, whereas the heterogeneous pain group revealed a low effect size for the other measures. By including the effect size of these measures, Anagnostis's study established a basis by which further studies of varying measures can be compared.

Another study compared the responsiveness of three instruments when assessing a low back pain population who had experienced pain for at least six weeks (Beurskens, deVet, & Koke, 1996). The measures used in this study included the Oswestry Low Back Pain Disability Questionnaire, the Roland-Morris Disability Questionnaire, and a Visual Analog Scale on which patients rated their pain. Beurskens and colleges' goal was to compare the responsiveness of these three instruments when assessing severity of pain and functional status. This study divided groups into those who improved and those who did not, and demonstrated that all of the instruments can discriminate between improved and non-improved patients, but sensitivity to change on the Oswestry was lower than the other measures (Beurskens, deVet, & Koke, 1996). As expected, the improved group showed higher effect sizes than the non-improved group on each instrument. These studies set the stage for further investigation into the responsiveness of other measures commonly used when assessing pain.

Scope of Present Investigation

The present study attempted to replicate and expand Anagnostis's, as well as Beurskens's findings by evaluating the effect size of measures given to chronic pain patients, at pre- and post-treatment, in order to determine which measures showed a greater effect in measuring the outcomes of interdisciplinary treatment. As previously reviewed, a number of assessment instruments are used to evaluate various biopsychosocial components of disability in pain populations. Each measure has been previously examined and shown utility in some capacity; however, limitations exist for all measures and arguments can be made regarding their clinical application (Kopec, 2000). Not all of the measures discussed were developed in the context of a biopsychosocial model, and in many cases psychosocial factors affecting pain and disability are not fully addressed. Additionally, some instruments were designed for specific pain populations, such as low back pain, and may not adequately assess a full range of chronic pain complaints. Therefore, it is necessary to look at which measures demonstrate responsiveness to treatment of a heterogeneous pain population, to aid in selecting a combination of instruments that will yield a more comprehensive understanding of treatment outcomes.

The primary purpose of this study was to evaluate the effect size of measures given to a heterogeneous population of chronic pain patients, who completed interdisciplinary treatment, and determine which instruments displayed the largest effect sizes. The heterogeneous population was also divided into different pain diagnostic groups to determine differences in effect size of the measures based on the type of pain.

The groups were divided into those with musculoskeletal pain, those with any other single pain complaint, and those who had multiple, or more than one, pain diagnosis.

Hypotheses

Based on an extensive literature search, and due to limited amount of previous studies evaluating effect size, the following hypotheses were proposed:

1. It was hypothesized that physical/functional measures would yield the largest effect sizes, ranging from medium to large.
    a. Specifically, the VAS would show a large effect size, as a previous study found a VAS effect size of *d*=1.58 (Beurskens, deVet, & Koke, 1996).
    b. The MVAS would have a moderate effect size based on a previous study (Anagnostis, Gatchel, & Mayer, 2004; MVAS, *d*=1.06 & MVAS *d*=0.37).
    c. The OSW would reveal a moderate effect size, based on results found in previous studies (Anagnostis, Gatchel, & Mayer, 2004; OSW, *d*=0.95 & OSW, *d*=0.41; Beurskens, deVet & Koke, 1996 OSW, *d*=0.80).
    d. The SF-36/PCS component would reveal a moderate effect size, based on results found in a previous study (Anagnostis, Gatchel, & Mayer, 2004; SF-36/PCS, *d*=0.67 & SF-36/PCS, *d*=0.28)
    e. It was further hypothesized that when the heterogeneous group was broken down into pain categories, the musculoskeletal group would reveal the greatest effect sizes on all the physical measures as most of the

physical measures were designed specifically for patients experiencing musculoskeletal pain.

2. It was hypothesized that psychosocial measures would show a moderate to large effect size.

    a. Specifically, the BDI-II would have a large effect size, as a previous study found BDI-II effect size ranging from 0.87-1.67 (Reisch, Thommen, Tschacher, & Hirsbrunner, 2001).

    b. The SF-36/MCS component would reveal a moderate effect size, based on results found in a previous study (Anagnostis, Gatchel, & Mayer, 2004; SF-36/MCS, *d*=0.73 & SF-36/MCS, *d*=0.13).

    c. The PMQ would show a moderate effect size based on a previous study indicating its value in predicting medication misuse (Holmes et al., 2006) despite the lack of reported effect sizes of this measure.

    d. It was additionally hypothesized that when the heterogeneous group was broken down into pain categories, the multiple pain group would reveal the lowest effect sizes on the psychosocial measures due to the idea that patients with multiple diagnoses may be less responsive to change

3. It was hypothesized that a coping measure would reveal the lowest effect size.

    a. Specifically, the MPI would show the lowest effect size of the measures analyzed in the present study, based on previous studies questioning this measure's predictive value (Davis, Reeves, Graff-Radford, Hastie, &

Naliboff, 2003; Ravani, 2005) and due to the lack of reported effect size of this measure.

CHAPTER THREE
Methodology

Subjects

Subjects were selected from a cohort of 312 consecutively treated chronic pain patients who were entered into interdisciplinary treatment at The Eugene McDermott Center for Pain Management (The Center) in Dallas, Texas, during the time period from August, 1998 through December, 2006. These subjects included patients that completed some aspect of both pre- and post- treatment testing. The sample included patients who participated in the interdisciplinary treatment program, which includes medical, psychosocial, psychiatric, and physical therapy components. Patients were included in the sample if they completed any part of both pre-treatment and post-treatment assessment measures. Patients were excluded if they did not participate in interdisciplinary treatment (i.e., medication only, medication and physical therapy) or did not complete at least some part of post-treatment testing (i.e., early drop out or discharged from the program prior to completing post-treatment testing). Scores were obtained from previously collected data from a database maintained at The Center. Inclusions were based on the physician's evaluation and recommendation for interdisciplinary treatment. Any medication-only patients, or medication and physical therapy intervention patients, were not included in this study.

Procedure

General Data Collection. Patients were referred from their treating physician for evaluation by a pain management physician at The Center. Patients completed an initial

medical evaluation, a physical diagnosis was assigned, and a treatment plan was established for pain management modalities including any combination of the following: pain medication, interventional procedures, referrals for physical therapy, and behavioral evaluations and possible treatment. Upon referral to the program, patients completed a packet of paperwork prior to their first medical appointment. The paperwork included treatment consent forms and questionnaires regarding the patient's medical history, medication usage, pain level, and functional abilities. Measures collected at both pre- and post- treatment included the Oswestry (OSW; Fairbank et al., 1980), Pain Medication Questionnaire (PMQ; Adams et al., 2004), Million Visual Analog Scale (MVAS; Million, Haavik-Nilsen, Jayson, & Baker, 1981), and Pain Visual Analogue Scale (VAS; Gallagher, Bijur, Latimer, & Silver, 2002).

Patients were also asked questions regarding vocational status, healthcare utilization, litigation, disability payments, and surgical procedures. If the physician deemed the patient to be a suitable candidate for interdisciplinary treatment, the patient was referred for behavioral medicine and physical therapy evaluations. Patients who were not believed to be appropriate for interdisciplinary treatment were monitored by their pain management physician only, and were excluded from the present study. Once a behavioral medicine evaluation was scheduled, each interdisciplinary patient received another packet of paperwork that included an explanation of the behavioral medicine program, a consent form for psychosocial assessment and treatment, and several psychosocial measures including the Beck Depression Inventory-II (BDI-II; Beck, et al. 1996), the Medical Outcomes Survey 36-Item Short Form Health Survey (SF-36; Ware et al. 1993), and the West-Haven-Yale Multidimensional Pain Inventory (MPI*;* Kerns et al.,

1985). After an evaluation was performed by a licensed psychologist, psychosocial testing results, along with historical data, were integrated to formulate psychological diagnoses and individualized treatment plans. Following the evaluation process, a designated number of individual behavioral medicine sessions (ranging from 1-10) and psychoeducational group sessions (6-10) were assigned. A single family educational session was also available for patients and their family members and, if warranted, a psychiatric medication consultation was recommended.

Following the completion of all the recommended behavioral medicine, group therapy, and physical therapy sessions, patients were discharged from the interdisciplinary treatment program. At that time, patients received a packet of questionnaires for post-treatment evaluation. Post-treatment data were not collected on patients who were discharged early from the treatment program. The most common reason for early discharge involved a patient's non-compliance with one or more of the treatment disciplines. Additional reasons for early discharge included early discharge due to good results, insufficient insurance coverage, geographical relocation, or intervening medical or psychiatric issues.

Instruments and Outcome Measures (Appendix A)

Physical/Functional Measures

Visual Analogue Scale (*VAS)* The VAS consists of a 10-centimeter horizontal line dashed at 2-point intervals. Patients self-report their degree of pain on a scale from 0 to 10, ranging from "no pain" to "worst possible pain." Patients are asked to mark an "X" on the line to represent their current level of pain. Studies evaluating chronic pain

patients have often used the VAS, which has consistently demonstrated good psychometric properties (Rissanen et al., 1994; Gallagher, Bijur, Latimer, & Silver, 2002).

Million Visual Analog Scale (*MVAS;* Million, Haavik-Nilsen, Jayson, & Baker, 1981). This questionnaire is a self-report questionnaire that addresses the domains of pain and disability. The MVAS is a 15-item analogue scale on which patients respond by indicating, on a 10-cm line, their level of pain associated with each domain. The total score is comprised of all the responses added together. Scores ranging from 0-39 indicate mildly disabling pain; 40-84 indicate moderately disabling pain, and scores 85 and over indicate severely disabling pain. The MVAS is particularly useful in instances when patients' self-report of pain exceeds that which would be projected given physical findings, the psychosocial components are considered in the patient's disability (Capra et al., 1985).

Oswestry Low Back Pain Disability Questionnaire (OSW; Fairbank et al., 1980). The Oswestry is a 10-item, self-rated measure that assesses limitations of various activities of daily living secondary to pain and was designed specifically for use with a low back pain population. Each item is scored on a 0-5 point scale, with a potential range of total scores from 0 to 50, with higher scores indicating increasing levels of disability. The Oswestry has demonstrated adequate reliability and validity in various cross-sectional studies (Leclaire, Blier et al., 1997).

Medical Outcomes Survey 36-Item Short Form Health Survey (*SF-36;* Ware et al., 1993). This 36-item questionnaire assesses quality of life related to health status. This measure is widely used for routine monitoring and assessment of healthcare treatment

outcomes, and assesses both physical and mental components. The SF-36 contains eight scales, as well as two standardized summary scales that correspond to patients' overall sense of physical and mental well-being - - the Mental Component Scale (MCS) and the Physical Component Scale (PCS). Population-based normative data from various medical populations are widely available and makes the SF-36 useful for comparative purposes. Several studies have reported high test-retest reliability coefficients, and good internal consistency (Ware et al., 1993; Gatchel et al, 1999; Gatchel et.al, 1998; Taylor et al., 1999).

Psychosocial Measures

Beck Depression Inventory-II (*BDI-II;* Beck et al., 1996) The BDI-II is a 21-item self-report inventory designed to assess the severity of depressive symptoms. Each item is scored from 0 to 3, with a potential range of scores from 0 to 63. The BDI was originally developed by Beck and colleagues in 1961, and revised in 1996 (Beck et al. 1961; Beck et al. 1996). This measure offers a reliable and valid measure of the presence and/or severity of depression (Romano & Turner 1985). The original BDI indicated that a total score of 0-9 is considered normal; 10-15 is mild depression; 16-19 represents mild to moderate depression; 20-29 reflects moderate to severe depression; and scores over 30 indicates severe depression (Beck et al. 1988). The BDI-II has slightly different categorical divisions with 0-13 considered to be minimal depression; 14-19 is mild depression; 20-28 is moderate depression and 29-63 indicates severe depression (Beck et al., 1996). The BDI-II has been demonstrated to be a valid measure of depression in chronic pain patients (Beck et al., 1996).

Medical Outcomes Survey 36-Item Short Form Health Survey (*SF-36;* Ware, et al., 1993). This 36-item questionnaire assesses quality of life related to health status. This measure is widely used for routine monitoring and assessment of healthcare treatment outcomes, and assesses both physical and mental components. The SF-36 contains eight scales, as well as two standardized summary scales that correspond to patients' overall sense of physical and mental well-being - - the Mental Component Scale (MCS) and the Physical Component Scale (PCS). Population-based normative data from various medical populations are widely available and makes the SF-36 useful for comparative purposes. Several studies have reported high test-retest reliability coefficients, and good internal consistency (Ware et al., 1993).

