

CHRONIC WIDESPREAD PAIN IN PATIENTS WITH OCCUPATIONAL SPINAL
DISORDERS: PREVALENCE, PSYCHIATRIC COMORBIDITY, AND
ASSOCIATION WITH ONE-YEAR TREATMENT OUTCOMES

by

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ABSTRACT

CHRONIC WIDESPREAD PAIN IN PATIENTS WITH OCCUPATIONAL SPINAL DISORDERS: PREVALENCE, PSYCHIATRIC COMORBIDITY, AND ASSOCIATION WITH ONE-YEAR TREATMENT OUTCOMES

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Chronic Widespread Pain (CWP) is estimated to affect 4.1% - 13.5% of the general population. Compared to those who are pain-free or have localized pain, those with widespread body pain have been found to higher rates of psychiatric disorder, greater pain intensity, and greater disability. Treatment programs for CWP patients often have high drop-out rates and have only achieved modest results. The present study sought to compare demographic characteristics, psychiatric comorbidity, and one-year treatment outcomes of patients with chronic disabling occupational spinal disorders (CDOSDs) meeting criteria for CWP to those who fail to meet criteria. Within this CDOSD cohort (n = 2730), 32% of the patients (n=878) met criteria for CWP. Psychiatric evaluation revealed that the CWP groups had a higher prevalence of Major

Depressive Disorder and Anxiety Disorder, relative to the non-CWP group. For program completers, CWP was not associated with lower rates of program completion or less successful one-year socioeconomic outcomes. Additionally, logistic regression analysis identified variables that differentiated, with 83 % accuracy, between non-CWP and CWP patients.

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CHAPTER 1

INTRODUCTION

Chronic musculoskeletal pain is both prevalent and costly in industrialized nations. Most research in this area has focused on spinal disorders, in particular chronic low back pain. Beyond the problems associated with the physical injury, chronic spinal disorders are associated with high rates of physical and psychological comorbidities which significantly contribute to the disability of an injured person (Von Korff et al., 2005).

Previous research has demonstrated that in patients with chronic pain, those with pain in multiple pain locations have higher rates of psychopathology, greater disability, and greater pain intensity (Andersson, Ejlertsson, Leden, & Rosenberg, 1996). Consistent with the findings on patients with multiple pain sites, those meeting criteria for Chronic Widespread Pain (CWP) have been found to have high rates of psychopathology, psychosocial distress, and disability (Benjamin, Morris, McBeth, Macfarlane, & Silman, 2000; Clauw & Crofford, 2003; Macfarlane, Morris et al., 1999).

Despite extensive research on the efficacy of multidisciplinary rehabilitation for problematic conditions such as chronic spinal disorders, very few studies have evaluated it's efficacy within the CWP population. The few studies that have evaluated

the treatment of patients with CWP have provided only limited evidence that multidisciplinary rehabilitation programs are effective in treating these patients (Karjalainen et al., 1999). Unfortunately these studies have failed to use control groups and have not assessed long term outcomes such as work status. The current study addresses these limitations by comparing the 1-year treatment outcomes of chronic disabling occupational spinal disorder (CDOSD) patients meeting criteria for CWP versus those who fail to meet criteria who were treated in a tertiary level functional restoration program.

1.1 Chronic Musculoskeletal Pain

The cost and prevalence of chronic musculoskeletal pain and disability among industrialized nations have been well documented. Approximately \$27 billion is spent annually for the diagnosis and treatment of musculoskeletal injuries (Gatchel & Mayer, 2000). This figure excludes indirect costs associated with musculoskeletal pain and disability (e.g., work modification, retraining, and legal or other dispute costs) which have been estimated to exceed \$800 billion (Brady, Bass, Royce, et. al., 1997; National Safety Council, 2000; US Bureau of Labor Statistics, 1998a;, 1998b). During their careers, as many as 85% of adults will miss work and seek professional treatment for musculoskeletal pain (Fordyce, 1995; Nachemson, 1992; Waddell, 1996).

Although chronic musculoskeletal pain includes an array of anatomical locations, individuals with chronic spinal disorders (CSDs), predominately those with low back pain, have been the most extensively studied. Mayer, Gatchel, Mayer et al.