Pain Medication Questionnaire (*PMQ;* Adams et al., 2004). The PMQ is a self-report screening measure containing 26-items based on behavioral correlates and attitudes suggestive of opioid misuse. The PMQ is constructed on a 5-point Likert scale, ranging from 0-4 with various interments that range from "Disagree" to "Agree," and some items are reverse scored. The PMQ was found to be psychometrically sound, with test-retest reliability and examination of internal consistency. Greater potential risk of opioid misuse is reflected by an overall higher score (Adams et al., 2004). A previous study indicated its value in predicting medication misuse (Holmes et al., 2006).

Coping Measure

The West-Haven-Yale Multidimensional Pain Inventory (*MPI;* Kerns et al., 1985).The MPI is a 61-item, self-report measure that utilizes a cognitive-behavioral perspective to examine how patients evaluate and manage their pain. This assessment

evaluates a patient's perception of pain and results in coping styles: Adaptive, Interpersonally Distressed, Dysfunctional, Anomalous, Hybrid, and Unanalyzable. A normative sample of chronic pain patients was used in the development of this measure with good internal consistency reliability demonstrated (Kerns et al., 1985).

Design and Analyses

The initial data were collected and analyzed from a database maintained by The Center. The study design utilized data collected on an ongoing basis from program participants at pre- and post-treatment. No Institutional Review Board (IRB) consent was needed, as completion of all measures is a part of standard treatment, and information was maintained in The Center database as part of ongoing Quality Assurance procedures.

Analyses were preformed on demographic variables. Demographic measures included: age, gender, race, marital status, disability payment status (receiving disability payments or not), and litigation status (involvement in pending litigation related to pain or not). These measures were individually analyzed using chi-square (χ^2) analyses. The continuous variable of age was analyzed with a t-test for the overall mean, standard deviation, minimum, and maximum. Paired sample t-tests were conducted to evaluate each measure for pre- to post-treatment change, and dependent variables included the various psychometric tests (BDI-II, MPI, PMQ, MVAS, VAS, OSW, SF-36/MCS, and SF-36/PCS). Effect size was measured for each instrument; using Cohen's *d*.

The heterogeneous group of chronic pain patients was further divided into specific pain diagnosis including: musculoskeletal pain, any other type of single pain diagnosis (e.g., headache, neuropathy, reflex sympathetic dystrophy, fibromyalgia, and

cancer), and multiple categories of pain diagnoses (i.e. more than one type of pain complaint). These groups were analyzed using paired sample t-tests to evaluate each measure for pre- to post-treatment change and Cohen's *d* was used to compute the effect size for each measure. Independent t-tests were also performed to determine any differences between completers and non-completers on all the outcome measures.

CHAPTER FOUR
Results

DEMOGRAPHIC VARIABLES

Demographic Variables: Descriptive Analyses

Demographic data about the study sample are presented in Appendix B, Table 1. The total sample of 312 patients was analyzed for proportional breakdowns for the categorical variables of gender, race, marital status, disability payment status (receiving disability payments or not), and litigation status (involvement in pending litigation related to pain or not). The continuous variable of age was analyzed for the overall mean, standard deviation, and minimum and maximum cut-off values.

Of the 312 patients in this sample, 68.3% (*n*=213) were female and 31.7% (*n*=99) were male. The mean age was 53.38 years (*SD* = 14.68), ranging from a minimum of 15 years to a maximum of 85 years. The largest racial group was Caucasian (85.4%; *n*=263), followed by African-American (8.1%; *n*=25) and Hispanic (4.2%; *n*=13). Asian and other races comprised only 2.2% (*n*=7) together. A large percentage of the sample was married (64.6%; *n*=197), followed by those who were single (13.8%; *n*=42) or separated/divorced (12.5%; *n*=38). The remainder of the sample were widowed (5.9%; *n*=18), or living with a significant other (3.0%; *n*=9). Analysis of disability status reflected that 20.7% (*n*=62) were receiving disability payments, 78.6% (*n*=235) were not receiving payments, and 0.7% (*n*=2). Of the total sample, 14.3 % (*n*=43) reported having some type of pending litigation, 84.7% (*n*=254) had no litigation pending, and 1.0% (*n*=3) did not report a

litigation status. The majority of the total sample completed the interdisciplinary treatment (93.9%, *n*=262), while only 6.1% (*n*=17) did not complete the treatment.

Analyses to determine any differences in demographic variables between those who completed treatment and those who did not were conducted using chi-square or independent t-test analyses, depending on the continuous or categorical nature of the variables. No significant differences were found between completers and non-completers for age, gender, race, marital status, disability payment status, litigation status, or status of condition. The 17 patients who did not complete the interdisciplinary treatment were excluded from the sample for the purposes of further analysis.

Demographic data about the sample of chronic pain patients that completed interdisciplinary treatment are presented in Appendix B, Table 2. The narrowed sample of 262 patients was analyzed for proportional breakdowns for the categorical variables of gender, race, marital status, disability payment status (receiving disability payments or not), and litigation status (involvement in pending litigation related to pain or not). The continuous variable of age was analyzed for the overall mean, standard deviation, and minimum and maximum cut-off values.

CHAPTER FIVE
Results

BIOPSYCHOSOCIAL MEASURES

Effect Size of Physical/Functional Measures

Heterogeneous Pain Group

Physical and/or functional measures included the VAS, MVAS, OSW, and SF-36/PCS. Paired sample t-tests were conducted to evaluate each measure for pre- to post-treatment change. These measures were further analyzed using Cohen's *d* (1992) to obtain the effect size. Results indicated that the instruments showing the greatest effect size were the VAS (*d*= 1.27) and the MVAS (*d*=0.94), both within the large effect size range. The OSW (*d*=0.67) and the PMQ (*d*=0.79) showed a moderate effect size, while the SF-36/PCS (*d*=0.19) had the lowest effect size of the physical measures (Appendix B, Table 3).

Musculoskeletal Pain Group

The sample was further divided by pain categories and when analyzing each measure by pain diagnosis, and again paired sample t-tests were conducted to evaluate each measure for pre- to post-treatment change. These measures were further analyzed using Cohen's *d* (1992) to obtain the effect size. Results revealed that when the measures were used to assess patients with musculoskeletal pain, the physical/functional instruments that displayed a large effect size were the VAS (*d*= 1.30), the MVAS (*d*=0.92), and the OSW (*d*=0.85). The SF-36/PCS (*d*=0.63) showed a moderate effect size (Appendix B, Table 4).

Other Pain Group

Again, paired sample t-tests were conducted to evaluate each measure for pre- to post-treatment change for patients that had any single diagnosis other than musculoskeletal pain. These measures were further analyzed using Cohen's *d* (1992) to obtain the effect size. Results indicated that the physical/functional instruments showing the greatest effect size were the VAS (*d*= 1.29), the MVAS (*d*=1.15), and the SF-36/PCS (*d*=0.90) all within the large effect size range. The OSW (*d*=0.49) showed a low effect size (Appendix B, Table 5).

Multiple Pain Category Group

For patients who displayed more than one pain diagnosis, paired sample t-tests were conducted to evaluate each measure for pre- to post-treatment change. These measures were further analyzed using Cohen's *d* (1992) to obtain the effect size. Results indicated that the instruments showing the greatest effect size were the VAS (*d*= 1.25) and the MVAS (*d*=0.97), both within the large effect size range. The OSW (*d*=0.65) displayed a moderate effect size, while the SF-36/PCS (*d*=0.02) had the lowest effect size of the physical measures when used with a population that has multiple pain complaints (Appendix B, Table 6).

Effect Size of Psychosocial Measures

Heterogeneous Pain Group

The BDI-II and SF-36/MCS identify depressed mood and the mental component of quality of life as related to health status, respectively, and the PMQ assesses potential

for medication misuse. Paired sample t-tests were conducted to evaluate these measures for pre- to post-treatment change. These measures were further analyzed using Cohen's *d* to obtain their effect sizes. Results indicated a moderate effect size for all three measures: the BDI-II (*d*=0.72), the SF-36/MCS (*d*=0.62) the PMQ (*d*=0.79) (Appendix B, Table 7).

Musculoskeletal Pain Group

Paired sample t-tests were conducted to evaluate these measures for pre- to post-treatment change. These measures were further analyzed using Cohen's *d* to obtain their effect sizes. Results indicated a large effect size for the PMQ (*d*=1.00). The BDI-II (*d*=0.68) and the SF-36/MCS (*d*=0.76) both showed a moderate effect size (Appendix B, Table 8).

Other Pain Group

Paired sample t-tests were conducted to evaluate these measures for pre- to post-treatment change. These measures were further analyzed using Cohen's *d* to obtain their effect sizes. Results indicated the psychosocial measure showing largest effect size to be the PMQ (*d*=1.21). The BDI-II (*d*=0.71) displayed a moderate effect size and the SF-36/MCS (*d*=0.43) revealed a low effect size (Appendix B, Table 9).

Multiple Pain Category Group

Paired sample t-tests were conducted to evaluate these measures for pre- to post-treatment change. These measures were further analyzed using Cohen's *d* to obtain their

effect sizes. Results indicated a moderate effect size for all three measures: the BDI-II (*d*=0.60), the SF-36/MCS (*d*=0.59), and the PMQ (*d*=0.59) (Appendix B, Table 10).

Effect Size of Coping Measure

Heterogeneous Pain Group

The MPI assessment evaluates the patient's perception of pain and results in categorization of different coping styles. A paired sample t-test was conducted to evaluate pre- to post-treatment change. This measure was further analyzed to obtain the effect size using Cohen's *d*. Results indicated an extremely low effect size for the MPI (*d*=0.03) (Appendix B, Table 7).

Musculoskeletal Pain Group

A paired sample t-test was conducted to evaluate pre- to post-treatment change. This measure was further analyzed to obtain the effect size using Cohen's *d*. Results indicated an extremely low effect size for the MPI (*d*=0.07) (Appendix B, Table 8).

Other Pain Group

A paired sample t-test was conducted to evaluate pre- to post-treatment change. This measure was further analyzed to obtain the effect size using Cohen's *d*. Results indicated an extremely low effect size for the MPI (*d*=0.17) (Appendix B, Table 9).

Multiple Pain Category Group

A paired sample t-test was conducted to evaluate pre- to post-treatment change. This measure was further analyzed to obtain the effect size using Cohen's *d*. Results indicated an extremely low effect size for the MPI (*d*=0.16) (Appendix B, Table 10).

CHAPTER SIX
Conclusions and Recommendations

DISCUSSION

Demographics

In this study, the sample consisted of a heterogeneous group of primarily chronic pain patients and, as expected, no differences were found among demographic variables. This finding supports the notion that the results can be generalized to other pain management settings. While the sample was largely comprised of Caucasian individuals who were married, no significant differences were found among demographic variables. Therefore, it can be assumed that this information can be generalized to a larger population.

Effect Size Based on Physical/Functional Measures

This study showed that a simple VAS measure held the greatest effect size, as hypothesized. A previous study found a VAS effect size to be 1.58 (Beurskens, deVet, & Koke, 1996). As hypothesized, previous findings were confirmed by the present study's results, as the VAS had the largest effect size (d=1.27). This conclusion is supported by other research that indicated a patient's self-report as the best measure of pain (Bodian, Freedman, Hossain, et al., 2001) and the utility of the VAS as a predictor in treatment outcome (McGeary, Mayer, & Gatchel, 2006). When the heterogeneous group is divided into various pain categories, (i.e. musculoskeletal pain, other single pain diagnoses, and multiple types of pain complaints) the VAS continued to display the largest effect size for all groups, indicating that it is applicable across differing types of pain categories. However, it can not be concluded that the VAS is the *only* measure needed to assess outcomes of interdisciplinary treatment for chronic pain patients.

Information about pain perception has shown to be a valuable tool in assessing and treating the chronic pain population, and can be gained the use of the VAS despite the limitations previously discussed. If forced to choose only one test to administer, the VAS would certainly be the "front runner". However, this study has shown the importance and strength of several other measures in assessing chronic pain patients and treating more than one aspect of specific physical complaints.

The MVAS contains 15 self-report items assessing perceived pain and disability and as hypothesized, was confirmed to have a large effect size (*d*=.94). This study supported the use of the MVAS as a strong indicator of significant change when assessing chronic pain patients. This may be due in part to the fact that the first question on the MVAS is the same as the question posed on the VAS, specifically "how bad is your pain?" Like the simple VAS, the MVAS had large effect sizes in the context of the heterogeneous population as well as in the divided groups (i.e. musculoskeletal, other, and multiple), supporting its utility in assessing a number of diagnostic pain categories. A previous study of the MVAS (Anagnostis, 2003) demonstrated the effectiveness of a simple disability rating scale, and its utility in predicting treatment outcomes for patients with chronic disabling spinal disorder, and the additional findings in the present study further supports the use of analog scales to determine a patient's perception of pain, and the manner in which pain effects behaviors. While other components to an evaluation may be beneficial for clinical reasons, this study demonstrates that best way to determine a patient's physical/functional measure of pain is with a visual analog scale. Other results from this study support the idea that a *combination* of these measures is useful when assessing chronic pain, even though the analog scales show more robust results.

The OSW is a 10-item, self-rated measure that assesses limitations of various activities of daily living secondary to pain. It was hypothesized that the OSW would reveal a moderate effect size, based on results found in previous studies (Anagnostis, Gatchel, & Mayer, 2004; OSW, *d*=0.95 & OSW, *d*=0.41; Beurskens, deVet & Koke, 1996 OSW, *d*=0.80). This study confirmed a moderate effect size for the OSW (*d*=.68). The earlier study Anagnostis study (2004) likely had a larger effect size for one of the groups it studied due to the specific population that yielded such an effect size. The group that displayed a large effect size in that study was a group of state and federal worker's compensation patients who were prescribed chronic pain management. This group may have had more secondary gain reasons for endorsing more significant impairments in functional daily activities at the onset of treatment, relative to the heterogeneous chronic pain population that was used in this study. Reporting higher levels of impairment at the beginning of treatment would make the effect size of the measure appear larger if the post-treatment outcome score were similar in both groups. The heterogeneous population in Anagnostis's study was similar to the one used in this study, but that study showed a low effect size while this study indicated a moderate effect. It is unclear why this discrepancy occurred, but may be due in part to the variability found in a heterogeneous group. The present study supports that idea, as the findings indicated a low effect size for the OWS for patients in the "other" category (*d*=0.49) When divided into diagnostic groups, patients who experienced any single pain complaint other than musculoskeletal did not indicate as high of a responsiveness to change on this measure. Beurskens's study (1996) displayed a large effect size for this measure, which can be explained by the population used in that study. His study consisted of low back pain patient, which is the specific group that the OSW was designed for, therefore it would be expected that the OSW would have a larger effect size for that population.

Previous studies have demonstrated good psychometric properties for this measure (Kaplan, Wurtele, & Gillis, 1996; Leclaire, Blier, Fortin, & Proulx, 1997), and the results in the present study further indicated that the OSW is a solid measure when used to assess change in treatment outcomes for chronic pain patients. Based on the present study and previous research discussed, this measure can be considered a good index of functional limitations within the context of a pain population.

The SF-36/PCS effect size was lower (*d*=.19) then expected, when compared to findings from a previous study (Anagnostis, Gatchel, & Mayer, 2004; SF-36/PCS, *d*=0.67 & SF-36/PCS, *d*=0.28). However, these findings did reflect what was found in the heterogeneous population of Anagnostis's study (2004; SF-36/PCS, *d*=0.28). The fact that the SF-36/PCS showed significantly lower effect sizes than any other physical measure analyzed in this study may be due to the nature of the questions asked in assessing the physical components related to quality of life. Other physical measures (i.e., VAS, MVAS, & OWS), assess perceived pain, physical disability, and direct limitations to specific activities of daily living due to pain, while the SF-36/PCS focuses on quality of life factors that may not be as consistently defined, and therefore, produced results that yield a smaller effect size. It has been shown that physical and mental components measuring quality of life both contribute to deficits in functioning (Katz, 2002). However, results from this study indicated that the quality of life physical components are may not be as significantly indicative of impairment as quality of life mental components when treating a heterogeneous group of chronic pain patients. The group in Anagnostis's study that revealed a moderate effect size for this measure (*d*=0.67), included only worker's compensation patients whose injuries were primarily musculoskeletal, and physical improvements in quality of life may be more apparent for that type of injury when compared to a heterogeneous group of

patients experiencing a variety of pain complaints. When the heterogeneous group in this study was divided into different pain categories, the impact of the discrepancies within the heterogeneous population became more apparent. The musculoskeletal and "other" group (single diagnosis of pain other than musculoskeletal, e.g. headache, neuropathy, reflex sympathetic dystrophy, fibromyalgia) revealed moderate and large effect sizes respectively, while the group who exhibited multiple pain complaints displayed an extremely low effect size (d=0.02). A possible explanation can be derived by considering when a chronic pain patient is experiencing multiple types of pain, the quality of their physical life is not as likely to change drastically in the course of treatment. It is understandable that patients with a single diagnosis would be more responsive to change and those changes would be reflected in this instrument. The division of the pain categories in this study was able to reveal that this measure shows a larger effect when used with specific pain groups rather than when given to patients with more than one type of pain diagnosis.

Effect Size Based on Psychosocial Measures

The BDI-II is a widely used measure for assessing depression levels in a variety of settings. Researchers have discussed the relationship between pain and depression, and the two are thought to be closely related. The present study's findings further support the use of the BDI-II in a chronic pain setting. The moderate effect size found (d=0.65) confirms this measure's strength in the ability to detect significant changes in interdisciplinary treatment outcomes for chronic pain patients. It was hypothesized that the BDI-II would show a large effect size, as a previous study found BDI-II effect size ranges from 0.87-1.67 (Reisch, Thommen, Tschacher, & Hirsbrunner, 2001). The effect size in the present study was probably

lower than the Reisch et al. (2001) study due to the specific population that was studied. In their study, participants included subjects who were being treated specifically for various psychiatric disorders as the primary diagnosis, and thus, likely had higher depression levels at pre-treatment than did the present pain population and indicated more significant changes at post-treatment. The application of this tool with various populations is further supported by the results from the division of pain categories in this study. All three categories (i.e. musculoskeletal, other, and multiple) revealed a moderate effect size for this measure (Appendix C, Figure 2). Thus it can be concluded that the BDI-II shows a moderate responsiveness to change and can be considered useful in a number of chronic pain populations.

The SF-36/MCS assesses quality of life related to health status, including a patient's overall sense of mental well-being. The availability of population-based normative data from various medical populations (such as a spinal population) makes the SF-36 useful for comparative purposes. The SF-36 has been found to have high test-retest reliability coefficients, and internal consistency (Ware et al., 1993). It was hypothesized that the SF-36/MCS would show a moderate effect size, as a previous study found varying degrees of effect with the SF-36/MCS to yielding an effect size of d=0.73 in one group; and d=0.13 in another (Anagnostis, Gatchel, & Mayer, 2004). This study confirmed a moderate effect size for the SF-36/MCS (d=.62). The mental well-being component has been consistently indicated as a factor in the assessment of pain management patients and has been replicated in many studies (Katz, 2002; Anagnostis, Gatchel, & Mayer, 2004; Gureje et al., 1998). This component of the SF-36 measure proved to be sturdy in terms of assessing changes in outcome measures in a heterogeneous chronic pain population. This measure as a whole stands up to statistical analysis in the context of this population. However, the mental component resulted in a stronger measure

of effect size than the physical component did, which indicates that a measure of the mental sense of well-being is more robust when assessing change in pre- to post-treatment outcomes of interdisciplinary chronic pain patients, again supporting a biopsychosocial assessment. By looking at the results in the context of the different type of pain diagnoses studied in this heterogeneous population, it can be noted that the mental component yielded a moderate effect size for the musculoskeletal and multiple pain categories, however had a low effect size for the other single diagnosis group. This could indicate that the mental factors this measure uses to assess quality of life are not as sensitive to change for patients how have a single pain diagnosis such as headache, neuropathy, fibromyalgia, reflex sympathetic dystrophy, or cancer. The reason for this is unclear, but may relate to previous research which has indicated shortcomings of this measures ability to show change when used for individual assessment as it has greater utility in comparing group changes over time (Gatchel et al., 1998). The "other" category used in this study may be too broad to yield as meaningful results as other more specific parameters for group classification.

The PMQ is a self-report screening measure containing 26-items based on behavioral correlates and attitudes suggestive of opioid misuse. Greater potential risk of opioid misuse is reflected by an overall higher score (Adams et al., 2004). The PMQ has not been extensively researched; however, it displayed a moderate effect size (d=.79), indicating its utility in assessing change as related to opioid misuse in chronic pain populations. This finding has greater implications as the current focus of many pain management programs address the concern of identifying and treating opioid misuse in chronic pain patients (Bernstein et. al, 2007). The division of the heterogeneous group into specific diagnostic pain categories yielded moderate to large effect sizes as well supporting the use of this measure in a variety of specific

pain populations. The single pain categories (musculoskeletal and other single type of diagnoses) revealed a large effect size, and the patients with multiple types of pain complaints showed a moderate effect size. This can be explained by considering that persons with more than one type of pain diagnosis may be less likely to report a change in their attitudes and behaviors in medication use, than those who are only experiencing one type of pain, thus yielding a slightly lower effect size.

Effect Size Based on Coping Measure

The MPI is a self-report measure designed to assess the impact of pain on the individual's life, the patient's perceived responses of others to the patient's pain, and the frequency of patient participation in common daily activities (Kerns et al., 1985). In one study that evaluated the effectiveness of the MPI in predicting response to interdisciplinary treatment in a heterogeneous group of patients with chronic pain, it was found that the MPI subgroup classification did not significantly predict the degree of positive treatment outcomes (Davis, Reeves, Graff-Radford, Hastie, & Naliboff, 2003). Another study expressed concern regarding the MPI and its ability to predict treatment outcomes in a chronic pain population, even though the measure was specifically designed for that population (Ravani, 2005). The present study further supports the idea that the MPI is not a strong measure when used to assess significant outcome changes in a heterogeneous chronic pain population. This study showed that the MPI lacked the statistical strength to indicate a low effect size as the results indicated (d=.02), which is well below the .2 level that Cohen established as a low effect size (Cohen, 1992). As hypothesized, the MPI showed the lowest effect size of the measures analyzed in the present study when looking at the heterogeneous group of chronic pain patients. Similar results were

found when the heterogeneous group was divided into diagnostic pain categories, with only slightly better results in the multiple pain diagnoses group, and the group of other single pain diagnoses (multiple, *d*=16; other, *d*=17). These results can be explained by the fact that this instrument was originally developed and intended to be used for pre-treatment evaluation, not as a measure of treatment outcome (Kerns et al., 1985). As previous research as indicated, this measure is not sensitive to change and therefore may show more clinical utility when used in pre-treatment evaluation (Davis, Reeves, Graff-Radford, Hastie, & Naliboff, 2003; Ravani, 2005).

Limitations and Directions for Future Research

The findings of this study concluded that the VAS and MVAS have large effect sizes when used in a pain management setting, but additional research would be useful in replicating these findings and supporting the use of more that one outcome measure. Future studies should examine a larger population including follow up on patients who did not complete the program. It might also be advised for future studies to look at patients who received other treatment, i.e., non-interdisciplinary. Effect size is a stable measure across which various treatments can be compared; therefore, it would be interesting for future studies to try to replicate these findings in the context of different treatments and/or settings. The measures might indicate different effect sizes when viewed in the context of different treatment modalities, and should be studied further to support the results of the current study. Effect size is a good indicator of responsiveness, as this study has shown, however controversy still exists about what statistical method to use as a measure of responsiveness. Another strategy for determining responsiveness is a Receiver Operating Characteristic analysis (ROC). The ROC curve depicts a graph comparing sensitivity

and specificity for various cut-off points in score change (Deyo & Centor, 1986). It would be beneficial for future studies to use a ROC analysis in addition to effect size, to help determine what cut-off points for each measure represents improvement, and distinguish the level of minimal important clinical difference.

Summary and Conclusions

A variety of measures assist in clinical assessment and help illustrate changes over a period of time or with a given treatment, and measuring effect size is one way to interpret and communicate relevant changes across the course of treatment. Measuring the effect size provides a clearer understanding of results, as effect sizes are often used to translate the "before-and-after" changes of a group, into a standard unit of measurement (Kazis, Anderson, & Meenan, 1989). Effect size provides three main benefits; 1) it reflects the relative magnitude of effect in a common term; 2) is used to determine whether a change is clinically relevant; 3) permits comparison with other instruments, interventions, or studies (Guyatt, Walter, & Norman, 1987). The purpose of the present study was to evaluate the effect size of measures recorded from chronic pain patients, at pre- and post-treatment, to determine which measures show more robustness in measuring interdisciplinary treatment outcomes.