(1987) have deemed low back pain “the most expensive benign condition in America.” Chronic low back pain is the leading cause of disability in persons under the age of 45 and third in those over the age of 45 (Mayer & Gatchel, 1988). Since the chronic spinal disorder population is the focus of the current thesis, most of the emphasis will be on this group. An estimated 80 % of all adults experience back pain during their lifetime (Abraham & Snyder, 2001; Deyo, 1983). Approximately 80-90% of those who experience low back pain will recover within weeks of the injury, however 5-15% will not recover and will have prolonged or permanent disability (Seres & Newman, 1983). After factoring in long-term disability payments, this small group of individuals with chronic spinal disorders generates 90% of the cost of back pain treatment.

1.2 Theories of Pain

There have been dramatic changes in our understanding of what causes pain and what factors determine its intensity and duration. Theories of pain dating back to the 17th century philosopher Rene Descartes have traditionally viewed pain solely in terms of organic pathology. According to this biomedical model, other concomitants of pain such as depression and psychosocial disability were seen as epiphenomenon and assumed to dissipate when the injury had healed or illness was cured (Turk & Monarch, 2002).

Since Descartes time, it has become increasingly apparent that neither the presence of nor the degree of physiological pathology alone can account for all physical symptoms reported by the patient (Turk & Monarch, 2002). Beecher (1956) reported that there is no direct relationship between degree of tissue damage and severity of pain.

Others have found modest associations between physiological impairments and reported pain and disability (Flor & Turk, 1988; Waddell & Main, 1984). Furthermore, Fordyce (1997) notes that people differ in the way they are affected by injury; some function regardless of the degree of bodily damage while others are unable to function with little or no anatomical defects.

As a result of the inability of the biomedical model to account for these differences, it became increasingly evident that psychosocial factors play an important role in the development and onset of chronic pain. Engel (1959) hypothesized some patients were “pain prone,” and these patients exhibited personality factors such as history of defeat, unsatisfied aggressive impulses, and guilt, which predisposed these individuals to develop chronic pain. Engle also introduced the term “psychogenic pain” that describes pain for which no identifiable physiological basis could be found.

It is important to distinguish between the neurological event and the perception of pain. Nociception is nerve stimulation conveying information to the brain that there is tissue damage. Pain is the subjective perception of sensory information stemming from a nociceptive event, which is modulated by factors such as genetics, past experiences, and current mood state (Turk & Monarch, 2002). The first theory that attempted to integrate both psychological factors and physiological mechanisms was Melzack and Wall’s (1965) gate-control theory of pain. According to this theory, the dorsal horn of the spinal cord acts as a gate. Both physical and psychological factors can influence the opening and the closing of the gate, and therefore contribute to the intensity and duration of the perception of the pain experience.

In addition to physiological and psychological factors, social, occupational, and economic factors have also been found to play an important role in the onset and maintenance of pain. Mechanic (1966;1972) noted that the manner in which a patient responds to pain symptoms can be conceptualized as a function of social implications of the behavior, such as evading occupational responsibilities, receiving attention from a spouse, or receiving financial compensation. Fordyce (1976) placed these ideas within the perspective of operant conditioning. He suggested that pain behaviors such as limping may be maintained by reinforcement, such as positive reinforcement (e.g., financial compensation) and negative reinforcement (e.g., avoiding undesirable activities such as work). Socioeconomic and occupational factors such as low job satisfaction, lower socioeconomic class, lower educational level, and receiving compensation have been predictive of which individuals report an injury, develop chronic disability, and have poorer treatment outcomes (Bigos et al., 1991; Gatchel, Polatin, & Mayer, 1995; Moreno, Cunningham, Gatchel, & Mayer, 1991; Rohling, Binder, & Langhinrichsen-Rohling, 1995; Volinn, Van Koevering, & Loeser, 1991).

The first model to comprehensively account for these physiological, biological, affective, and social components of pain was the biopsychosocial model of pain proposed by Turk and Rudy (1987). According to their model, Turk and Rudy conceptualize these psychosocial factors as being independent and that interactions between these factors are both dynamic and reciprocal. This model suggests that psychosocial factors become increasingly important to the perpetuation of pain behavior and suffering as the pain becomes more chronic.

1.3 Acute Pain Versus Chronic Pain

Pain is a necessary although unpleasant experience in that it causes us to attend to an injury or to remove ourselves from a noxious stimulus. Pain can be classified as either acute or chronic, which is determined by the duration of the pain experience.

Acute pain is typically caused by a injury or disease process (Chapman, 1984) and usually dissipates in less than four months, which is the normal amount of time it takes for tissue and other bodily damage to heal. In a small percentage of patients, the pain persists longer than four months, becoming chronic.