This study has demonstrated the utility of a number of measures used in the assessment and treatment of chronic pain patients. While certain measures, specifically the VAS and MVAS, indicated a large effect size, several other tools displayed a strong moderate level of effect (i.e., OSW, BDI-II, PMQ, & SF-36/MCS), and cannot be disregarded when choosing a battery of tests for assessment purposes. Gatchel (1999) recommends using multiple measures of change whenever possible, and this study supports the usefulness of multiple assessment

instruments. As previous research has shown, physiological, biological, cognitive, affective, behavioral, and social factors are all important aspects to consider when assessing chronic pain (Turk & Rudy, 1987). The biopsychosocial model demonstrates the various roles that psychosocial factors play in the lives of chronic pain patients. Thus, it remains important to assess the degree to which psychosocial factors are affecting patients in a pain management setting. This study gives direction for selection of the strongest measures if a comprehensive assessment is not available due to time constraints or financial limitations. If only two measures of outcome could be given, then the two to choose would be the VAS and the MVAS; however, as discussed previously, those measures have limitations and do not represent a full spectrum of pain assessment when treating patients in the context of a biopsychosocial model. This study offers more detailed information on the effect sizes of different measures in order to facilitate the decision making process when selecting assessment tools to use with a chronic pain population.

APPENDIX A
Measures

MVAS

NAME: _____ **DATE:** _____

PLEASE MAKE AN "X" ALONG THE LINE TO SHOW HOW FAR FROM NORMAL TOWARD THE WORST POSSIBLE SITUATION YOUR PAIN PROBLEM HAS TAKEN YOU.

1. **How bad is your pain?**

no pain — worst possible

2. **How bad is the pain at night?**

no pain — worst possible

3. **Does the pain interfere with your lifestyle?**

no problem — total change in lifestyle

4. **How good are pain killers for your pain?**

complete relief — no relief

5. **How stiff is your back?**

no stiffness — worst possible stiffness

6. **Does your pain interfere with walking?**

no problem — cannot walk

7. **Do you hurt when walking?**

no pain — worst possible pain

8. **Does your pain keep you from standing still?**

can stand still as long as I want — cannot stand still at all

Name:_____

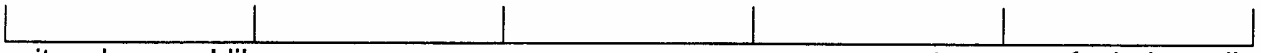
9. **Does your pain keep you from twisting?**

no problem cannot twist

10. **Does your pain allow you to sit in an upright position?**

sit as long as I like cannot use a hard chair at all

11. **Does your pain allow you to sit in a soft arm chair?**

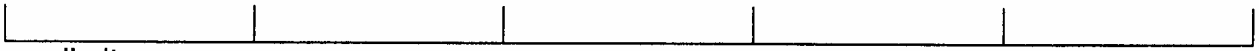


sit as long as I like cannot use a soft chair at all

12. **Do you have back pain when lying in bed?**

no pain no relief at all

13. **How much does pain limit your normal lifestyle?**

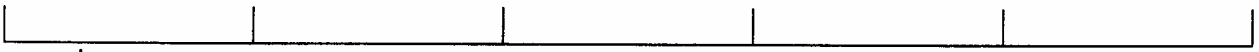


no limit cannot do anything

14. **Does pain interfere with your work?**

no problem totally cannot work

15. **How much have you had to change your work because of back pain?**



no change so much that I cannot keep a job

OSWESTRY

NAME:_____ DATE:_____

How long have you had your pain? _____ Years _____ Months _____Weeks

Please read: This questionnaire has been designed to give the doctor information as to how your pain has affected your ability to manage in everyday life. Please answer every section, and mark in each section only the ***one box*** which applies to you. We realize you may consider that two of the statements in any one section relate to you, but please just *mark the **one box** which most closely describes your problem*.

Section 1 - Pain Intensity

- ❑ I can tolerate the pain I have without having to use pain killers.
- ❑ The pain is bad, but I manage without taking pain killers.
- ❑ Pain killers give complete relief from pain.
- ❑ Pain killers give moderate relief from pain.
- ❑ Pain killers give very little relief from pain
- ❑ Pain killers have no effect on the pain and I do not use them.

Section 2 - Personal Care (Washing, Dressing, etc)

- ❑ I can look after myself normally without causing extra pain.
- ❑ I can look after myself normally, but it causes extra pain.
- ❑ It is painful to look after myself and I am slow and careful.
- ❑ I need some help, but manage most of my personal care.
- ❑ I need help every day in most aspects of self care.
- ❑ I do not get dressed, wash with difficulty and stay in bed.

Section 3 - Lifting

- ❑ I can lift heavy weights without extra pain.
- ❑ I can lift heavy weights, but it gives extra pain.
- ❑ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, e.g., on a table.
- ❑ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
- ❑ I can lift only very light weights.
- ❑ I cannot lift or carry anything at all.

Section 4 - Walking

- ❑ Pain does not prevent me from walking any distance.
- ❑ Pain prevents me walking more than a mile.
- ❑ Pain prevents me walking more than 1/2 mile.
- ❑ Pain prevents me walking more than 1/4 mile
- ❑ I can only walk using a stick or crutches.
- ❑ I am in bed most of the time and have to crawl to the toilet.

Section 5 - Sitting

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

Section 6 - Standing

- ❑ I can stand as long as I want without extra pain.
- ❑ I can stand as long as I want, but it gives me extra pain.
- ❑ Pain prevents me from standing for more than 1 hour.
- ❑ Pain prevents me from standing for more than 30 minutes.
- ❑ Pain prevents me from standing for more than 10 minutes.
- ❑ Pain prevents me from standing at all.

Section 7 - Sleeping

- ❑ Pain does not prevent me from sleeping well.
- ❑ I can sleep well only by using tablets.
- ❑ Even when I take tablets, I have less than 6 hours sleep.
- ❑ Even when I take tablets, I have less than 4 hours sleep.
- ❑ Even when I take tablets, I have less than 2 hours sleep.
- ❑ Pain prevents me from sleeping at all.

Section 8 - Sex Life

- ❑ My sex life is normal and causes no extra pain.
- ❑ My sex life is normal, but causes some extra pain.
- ❑ My sex life is nearly normal, but is very painful.
- ❑ My sex life is severely restricted by pain.
- ❑ My sex life is nearly absent because of pain.
- ❑ Pain prevents any sex life at all.

Section 9 - Social Life

- ❑ My social life is normal and gives me no extra pain.
- ❑ My social life is normal, but increases the degree of pain.
- ❑ Pain has no significant effect on my social life apart from limiting my more energetic interests (e.g., dancing).
- ❑ Pain has restricted my social life and I do not go out as often.
- ❑ Pain has restricted my social life to my home.
- ❑ I have no social life because of pain.

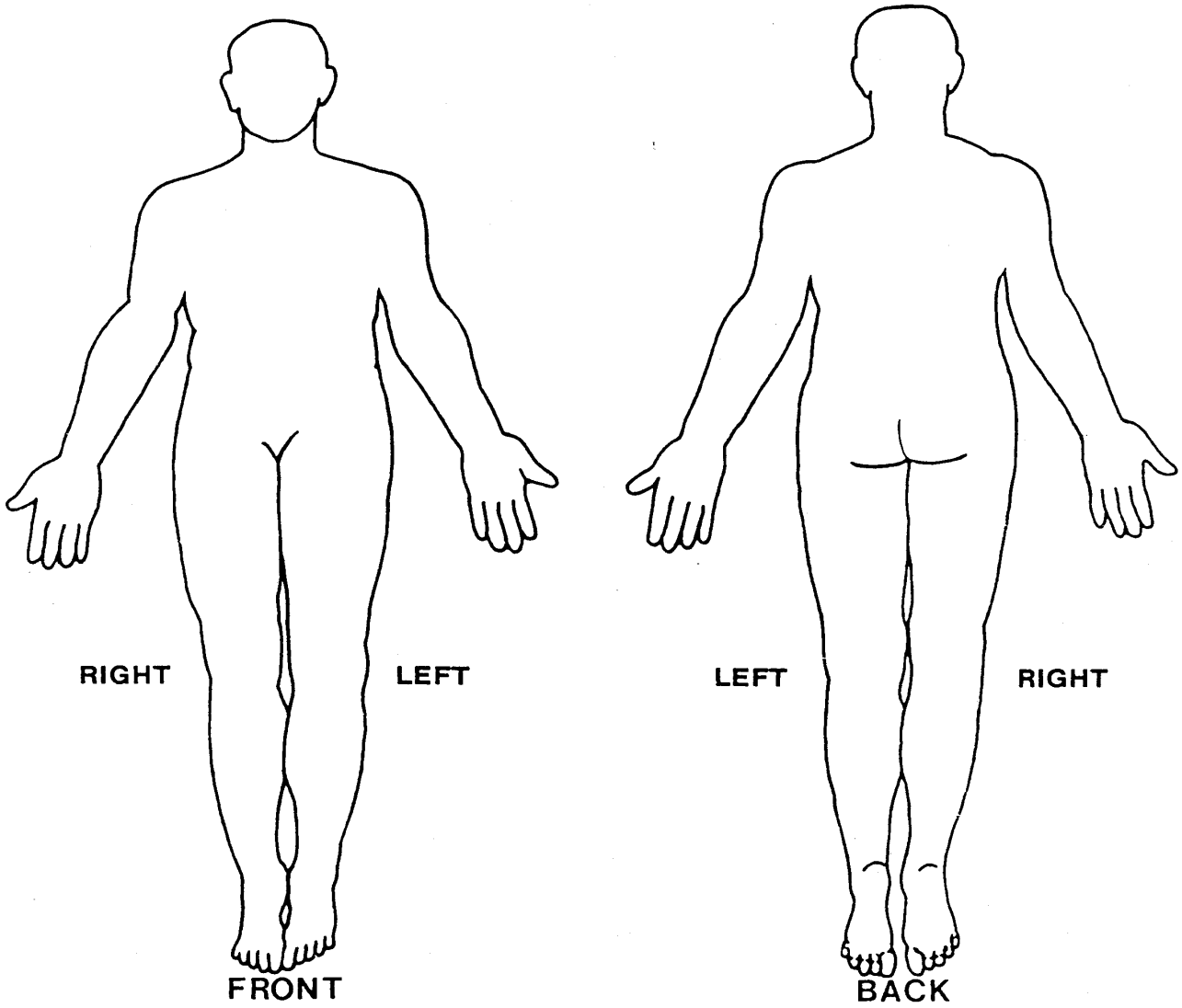
Section 10 - Traveling

- ❑ I can travel anywhere without extra pain.
- ❑ I can travel anywhere, but it gives me extra pain.
- ❑ Pain is bad, but I manage journeys over 2 hours.
- ❑ Pain restricts me to journeys of less than 1 hour.
- ❑ Pain restricts me to short necessary journeys under 30 minutes.
- ❑ Pain prevents me from traveling except to the doctor or hospital.

VAS

Draw the location of your pain on the body outlines and mark whether it is all back/neck or all arm/leg.

ALL BACK/NECK — ALL ARM/LEG



How bad is your pain?

NO PAIN — WORST POSSIBLE

Name_____ Date_____

MULTIDIMENSIONAL PAIN INVENTORY

Instructions: An important part of our evaluation includes examination of pain from **your** perspective. You know your pain better than anyone, so the information you give is very helpful in planning a treatment program for you.

Please read each question carefully and then do your best to answer each one. **Do not skip any questions.** If there is a question that you think does not apply to you, please **circle the number** of that question. After you have completed the questionnaire, check your responses to make sure that you have answered each question. Please use the last page to add any additional information or comments that you think would be of help to us in better understanding your pain problem.

A. Some of the questions in this questionnaire refer to your "significant other." A significant other is a person with whom you feel closest. This includes anyone that you relate to on a regular or frequent basis. It is very important that you identify someone as your "significant other." Please indicate below who your significant other is (circle one):

- Spouse
- Partner/Companion
- Housemate/Roommate
- Friend
- Neighbor
- Parent/Child
- Other (please describe):_____

B. Do you currently live with this person? YES NO

When you answer the questions on the following pages about your "significant other," always respond in reference to the specific person you just indicated.

SECTION 1

This part asks questions to help us learn more about your pain and how it affects your life. Under each question is a scale to mark your answer. Read each answer carefully and then **circle a number** on the scale under that question to indicate how that specific question applies to you. An example may help you to better understand how you should answer these questions.

EXAMPLE:

How nervous are you when you ride in a car when the traffic is heavy?

0	1	2	3	4	5	6
Not at all Nervous						Extremely Nervous

If you are not at all nervous when riding in a car in heavy traffic, you would want to **circle** the number 0. If you are very nervous when riding in a car in heavy traffic, you would then **circle** the number 6. Lower numbers would be used for less nervousness, and higher numbers for more nervousness.

Please continue on the next page.

Please answer the following questions:

1. Rate the level of your pain at the **present moment.**

0	1	2	3	4	5	6
No Pain						Very Intense Pain

2. In general, how much does your pain interfere with your day-to-day activities?

0	1	2	3	4	5	6
No Interference						Extreme Interference

3. Since the time your pain began, how much has your pain changed your ability to work?
(_____ Check here if you are not working for reasons other than your pain.)

0	1	2	3	4	5	6
No Change						Extreme Change

4. How much has your pain changed the amount of satisfaction or enjoyment you get from taking part in social and recreational activities?

0	1	2	3	4	5	6
No Change						Extreme Change

5. How supportive or helpful is your significant other (this refers to the person you indicated above) to you in relation to your pain?

0	1	2	3	4	5	6
Not at all Supportive						Extremely Supportive

6. Rate your overall mood during the **past week**.

0	1	2	3	4	5	6
Extremely Low						Extremely High

7. How much has your pain interfered with your ability to get enough sleep?

0	1	2	3	4	5	6
No Interference						Extreme Interference

8. On average, how severe has your pain been during the **last week**?

0	1	2	3	4	5	6
Not at all Severe						Extremely Severe

9. How able are you to predict when your pain will start, get better, or get worse?

0	1	2	3	4	5	6
Not at all able to predict						Very able to predict

10. How much has your pain changed your ability to take part in recreational and other social activities?

0	1	2	3	4	5	6
No Change						Extreme Change

Please continue on the next page.

11. How much do you limit your activities in order to keep your pain from getting worse?

0	1	2	3	4	5	6
Not at all						Very Much

12. How much has your pain changed the amount of satisfaction or enjoyment you get from family related activities?

0	1	2	3	4	5	6
No Change						Extreme Change

13. How worried is your spouse (significant other) about you because of your pain?

0	1	2	3	4	5	6
Not at all Worried						Extremely Worried

14. During the **past week**, how much control do you feel you have had over your life?

0	1	2	3	4	5	6
No Control						Extreme Control

15. On an average day, how much does your pain vary (increase or decrease)?

0	1	2	3	4	5	6
Remains the same						Changes a lot

16. How much suffering do you experience because of your pain?

0	1	2	3	4	5	6
No Suffering						Extreme Suffering

17. How often are you able to do something that helps to reduce your pain?

0	1	2	3	4	5	6
Never						Very Often

18. How much has your pain changed your relationship with your spouse, family, or significant other?

0	1	2	3	4	5	6
No Change						Extreme Change

19. How much has your pain changed the amount of satisfaction or enjoyment you get from work?
(_____ Check here if you are not presently working.)

0	1	2	3	4	5	6
No Change						Extreme Change

20. How attentive is your spouse (significant other) to you because of your pain?

0	1	2	3	4	5	6
Not at all Attentive						Extremely Attentive

21. During the **past week**, how well do you feel you have been able to deal with your problems?

0	1	2	3	4	5	6
Not at all						Extremely Well

Please continue on the next page.

22. How much control do you feel you have over your pain?

0	1	2	3	4	5	6
No control at all						A great deal of control

23. How much has your pain changed your ability to do household chores?

0	1	2	3	4	5	6
No Change						Extreme Change

24. During the **past week**, how successful were you in coping with stressful situations in your life?

0	1	2	3	4	5	6
Not at all Successful						Extremely Successful

25. How much has your pain interfered with your ability to plan activities?

0	1	2	3	4	5	6
No Change						Extreme Change

26. During the **past week**, how irritable have you been?

0	1	2	3	4	5	6
Not at all Irritable						Extremely Irritable

27. How much has your pain changed your friendships with people other than your family?

0	1	2	3	4	5	6
No Change						Extreme Change

28. During the **past week**, how tense or anxious have you been?

0	1	2	3	4	5	6
Not at all tense or anxious						Extremely tense & anxious

SECTION 2

In this section, we are interested in knowing how your spouse (or significant other) responds to you when he or she knows you are in pain. On the scale listed below each question, **circle a number** to indicate how often your spouse (or significant other) responds to you in that particular way when you are in pain.

1. Ignores me.

0	1	2	3	4	5	6
Never						Very Often

2. Asks me what he or she can do to help.

0	1	2	3	4	5	6
Never						Very Often

3. Reads to me.

0	1	2	3	4	5	6
Never						Very Often

4. Gets irritated with me.

0	1	2	3	4	5	6
Never						Very Often

Please continue on the next page.

5. Takes over my jobs or duties.

0	1	2	3	4	5	6
Never						Very Often

6. Talks to me about something else to take my mind off the pain.

0	1	2	3	4	5	6
Never						Very Often

7. Gets frustrated with me.

0	1	2	3	4	5	6
Never						Very Often

8. Tries to get me to rest.

0	1	2	3	4	5	6
Never						Very Often

9. Tries to involve me in some activity.

0	1	2	3	4	5	6
Never						Very Often

10. Gets angry with me.

0	1	2	3	4	5	6
Never						Very Often

11. Gets me pain medication.

0	1	2	3	4	5	6
Never						Very Often

12. Encourages me to work on a hobby.

0	1	2	3	4	5	6
Never						Very Often

13. Gets me something to eat or drink.

0	1	2	3	4	5	6
Never						Very Often

14. Turns on the T.V. to take my mind off my pain.

0	1	2	3	4	5	6
Never						Very Often

Please continue on the next page.

SECTION 3

Listed below are 18 daily activities. Please indicate how often you do each of these by circling a number on the scale listed below each activity. Please complete all 18 questions.

1. Wash dishes.

0	1	2	3	4	5	6
Never						Very Often

2. Mow the lawn. (_____ Check here if you do not have a lawn to mow.)

0	1	2	3	4	5	6
Never						Very Often

3. Go out to eat.

0	1	2	3	4	5	6
Never						Very Often

4. Play cards or other games.

0	1	2	3	4	5	6
Never						Very Often

5. Go grocery shopping.

0	1	2	3	4	5	6
Never						Very Often

6. Work in the garden. (_____ Check here if you do not have a garden.)

0	1	2	3	4	5	6
Never						Very Often

7. Go to a movie.

0	1	2	3	4	5	6
Never						Very Often

8. Visit friends.

0	1	2	3	4	5	6
Never						Very Often

9. Help with the house cleaning.

0	1	2	3	4	5	6
Never						Very Often

10. Work on the car. (_____ Check here if you do not have a car.)

0	1	2	3	4	5	6
Never						Very Often

11. Take a ride in a car or bus.

0	1	2	3	4	5	6
Never						Very Often

Please continue on the next page.

12. Visit relatives. (_____ Check here if you do not have relatives within 100 miles.)

0	1	2	3	4	5	6
Never						Very Often

13. Prepare a meal.

0	1	2	3	4	5	6
Never						Very Often

14. Wash the car. (_____ Check here if you do not have a car.)

0	1	2	3	4	5	6
Never						Very Often

15. Take a trip.

0	1	2	3	4	5	6
Never						Very Often

16. Go to a park or beach.

0	1	2	3	4	5	6
Never						Very Often

17. Do the laundry.

0	1	2	3	4	5	6
Never						Very Often

18. Work on a needed household repair.

0	1	2	3	4	5	6
Never						Very Often

PMQ PAIN MEDICATION QUESTIONNAIRE

NAME: _____

In order to develop the best treatment plan for you, we want to understand your thoughts, needs and experiences related to pain medication. Please read each statement below and indicate how much it applies to you by marking your response with an "X" anywhere on the line below it.

1) I believe I am receiving enough medication to relieve my pain.

Disagree | *Somewhat Disagree* | *Neutral* | *Somewhat Agree* | *Agree*

2) My doctor spends enough time talking to me about my pain medication during appointments.

Disagree | *Somewhat Disagree* | *Neutral* | *Somewhat Agree* | *Agree*

3) I believe I would feel better with a higher dosage of my pain medication.

Disagree | *Somewhat Disagree* | *Neutral* | *Somewhat Agree* | *Agree*

4) In the past, I have had some difficulty getting the medication I need from my doctor(s).

Disagree | *Somewhat Disagree* | *Neutral* | *Somewhat Agree* | *Agree*

5) I wouldn't mind quitting my current pain medication and trying a new one, if my doctor recommends it.

Disagree | *Somewhat Disagree* | *Neutral* | *Somewhat Agree* | *Agree*

6) I have clear preferences about the type of pain medication I need.

Disagree | *Somewhat Disagree* | *Neutral* | *Somewhat Agree* | *Agree*

7) Family members seem to think that I may be too dependent on my pain medication.

Disagree | *Somewhat Disagree* | *Neutral* | *Somewhat Agree* | *Agree*

8) It is important to me to try ways of managing my pain in addition to the medication *(such as relaxation, biofeedback, physical therapy, TENS unit, etc.)*

Disagree | *Somewhat Disagree* | *Neutral* | *Somewhat Agree* | *Agree*

(Please continue on the next page)

PMQ PAIN MEDICATION QUESTIONNAIRE

9) At times, I take pain medication when I feel anxious and sad, or when I need help sleeping.

Never Occasionally Sometimes Often Always

10) At times, I drink alcohol to help control my pain.

Never Occasionally Sometimes Often Always

11) My pain medication makes it hard for me to think clearly sometimes.

Never Occasionally Sometimes Often Always

12) I find it necessary to go to the emergency room to get treatment for my pain.

Never Occasionally Sometimes Often Always

13) My pain medication makes me nauseated and constipated sometimes.

Never Occasionally Sometimes Often Always

14) At times, I need to borrow pain medication from friends or family to get relief.

Never Occasionally Sometimes Often Always

15) I get pain medication from more than one doctor in order to have enough medication for my pain.

Never Occasionally Sometimes Often Always

16) At times, I think I may be too dependent on my pain medication.

Never Occasionally Sometimes Often Always

17) To help me out, family members have obtained pain medications for me from their own doctors.

Never Occasionally Sometimes Often Always

(Please continue on the next page)

PMQ PAIN MEDICATION QUESTIONNAIRE

18) At times, I need to take pain medication more often than it is prescribed in order to relieve my pain.

Never | Occasionally | Sometimes | Often | Always

19) I save any unused pain medication I have in case I need it later.

Never | Occasionally | Sometimes | Often | Always

20) I find it helpful to call my doctor or clinic to talk about how my pain medication is working.

Never | Occasionally | Sometimes | Often | Always

21) At times, I run out of pain medication early and have to call my doctor for refills.

Never | Occasionally | Sometimes | Often | Always

22) I find it useful to take additional medications *(such as sedatives)* to help my pain medication work better.

Never | Occasionally | Sometimes | Often | Always

23) How many painful conditions *(injured body parts or illnesses)* do you have?

1 painful conditions | 2 painful conditions | 3 painful conditions | 4 painful conditions | 5+ painful conditions

24) How many times in the past year have you asked your doctor to increase your prescribed dosage of pain medication in order to get relief?

Never | 1 time | 2 times | 3 times | 4+ times

25) How many times in the past year have you run out of pain medication early and had to request an early refill?

Never | 1 time | 2 times | 3 times | 4+ times

26) How many times in the past year have you accidentally misplaced your prescription for pain medication and had to ask for another?