To further the understanding of the transition from acute pain to chronic pain disability and associated distress, Gatchel (1991; 1996) developed a three stage model . In the first stage of Gatchel's model, the patient experiences emotions, such as fear or anxiety, that compels the individual to protect the injured area or to seek medical treatment. If the pain persists longer than the normal healing time, the person enters stage two.

During this stage, as a consequence of coping with the pain, the person experiences an exacerbation of behavioral and psychological problems such as anger, distress, and learned helplessness. Gatchel hypothesized that the nature of these problems is related to the persons pre-existing personality as well as environmental conditions and socioeconomic factors. This stage of the model parallels the diathesis-stress model (Levi, 1974) in which stress resulting from coping with the pain (stress) leads to the worsening of the persons' pre-existing psychological issues (diatheses). In the third stage the person adopts a "sick role," also known as a "disability conviction" (Aronoff,

Feldman, & Champion, 2000), in which the person absolves him/herself from occupational and social responsibilities.

1.4 Chronic Musculoskeletal Pain and Psychopathology

It has become increasingly evident that psychological factors play an important role in the etiology and maintenance of chronic pain. Studies have found that psychopathology may increase pain intensity and disability, perpetuating pain-related dysfunction (Hensing & Spak, 1998; Holzberg, Robinson, Geisser, & Gremillion, 1996). For example, anxiety has been found to reduce pain tolerance (Cornwall & Donderi, 1988; Kremer, Atkinson, & Ignelzi, 1981) and depression has been associated with both the magnification of medical symptoms (Katon, 1996) and poorer treatment outcomes (Burchiel et al., 1995; Burns, Johnson, Mahoney, Devine, & Pawl, 1998).

Early research on the relationship between chronic pain and psychopathology, conducted mostly on chronic low back pain patients in the 1980s, documented higher rates of anxiety, depression, and substance use disorders than in the general population (Fishbain, Goldberg, Meagher, Steele, & Rosomoff, 1986; Katon, Egan, & Miller, 1985; Magni, Caldieron, Rigatti-Luchini, & Merskey, 1990; Reich, Tupin, & Abramowitz, 1983). Although these studies took an important first step in evaluating psychopathology in these patients, a number of methodological flaws such as failing to use the Diagnostic and Statistical Manual of Mental Disorders (DSM) or basing diagnostic decisions on self-report questionnaires have limited their usefulness (Gatchel, 1996).

Later studies have addressed these limitations by using semi-structured interviews based on DSM diagnostic criteria. Reich, Rosenblatt, and Tupin (1983) recommended the use of the DSM in diagnosing psychopathology in chronic pain patients because it's multi-axial classification format allows for the consideration of both physiological and psychological components of chronic pain. The first two Axes of the DSM-IV (American Psychiatric Association, 1994) concern psychiatric disorders, with Axis I being used to diagnose major clinical disorders such as Mood Disorders, Anxiety disorders, Substance use disorders and Somatoform disorders. Axis II of the

DSM is used to diagnose Personality Disorders such as Borderline, Histrionic, and Narcissistic as well as mental retardation. Personality Disorders are diagnosed when personality traits are judged to be inflexible and stable, causing distress or impairments in social or occupational functioning (American Psychiatric Association, 1994). Although not used in this study, the DSM-IV includes three additional Axes that assess relevant medical conditions, psychosocial and environmental factors, and a global assessment of functioning.

Semi-structured interviews based on DSM criteria, such as the Structured Clinical Interview for DSM (SCID; (Spitzer, Williams, Gibbon, & First, 1988) allows direct comparisons of rates of psychopathology across studies (Gatchel, 1996). Studies using the SCID have found that patients with back pain have a higher prevalence of Axis I disorders such as Major Depressive Disorder (MDD), Anxiety, Substance Use disorders (abuse and dependence), and Pain disorder as well as higher prevalence of Axis II Personality Disorders compared to the general population (Dersh, Gatchel,

Polatin, & Mayer, 2002; Weaver & Schnoll, 2002). Within a cohort of patients with chronic musculoskeletal pain, Dersh, Gatchel, Polatin, and Mayer (2002) found that even when the diagnosis of pain disorder was excluded (which was nearly universal in this cohort), 64% of patients were diagnosed with at least one Axis I disorder. The most common Axis I disorder diagnosis was MDD with 55% of patients meeting criteria. The prevalence of psychiatric disorders in this sample is substantially higher than population estimates of 15.5% for at least one Axis I diagnosis and 2.2% for MDD (Regier et al., 1988).