Never | 1 time | 2 times | 3 times | 4+ times

(Stop)

APPENDIX B
Tables

Table 1. Demographic Variables - Total Interdisciplinary Sample

Variables	(N=312)
Age-Mean(SD)	53.38 (14.68)
Gender (%)	
Male	99 (31.7)
Female	213 (68.3)
Race (%)	
Caucasian	263 (85.4)
African American	25 (8.1)
Hispanic	13 (4.2)
Asian	2 (0.6)
Other	5 (1.6)
Marital Status (%)	
Single	42 (13.8)
Married	197 (64.6)
Living with significant other	9 (3.0)
Divorced or separated	38 (12.5)
Spouse Deceased	18 (5.9)
Completed treatment as prescribed (%)	
Yes	262 (93.9)
No	17 (6.1)
Receiving Disability Payments (%)	
Yes	62 (20.7)
No	235 (78.6)
Pending litigation related to pain (%)	
Yes	43 (14.3)
No	254 (84.7)

Table 2. Demographic Variables – Interdisciplinary Treatment Completers

Variables	(*n*=262)
Age-Mean(SD)	53.73 (14.99)
Gender (%)	
Male	81 (30.9)
Female	181 (69.1)
Race (%)	
Caucasian	217 (84.1)
African American	23 (8.8)
Hispanic	12 (4.6)
Asian	2 (0.8)
Other	4 (1.5)
Marital Status (%)	
Single	33 (12.6)
Married	169 (66.0)
Living with significant other	8 (3.1)
Divorced or separated	29 (11.3)
Spouse Deceased	16 (6.3)
Receiving Disability Payments (%)	
Yes	47 (18.2)
No	203 (81.2)
Pending litigation related to pain (%)	
Yes	217 (86.1)
No	35 (13.9)

Table 3. Effect Size for Physical/Functional Measures – Heterogeneous Group (*n*=262)

Measures	*n* (Mean Δ)	*SD*	*d*
VAS	238 (3.19)	2.50	1.27*
MVAS	227 (26.05)	27.57	0.94*
OSW	227 (5.41)	8.03	0.67**
SF-36/PCS	209 (4.16)	22.20	0.19***

*high effect size; **moderate effect size; ***low effect size

Table 4. Effect Size for Physical/Functional Measures – Musculoskeletal Pain Group (*n*=98)

Measures	*n* (Mean Δ)	*SD*	*d*
VAS	86 (3.11)	2.28	1.30*
MVAS	82 (24.32)	26.30	0.92*
OSW	24 (6.36)	7.46	0.85*
SF-36/PCS	80 (5.48)	8.76	0.63**

*high effect size; **moderate effect size; ***low effect size

Table 5. Effect Size for Physical/Functional Measures – Other Pain Group (*n*=43)

Measures	*n* (Mean Δ)	*SD*	*d*
VAS	41 (3.17)	2.46	1.29*
MVAS	38 (24.29)	21.04	1.15*
OSW	38 (3.84)	7.89	0.49***
SF-36/PCS	34 (7.56)	8.44	0.90*

*high effect size; **moderate effect size; ***low effect size

Table 6. Effect Size for Physical/Functional Measures – Multiple Pain Group (*n*=99)

Measures	*n* (Mean Δ)	*SD*	*d*
VAS	94 (3.36)	2.68	1.25*
MVAS	89 (29.85)	30.66	0.97*
OSW	87 (5.59)	8.62	0.65**
SF-36/PCS	78 (0.85)	34.62	0.02***

*high effect size; **moderate effect size; ***low effect size

Table 7. Effect Size for Psychosocial Measures – Heterogeneous Group (*n*=262)

Measures	*n* (Mean Δ)	*SD*	*d*
PMQ	87 (6.43)	8.15	0.79*
BDI-II	214 (5.50)	7.62	0.72*
SF-36/MCS	209 (7.61)	12.34	0.62**
MPI	234 (0.08)	2.47	0.03***

*high effect size; **medium effect size; ***low effect size

Table 8. Effect Size for Psychosocial Measures – Musculoskeletal Pain Group (*n*=98)

Measures	*n* (Mean Δ)	*SD*	*d*
PMQ	24 (6.33)	6.35	1.00*
BDI-II	88 (6.00)	8.79	0.68**
SF-36/MCS	80 (9.13)	11.95	0.76**
MPI	86 (0.20)	2.66	0.07***

*high effect size; **medium effect size; ***low effect size

Table 9. Effect Size for Psychosocial Measures – Other Pain Group (*n*=43)

Measures	*n* (Mean Δ)	*SD*	*d*
PMQ	15 (8.33)	6.88	1.21*
BDI-II	41 (5.39)	7.64	0.71**
SF-36/MCS	34 (5.63)	13.11	0.43***
MPI	39 (0.41)	2.45	0.17***

*high effect size; **medium effect size; ***low effect size

Table 10. Effect Size for Psychosocial Measures – Multiple Pain Group (*n*=99)

Measures	*n* (Mean Δ)	*SD*	*d*
PMQ	40 (5.69)	9.63	0.59**
BDI-II	94 (5.20)	6.82	0.76**
SF-36/MCS	78 (8.71)	11.94	0.73**
MPI	93 (0.38)	2.28	0.16***

*high effect size; **medium effect size; ***low effect size

APPENDIX C
Figures

Figure 1

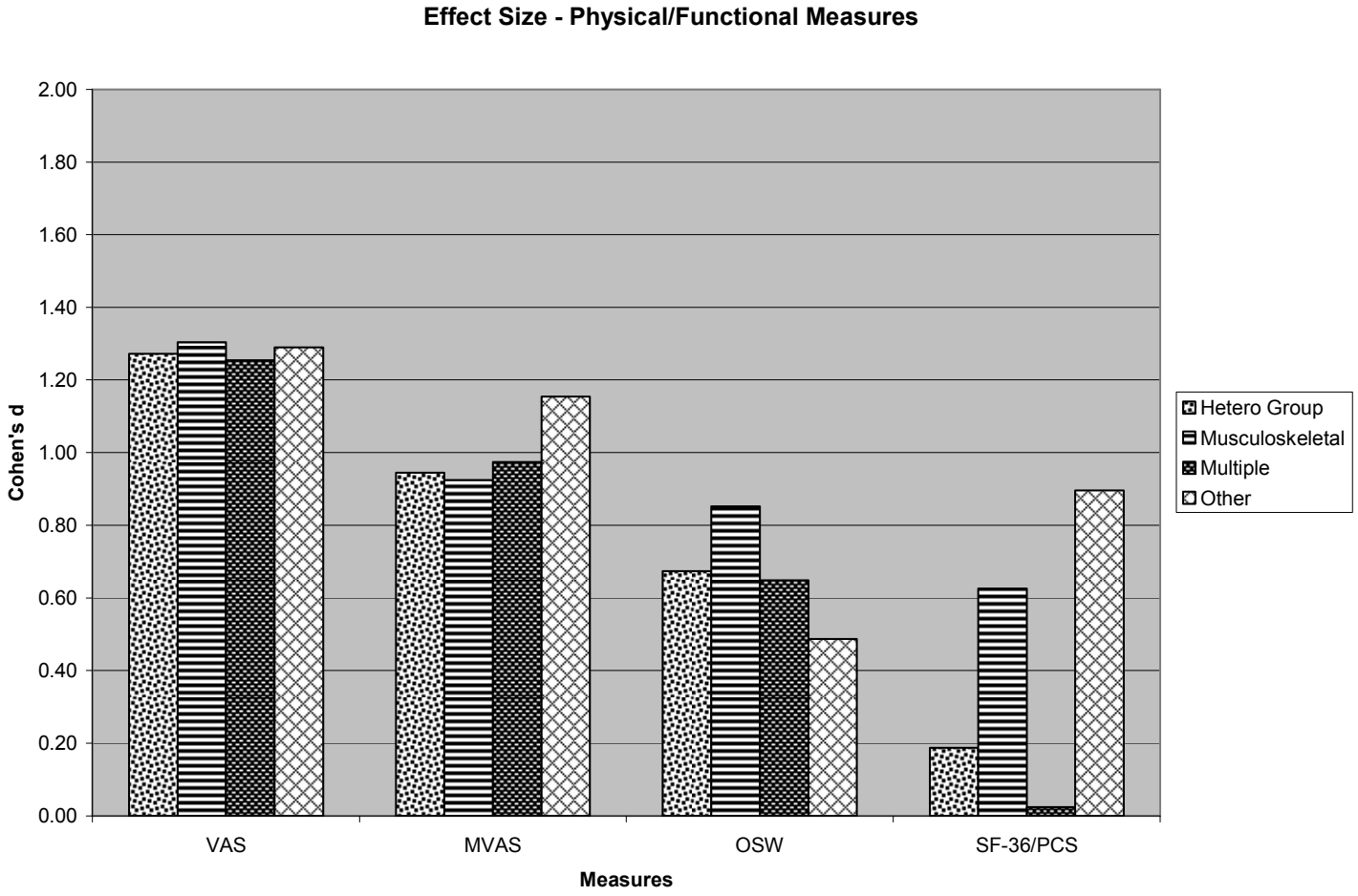
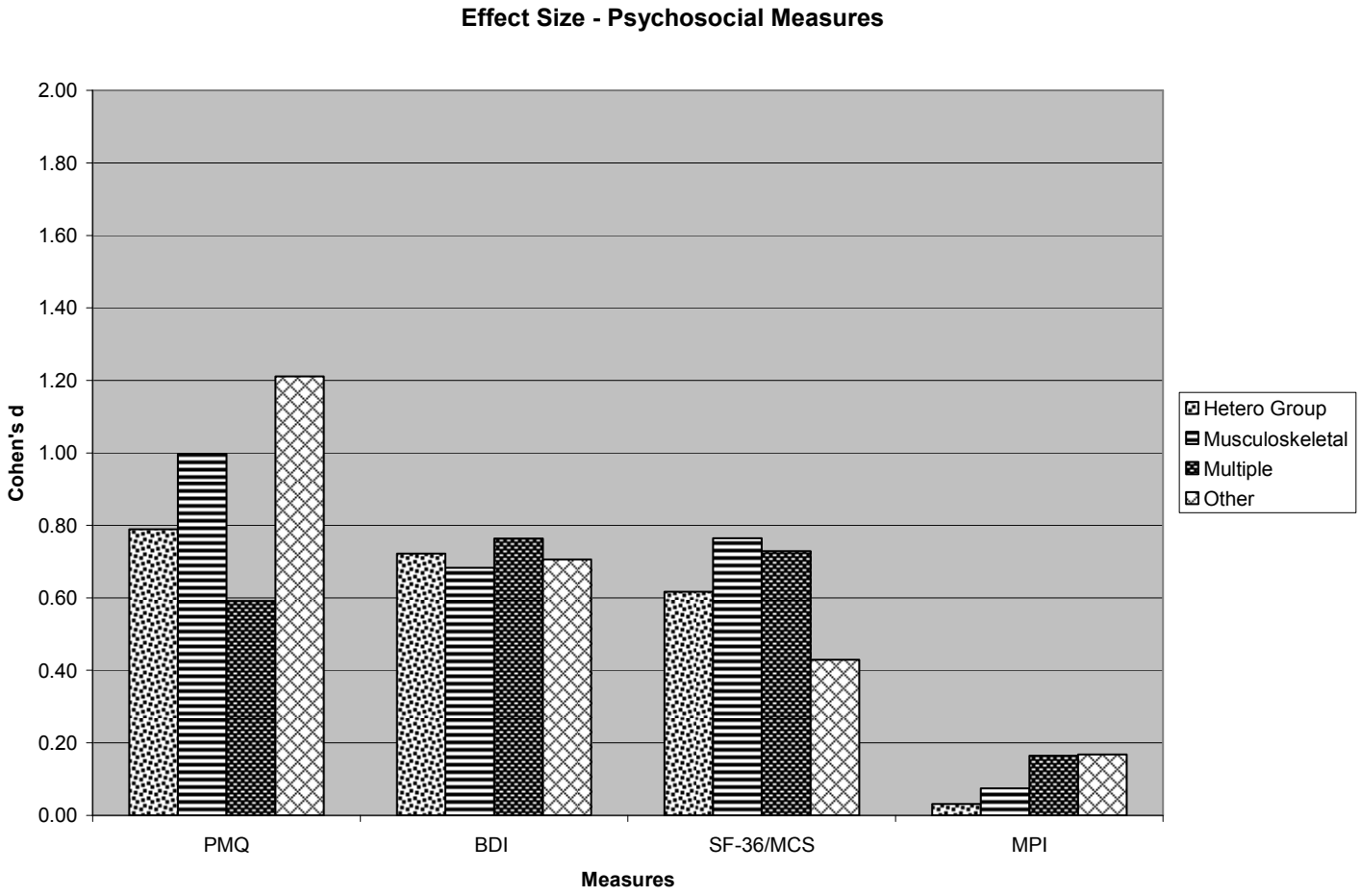


Figure 2


Effect Size - Psychosocial Measures
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Cohen's d
PMQ
BDI
SF-36/MCS
MPI
Measures
Hetero Group
Musculoskeletal
Multiple
Other

BIBLIOGRAPHY

Adams, L. L., Gatchel, R. J., Robinson, R. C., Polatin, P. P., Gajraj, N., Deschner, M., et al. (2004). Development of a self-report screening instrument for assessing potential opioid medication misuse in chronic pain patients. *Journal of Pain and Symptom Management, 27*(5), 440-459.

Alaranta, H., Rytotoski, U., Rissanen, A., Talo, S., Ronnemaa, T., Puukka, P., et al. (1994). Intensive physical and psychosocial training program for patients with chronic low back pain: A controlled clinical trial. *Spine, 19*, 1339-1349.

American Pain Society. (2000). Pain Care Bill of Rights. Baltimore: American Pain Foundation.

Anagnostis, C., Gatchel, R.J., Mayer, T.G. The pain disability questionnaire: a new psychometrically sound measure for chronic musculoskeletal disorders. *Spine. 29(20):2290-302; 2004 Oct 15.*

Arnst, C., & Licking, E. (1999). Conquering pain. *Business Week,* 36-39.

Barnes, D., Smith, D., Gatchel, R. J., & Mayer, T. G. (1989). Psychosocioeconomic predictors of treatment success/failure in chronic low-back pain patients. *Spine, 14*(4), 427-430.

Beck, A. T. (1997). The past and future of cognitive therapy. *Journal of Psychotherapy Practice & Research, 6*(4), 276-284.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Beck Depression Inventory Manual* (2nd ed.). San Antonio. TX: Psychological Corporation.

Beck, A. T., Steer, R. A., & Garbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review, 8*, 77-100.

Beck, A. T., Ward, C. H., Mendelson, M. M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 4*, 561-571.

Becker, N., Bondegaard Thomsen, A., Olsen, A. K., Sjogren, P., Bech, P., Eriksen, J. (1997). Pain epidemiology and health related quality of life in chronic non-malignant pain patients referred to a Danish multidisciplinary pain center. *Pain, 73*(3), 393-400.

Bendix, A. E., Bendix, T., Vaegter, K., Lund, C., Frolund, L., & Holm, L. (1996). Multidisciplinary intensive treatment for chronic low back pain: A randomized, prospective study. *Cleveland Clinic Journal of Medicine, 63*(1), 62-69.

Bernstein D., Stowell, A.W., Haggard, R. Worzer, W. Polatin, P. & Gatchel, R. (2007) Complex interplay of participants in opioid therapy. *Practical Pain Management*, (March), 10-36.

Beurskens, A. J., deVet, H. C., & Koke, A. J. (1996). Responsiveness of functional status in low back pain: A comparison of different instruments. *Pain, 65*(71-76).

Beurskens, A. J., deVet, H. C., Koke, A. J., Heijden, G. J. v. d., & Knipschild, P. G. (1995). Measuring the functional status of patients with low back pain: Assessment of the quality of four disease-specific questionnaires. *Spine, 20*, 1017-1028.

Block, A. R., Kremer, E. F., & Gaylor, M. (1980). Behavioral treatment of chronic pain: the spouse as a discriminative cue for pain behavior. *Pain, 9*, 243-252.

Bodian, C., Freedman, G., Hossain, S., Eisenkraft, J., & Yaakov, B. (2001). The Visual Analog Scale for pain: Clinical significance in postoperative patients. *Anesthesiology*, 95(6), 1356-1361.

Brookoff, D. (2000). Chronic pain: 1. A new disease? *Hospital Practice 35*(7), 45-52.

Butler, A. C., Chapman, J.E., Forman, E.M., Beck, A.T. (2006). The empirical status of cognitive-behavioral therapy: a review of meta-analyses. *Clinical Psychology Review, 26*(1), 17-31

Cairns, D., Pasino, J.A. (1977). Comparison of verbal reinforcement and feedback in the operant treatment of disability due to chronic low back pain. *Behavior Therapy, 8*(4), 621-630.

Capra, P., Mayer, T. G., & Gatchel, R. J. (1985). Using psychological scales to assess back pain. *Journal of Musculoskeletal medicine*, 41-52.

Clark, H. W., & Sees, K. L. (1993). Opioids, chronic pain and the law. *Journal of Pain and Symptom Management, 8*, 297-308.

Cohen, J. (1988). *Statistical Power Analyses for the Behavioral Sciences*. Hillsdale: Hive and Landen.

Cohen, J. (1992). A power primer. *Psychological Bulletin* 112(1), 155-159.

Davis, P.J., Reeves, J.L. 2nd, Graff-Radford, S.B., Hastie, B.A., & Naliboff, B.D. (2003). Multidimensional subgroups in migraine: differential treatment outcome to a pain medicine program. *Pain Medicine* 4(3), 215-22.

Deschner, M., & Polatin, P. B. (2000). Interdisciplinary programs: Chronic pain management. In T. G. Mayer, R. J. Gatchel & P. B. Polatin (Eds.), *Occupational Musculoskeletal Disorders: Function, Outcomes & Evidence* (pp. 629-637). Philadelphia: Lippincott, Williams & Wilkins.

Dexter, F. and D. H. Chestnut (1995). Analysis of statistical tests to compare visual analog scale measurements among groups. *Anesthesiology* 82(4), 896-902.

Dorwick, A. S., Gabbe, B.J., Williamson, O.D., & Cameron, P.A. (2005). Outcome instruments for the assessment of the upper extremity following trauma: a review. *Injury* (36), 468-476.

Dworkin, S. F., Von Korff, M. R., & LeResche, L. (1990). Multiple pains and psychiatric disturbance: An epidemiologic investigation. *Archives of General Psychiatry,* (47), 239-244.

Engel, G. L. (1959). "Psychogenic" pain and the pain-prone patient. *American Journal of Medicine*, 899-918.

Fairbank, J. C., Couper, J., Davies, J. B., & O'Brien, J. P. (1980). The Oswestry low back pain disability questionnaire. *Physiotherapy, 66*, 271-273.

Feise, R. J., & Menke, J. M. (2001). A new valid and reliable instrument to measure the magnitude of clinical change in spinal conditions. *Spine, 26*, 78-87.

Feuerstein, M., Berkowitz, S. M., & Peck, C. A. (1997). Musculoskeletal related disability in U.S. Army personnel: Prevalence, gender, and military occupational specialties. *Journal of Occupational and Environmental Medicine, 39*, 68-78.

Fishbain, D., Cutler, R. B., Rosomoff, H. L., & Rosomoff, R. S. (2000). What is the quality of the implemented meta-analytic procedures in chronic pain treatment meta-analyses? *The Clinical Journal of Pain, 16*(1), 73-85.

Fishbain, D. A., Goldberg, M., Meagher, B. R., Steele, R., & Rosomoff, H. (1986). Male and female chronic pain patients categorized by DSM-III psychiatric diagnostic criteria. *Pain, 26*, 181-197.

Fisher, K., & Johnson, M. (1997). Validation of the Oswestry low back pain disability questionnaire, its sensitivity as a measure of change following treatment and its relationship with other aspects of the chronic pain experience. *Physiotherapy Theory and Practice, 13*, 67-80.

Flor, H., & Turk, D. C. (1984). Etiological theories and treatments for chronic back pain: I. Somatic models and interventions. *Pain, 19*, 105-121.

Fordyce, W. (1976). *Behavioral Methods of Control of Chronic Pain and Illness*. St. Louis: Mosby.

Gallagher, E. J., Bijur, P. E., Latimer, C., & Silver, W. (2002). Reliability and validity of a visual analog scale for acute abdominal pain in the ED. *American Journal of Emergency Medicine, 20*, 287-290.

Gandek, B., Sinclair, S.J., Kosinski, M., Ware, J.E. Jr. (2004). Psychometric evaluation of the SF-36 survey in Medicare managed care. *Health Care Financial Rev* (25), 5-25.

Gardea, M. A., & Gatchel, R. J. (2000). Interdisciplinary treatment of chronic pain. *Current Review of Pain, 4*, 18-23.

Gatchel, R. J. (2001). A biopsychosocial overview of pre-treatment screening of patients with pain. *Clinical Journal of Pain, 17*, 192-199.

Gatchel, R. J. (2001). The hierarchy of clinical research studies. *The Spine Journal, 1*, 85-87.

Gatchel, R. J., & Epker, J. T. (1999). Psychosocial predictors of chronic pain and response to treatment. In R. J. Gatchel & D. C. Turk (Eds.), *Psychosocial Factors in Pain: Critical Perspectives* (412-434). New York: Guilford Publications, Inc.

Gatchel, R. J., & Gardea, M. A. (1999). Psychosocial issues: Their importance in predicting disability, response to treatment, and search for compensation. *Neurologic Clinics, 17*(1), 149-166.

Gatchel, R. J., Polatin, P., & Mayer, T. (1995). The dominant role of psychosocial risk factors in the development of chronic low back pain disability. *Spine, 20*(24), 2702-2709.

Gatchel, R. J., & Turk, D. C. (1996). *Psychological Approaches to Pain Management: A Practitioner's Handbook*. New York: Guilford Publications, Inc.

Gatchel, R. J. (2005). *Clinical Essentials of Pain Management*. Washington, DC: American Psychological Association.

Greenough, C. G., & Fraser, R. D. (1992). Assessment of outcome in patients with low back pain. *Spine, 17*, 36-41.

Grimm, L. G., Yarnold, P.R. (Ed.). (1998). *Reading and understanding multivariate statistics*. Washington, DC: American Psychological Association.

Gronblad, M., Hupli, M., & Wennerstrand, P. (1993). Intercorrelation and test-retest reliability of the Pain Disability Index and the Oswestry Disability Questionnaire and their correlation with pain intensity in low back pain patients. *Clinical Journal of Pain, 9*, 189-195.

Gureje, Von Korff, Simon, et al. (1998). Persistent pain and well-being: A World Health Organization study in primary care. *JAMA* 280, 147-151.

Guyatt, G., Walter, S., Norman, G. Measuring change over time: assessing the usefulness of evaluative instruments. *Journal of Chronic Diseases. 40(2):171-8, 1987.*

Hall, W. (1981). On ratio scales of sensory and affective verbal pain descriptors. *Pain* 11(1), 101-7.

Holmes, C. P., Gatchel, R.J., Adams, L.L., Stowell, A.W., Hatten, A., Noe, C., Lou, L. (2006). An opioid screening instrument: Long-term evaluation of the utility of the Pain Medication Questionnaire. *Pain Practice* 6(2), 74-88.

Hosmer, D.W. & Lemeshow, S. (1989). Applied logistic regression. NY; John Wiley & Sons.

IASP, International Association for the Study of Pain. (2007). IASP Pain Terminology. Retrieved June18, 2007, from http://www.iasp-pain.org/AM/Template.cfm?Section=General Resource_Links&Template=/CM/HTMLDisplay.cfm&ContentID=3058#Pain.

Joint Commission on Accreditation of Healthcare Organizations. (2000). *Pain Assessment and Management: An Organizational Approach.* Oakbrook, IL: Author.

Johansson, E., & Lindberg, P. (1998). Subacute and chronic low back pain: Reliability and validity of a Swedish version of the roland and morris disability questionnaire. *Scandinavian Journal of Rehabilitative Medicine*, 30, 139-143.

Kaplan, G.M., Wurtele, S.K., & Gillis, D. (1996). Maximal effort during functional capacity evaluations: an examination of psychological factors. *Arch Phys Med Rehab*, 77, 161-164.

Katon, W., Egan, K., & Miller, D. (1985). Chronic pain: Lifetime psychiatric diagnoses and family history. *American Journal of Psychiatry, 142*, 1156-1160.

Katz, N. (2002). The impact of pain management on quality of life. *Journal of Pain and Symptom Management,* 24, 38-47.

Kazis, L. E., Anderson, J. J., Meenan, R. F. (1989). Effect sizes for interpreting changes in health status. *MedicalCare, 27,* 178-189.

Kerns, R. D., Turk, D. C., & Rudy, T. E. (1985). The West Haven-Yale Multidimensional Pain Inventory. *Pain, 23*, 345-356.