Dersh and colleagues (2002) also found that 70% of patients met criteria for at least one Personality Disorder which is also substantially higher than the non-clinical population estimates ranging from 6% to 14% (Reich, Yates, & Nduaguba, 1989; Samuels, Nestadt, Romanoski, Folstein, & McHugh, 1994; Zimmerman, 1993; Zimmerman & Coryell, 1989). Nearly identical results were also found in a recent study with a cohort limited to patients with spinal disorders (Dersh, Gatchel, Mayer, Polatin, & Temple, 2006). Weisberg and Keefe (1997) have sought to explain the high prevalence PD's within chronic spinal pain population within a diathesis stress model. They hypothesized that people with personality patterns that are associated with marginally adaptive coping styles decompensate under the stress of injury, disability, and pain, which results in the expression of a Personality Disorder.

The SCID also allows the determination of a current and lifetime diagnosis as well as whether psychiatric symptoms were present before or subsequent to a particular pain episode (Gatchel, 1996). Several studies have attempted to provide answers to this

“chicken and egg question” of whether chronic pain or psychopathology comes first (Gatchel, 1991). There have been conflicting results from studies addressing this question with some studies suggesting chronic pain precedes psychopathology while others suggest chronic pain develops subsequent to psychopathology. Other studies suggest that both relationships do occur depending on the specific psychiatric illness; some psychiatric illnesses precede pain while other psychiatric illnesses develop subsequent to the onset of chronic pain. For example, Polatin, Kinney, Gatchel, Lillo, and Mayer (1993) found that in a sample of chronic low back pain patients, the onset of Anxiety and Substance Use disorders preceded the onset of chronic pain. They also found that the onset of MDD had an equal likelihood of either preceding or developing after the onset of chronic pain. More recently, Dersh, Mayer, Theodore, Polatin, and Gatchel (2007) found that, compared to the general population, the presence of least one Axis I disorder was higher in patients with chronic occupation spinal disorders for post-injury diagnoses but not for pre-injury diagnoses. Furthermore they found MDD and Opioid Dependence Disorder were more likely to occur post-injury, while other diagnosis such as anxiety disorder and alcohol abuse/dependence were more likely to be present before the injury.

Research has also investigated the differences between acute and chronic pain conditions in regard to the prevalence of psychiatric disorders. In a sample of low back pain patients, Kinney, Gatchel, Polatin, Forgarty, and Mayer (1993) found that patients with chronic pain, when compared to patients with acute pain, demonstrated higher

rates of MDD, substance abuse, and personality disorders. Acute pain patients on the other hand demonstrated higher rates of Anxiety disorders.

It is necessary to identify and treat psychopathology in chronic pain patients because, if left untreated, psychopathology can interfere with successful rehabilitation (Fishbain, Cutler, Rosomoff, & Rosomoff, 1998; Gatchel, 1996). For example, pre-surgical depression and anxiety have been found to be predictive of failure to return to work following lumbar surgery (Schade, 1999; Trief, 2000). Gatchel, Polatin, and Kinney (1995) found that in combination with other psychological variables, the presence of a Personality Disorder predicted which patients with acute low back pain would not return to work after six months.

Even when psychopathology is diagnosed and addressed, there is evidence that it may still be associated with less successful treatment outcomes. Burton, Polatin, and Gatchel (1997) found that the number of Axis I diagnoses, the presence of an Anxiety Disorder, and the presence of Borderline Personality Disorder were associated with lower rates of return to work. Mayer and colleagues (in press) found that a diagnosis of Opioid Dependence Disorder at the beginning of treatment was associated with lower rates of return to work and work retention as well as higher rates of health care utilization, despite patients' detoxification from opioid medications during treatment.

Research has also documented changes in psychopathology following intensive rehabilitation. For example, Owen-Saltars, Gatchel, Polatin, and Mayer (1996) found significant decreases in the prevalence of Pain Disorder and MDD. Vittengl, Clark,

Owen-Saltars, and Gatchel (1999) found reductions in the prevalence of Axis II disorders six months after completing the treatment program.

1.5 Functional Restoration

Practitioners treating chronic pain, particularly chronic spinal disorders, face many obstacles while attempting to rehabilitate these patients. Attempting to prevent further injury, these patients will often restrict physical activity which can result in de-conditioning and muscle atrophy further reducing mobility and function. In addition to physical problems, these patients may also face a multitude of socioeconomic obstacles that include family issues and employment related issues such as job satisfaction, relationship with the employer, and job demands.