Kopec, J. A. (2000). Measuring functional outcomes in persons with back pain. *Spine, 25*, 3110-3114.

Kopec, J. A., & Esdaile, J. M. (1995). Functional disability scales for back pain. *Spine, 20*(17), 1943-1949.

Kopec, J. A., Esdaile, J. M., Abrahamowicz, M., Abenhaim, L., Wood-Dauphinee, S., Lamping, D. L., et al. (1996). The Quebec Back Pain Disability Scale: Conceptualization and development. *Journal of Clinical Epidemiology, 49*, 151-161.

Lampe, A., Sollner, W., Krismer, M., Rumpold, G., Kantner-Rumplmair, W., Ogon, M., Rathner, G. (1998). The impact of stressful life events on exacerbation of chronic low-back pain. *Journal of Psychosomatic Research, 44*(5), 555-563.

Lawlis, G. F., Cuencas, R., Selby, D., & McCoy, C. E. (1989). The development of the Dallas pain questionnaire: an assessment of the impact of spinal pain on behavior. *Spine, 14*(5), 511-516.

Lazarus, R., & Folkman, J. (1984). *Stress, Appraisal, and Coping*. New York: Springer.

Leclaire, R., Blier, F., Fortin, L., & Proulx, R. (1997). A cross-sectional study comparing the Oswestry and Roland-Morris Functional Disability Scales in two populations of patients with low back pain of different levels of severity. *Spine (22)*, 68-71.

Linton, S. J., Nordin, E. (2006). A 5-year follow up evaluation of the health and economic consequences of an early cognitive behavioral intervention for back pain: a randomized, controlled trail. *Spine* (31), 853-858.

Loeser, J. D. (Ed.). (2001). *Bonica's Management of Pain (3rd Edition)* Lippincott Williams & Wilkins.

Ludington, E. & Dexter, F. (1998). Statistical analysis of total labor pain using the visual analog scale and application to studies of analgesic effectiveness during childbirth. *Anesthesia & Analgesia,* 87(3), 723-7.

Lynch, M. (2001). Pain as the fifth vital sign. . *Journal of Intravenous Nursing 24*(2), 85-94.

Mantha, S., R. Thisted, et al. (1993). A proposal to use confidence intervals for visual analog scale data for pain measurement to determine clinical significance. *Anesthesia & Analgesia* 77(5), 1041-7.

Matheson, L. N., Melhorn, J.M., Mayer, T.G., Theodore, B.R., Gatchel, R.J. (2006). Reliability of a visual analog version of the quickDASH. *Journal of Bone and Joint Surgery* (88), 1782-1787.

Mayer, T. G. (1999). Rehabilitation. What do we do with the chronic patient? *Neurologic Clinics of North America, 17*, 131-147

Mayer, T. G., Gatchel, R. J., & Polatin, P. B. (Eds.). (2000). *Occupational Musculoskeletal Disorders: Function, Outcomes and Evidence*. Philadelphia: Lippincott Williams & Wilkins.

Mayer, T. G., Prescott, M., & Gatchel, R. J. (2000). Objective outcomes evaluation: Methods and evidence. In T. G. Mayer, P. B. Polatin & R. J. Gatchel (Eds.), *Occupational Musculoskeletal Disorders: Function, Outcomes and Evidence* (pp. 651-667). Philadelphia: Lippincott Williams & Wilkins.

McCracken, L. M., Turk, D.C. (2002). Behavioral and cognitive-behavioral treatment for chronic pain: outcome, predictors of outcome, and treatment process. *Spine* 27(22), 2564-73.

McGeary, D. D., Mayer T.G., Gatchel R.J. (2006). High pain ratings predict treatment failure in chronic occupational musculoskeletal disorders. *Journal of Bone & Joint Surgery American Volume. 88*(2), 317-325.

Meldrum, M. L. (2003). A capsule history of pain management. *JAMA, 290*(18), 2470-2475.

Melzack, R. (1993). Pain: Past, present and future. *Canadian Journal of Experimental Psychology, 47*(4), 615-629.

Melzack, R., & Casey, K. L. (1968). Sensory, motivational, and central control determinants of pain: A new conceptual model. In D. Kenshalo (Ed.), *The skin senses* (pp. 423-443). Springfield: Thomas.

Melzack, R., & Wall, P. D. (1965). Pain mechanisms: A new theory. *Science, 50*, 971-979.

Merskey, H. (1979). Pain terms: a list with definitions and notes on usage. Recommended by the IASP subcommittee on taxonomy. *Pain, 6*, 249-252.

Million, R., Haavik-Nilsen, J., Jayson, M. I. V., & Baker, R. D. (1981). Evaluation of low back pain and assessment of lumbar corsets with and without back supports. *Annals of the Rheumatic Diseases, 40*, 449-454.

Morley, S., Eccleston, C., Williams, A. (1999). Systematic review and meta-analysis of randomized controlled trials of cognitive behaviour therapy and behaviour therapy for chronic pain in adults, excluding headache. *Pain* (80), 1-13.

Myles, P. S., S. Troedel, et al. (1999). "The pain visual analog scale: is it linear or nonlinear? *Anesthesia & Analgesia* 89(6), 1517-20.

N.A.C.H.D. (1997). *Guide to Assessing Yellow Flags in Acute Low Back Pain Patients*. Wellington, New Zealand: Ministry of Health.

National Center for Health Statistics (2006). With Chartbook on Trends in the Health of Americans. Hyattsville, MD, National Center for Health Statistics.

Nunnally, J. C. (1978). *Psychometric Theory*. New York: McGarw-Hill.

Philip, B. K. (1990). Parametric statistics for evaluation of the visual analog scale. *Anesthesia & Analgesia* 71(6): 710.

Philips, H. C., Grant, L., & Berkowitz, J. (1991). The prevention of chronic pain and disability: A preliminary investigation. *Behavioral Research and Therapy, 29*, 443-450.

Polatin, P. B., Kinney, R. K., Gatchel, R. J., Lillo, E., & Mayer, T. G. (1993). Psychiatric illness and chronic low-back pain. The mind and the spine--Which goes first? *Spine, 18*(1), 66-71.

Portenoy, R. K., Foley, K.M., Inturrisi, C.E. (1990). The nature of opioid responsiveness and its implications for neuropathic pain: new hypotheses derived from studies of opioid infusions. *Pain* (43), 273-286.

Ravani, P. (2005). Multidimensional Pain Inventory: Revised profile classification based on clinical observations in a pain setting. *Thesis*. University of Texas Southwestern Medical Center at Dallas.

Reisch, T., Thommen, M., Tschacher,W., Hirsbrunner, H.P. (2001). Outcomes of a cognitive-behavioral day treatment program for a heterogeneous patient group. *Psychiatric Services. 52*(7):970-2.

Rissanen, A., Alaranta, H., Sainio, P., & Harkonen, H. (1994). Isokinetic and non-dynamometric tests in low back pain patients related to pain and disability index. *Spine, 19*, 1963-1967.

Robinson, R. C. (2001). Psychometric testing: The early years of the MMPI. In R. J. Gatchel & J. N. Weisberg (Eds.), *Personality Characteristics of Chronic Pain Patients*. Washington, DC: American Psychological Association.

Roland, M., & Fairbank, J. (2000). The Roland-Morris disability questionnaire and the Oswestry Disability Questionnaire. *Spine, 25*, 3115-3124.

Roland, M., & Morris, R. (1983). A study of the natural history of back pain. Part I: Development of a reliable and sensitive measure of disability and low back pain. *Spine, 8*, 141-144.

Romano, J. M., & Turner, J. A. (1985). Chronic pain and depression: Does the evidence support a relationship? *Psychological Bulletin, 97*, 18-34.

Romano, J. M., Turner, J.A., Friedman, L.S., Bulcroft, R.A., Jensen, M.P., Hops, H., Wright, S.F. (1992). Sequential analysis of chronic pain behaviors and spouse responses. *Journal of Consulting & Clinical Psychology, 60*(5), 777-782.

Romano, J. M., Turner, J.A., Jensen, M.P., Friedman, L.S., Bulcroft, R.A., Hops, H., Wright, S.F. (1995). Chronic pain patient-spouse behavioral interactions predict patient disability. *Pain, 63*(3), 353-360.

Rosenthal, R., & Rosnow, R. L., (1991). *Essentials of behavioral research: Methods and data analysis* (2nd ed.). New York: McGraw Hill.

Rosnow, R. L., & Rosenthal, R. (1996). Computing contrasts, effect sizes, and counternulls on other people's published data: General procedures for research consumers. *Psychological Methods, 1*, 331-340.

Sharp, T. J. (2001). Chronic pain: a reformulation of the cognitive-behavioural model. . *Behaviour Research & Therapy, 39*(7), 787-800.

Stratford, P., & Binkley, J. (1997). Measurement properties of the RM-18: a modified version of the roland-morris disability scale. *Spine*, 22, 2416-2421.

Sternbach, R. A. (1974). *Pain Patients: Traits and Treatment*. New York, NY: Academic Press.

Taylor, S. J., Taylor, A. E., Foy, M. A., & Fogg, A. J. (1999). Responsiveness of common outcome measures for patients with low back pain. *Spine, 24*, 1805-1812.

Turk, D. C. (1996). Biopsychosocial perspective on chronic pain. In R. J. Gatchel & D. C. Turk (Eds.), *Psychological Approaches to Pain Management* (pp. 3-32). New York: Guilford Press.

Turk, D. C. (1999). Assessment of patients reporting pain: An integrated perspective. *The Lancet, 353*, 1784-1788.

Turk, D. C., & Flor, H. (1999). Chronic pain: A biobehavioral perspective. In R. J. Gatchel & D. C. Turk (Eds.), *Psychosocial Factors in Pain: Critical Perspectives* (pp. 18-34). New York: Guilford.

Turk, D. C., & Gatchel, R. J. (1999). Multidisciplinary programs for rehabilitation of chronic low back pain patients. In W. H. Kirkaldy-Willis & T. N. Bernard, Jr. (Eds.), *Managing Low Back Pain* (4th ed., pp. 299-311). New York: Churchill Livingstone.

Turk, D. C., Meichenbaum, D., & Genest, M. (Eds.). (1983). *Pain and Behavioral Medicine: A Cognitive-Behavioral Perspective*. New York: The Guilford Press.

Turk, D. C., & Monarch, E. S. (2002). Biopsychosocial perspective on chronic pain. In D. C. Turk & R. J. Gatchel (Eds.), *Psychological Approaches to Pain Management: A Practitioner's Handbook* (2nd ed.). New York: Guilford.

Turk, D. C., & Rudy, T. E. (1987). Towards a comprehensive assessment of chronic pain patients. *Behavioral Research and Therapy, 25*, 237-249.

Van Tulder, M. W., R. Ostelo, et al. (2001). Behavioral treatment for chronic low back pain: a systematic review within the framework of the Cochrane Back Review Group. *Spine* 26(3): 270-81.

Volinn, E., Van Koevering, D., & Loeser, J. (1991). Back sprain in industry: The role of socioeconomic factors in chronicity. *Spine, 16*(5), 542-548.

Von Korff, M., M. P. Jensen, et al. (2000). "Assessing global pain severity by self-report in clinical and health services research." *Spine* 25(24): 3140-51.

Waddell, G., Main, C. J., & Morris, E. W. (1984). Chronic low back pain, psychologic distress, and illness behavior. *Spine, 5*, 117-125.

Ware, J. E., Snow, K. K., Kosinski, M., & Gandek, B. (1993). *SF-36 Health Survey: Manual and Interpretation Guide*. Boston: The Health Institute, New England Medical Center.

Whitney, C.W., and Von Korff, M. (1992). Regression to the mean in treated versus untreated chronic pain. *Pain*, 50 (3), 281-285.

Woodwell, D.A. (2002). National Ambulatory Medical Survey: 1998 summary advanced data from vital and health statistics no.315. Hyattsville, MO: National Center for Health Statistics.

Wright, A. R., & Gatchel, R. J. (2002). Occupational musculoskeletal pain and disability. In D. C. Turk & R. J. Gatchel (Eds.), *Psychological Approaches to Pain Management: A Practitioner's Handbook* (2nd ed., pp. 349-364). New York: Guilford.

Zanoli G., Stromquvist B., Jonsson B. (2001). Visual analog scales for interpretation of back and leg pain in patients operated for degenerative lumbar spine disorders. *Spine,* 26: 2375-80.

VITAE

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