Functional restoration (Mayer et al., 1985) is a method of tertiary rehabilitation that emphasizes a gain in function rather than a reduction in pain. It addresses the complex issues previously listed by incorporating an interdisciplinary team of professionals which includes medical doctors, a psychiatrist, a psychologist, an occupational therapist, nurses, and case managers to address each area of a patients' functioning. As described by Mayer, McGeary, and Gatchel (2004), functional restoration consists of three phases: the evaluative phase, the pre-intensive phase, and the intensive phase. In the evaluation phase, the patient is evaluated in terms of physical ability, mental health, and disability. Next a quantitative functional evaluation is done to measure the patients' range of motion and strength in the injured body part(s). The scores a patient receives are normalized according to gender, age, and body weight and then used as the starting point for treatment.

In the pre-intensive phase, the physical and occupational therapists implement stretching and mobilizing exercises and attempt to alleviate fear of movement and re-injury in preparation of the muscle-training portion of the program. Physicians help to regulate pain with anti-inflammatory analgesics. The psychological staff addresses psychological issues such as anxiety and depression by using techniques based on cognitive therapy principles. Disability managers address other obstacles such as financial difficulties, childcare, and transportation.

The intensive treatment phase focuses on strengthening the injured area and the rest of the body through quantitatively directed exercises which promotes the regaining of function lost due to physical inactivity. In addition to physical exercises, work simulation exercises tailored to the individuals' occupational profession are also provided. An important feature of the functional restoration program is that the patient is encouraged to take an active role in their treatment rather than being a passive recipient and is encouraged to complete progressively more difficult tasks.

Compared to other pain treatment programs that focus on symptom reduction (e.g., pain) or increasing subjective well being, functional restoration emphasizes quantitative gain in function, allowing the success of the treatment to be evaluated in terms of outcomes such as work status and number of visits to a new provider. The emphasis on returning the patient to work is an important component of rehabilitation programs. Catchlove and Cohen (1982) found that patients in treatment directing the patient to return to work had over twice the return to work rates than patients in a similar treatment program that did not include the return to work component.

In a series of prospective randomized design studies comparing functional restoration to no-treatment and two less intensive treatment programs, Bendix and colleagues found that functional restoration was superior for many of the outcome variables such as return to work, days of sick leave, and number of contacts with the health care system at four months (Bendix et al., 1996; Bendix, Bendix, Lund, & et al., 1997), one year (Bendix, Bendix, Lund, & et al., 1997), two years (Altmaier, Lehmann, Russell, Weinstein, & Kao, 1992), and five years (Bendix, Bendix, & Hastrup, 1998) after treatment. In both Mayer et al. (1985) and an independent replication by Hazard et al. (1989), patients who completed a functional restoration program, when compared to the non-treatment comparison group, had higher rates of return to work and settlement of workers' compensation claims as well as lower rates of additional surgeries to the original area, health care utilization, and recurrent injuries. Mayer et al. (1987) found that these outcomes were sustained two years later. Compared to other treatment programs, functional restoration has also been found to improve quality of life, decrease pain intensity, and to decrease work restrictions in patients with chronic low back pain (Huge et al., 2006; Hunter, Sharp, Denning, & Terblanche, 2006).

1.6 Chronic Widespread Pain

Chronic Widespread Pain (CWP) is defined by the American College of Rheumatology (ACR) as a combination of pain above and below the waist, on the left and right side of the body, and along the axial skeleton (Wolfe et al., 1990). It is the primary symptom of fibromyalgia (FM), which is diagnosed by meeting criteria for CWP for at least three months and the presence of at least 11 tender points from 18

specific areas of the body (Wolfe et al., 1990). CWP has been studied extensively in multiple population samples, with the prevalence in the general population reported to be between 11.2% and 13% in England (Croft, Rigby, Boswell, Schollum, & Silman, 1993; Macfarlane, Morris et al., 1999), 10.6% in the USA (Wolfe, Ross, Anderson, Russell, & Hebert, 1995), 10.2% in Israel (Buskila, Abramov, Biton, & Neumann, 2000), 13.5% in Germany (Schochat & Raspe, 2003), 7.3% in Canada (White, Speechley, Harth, & Ostbye, 1999), and between 4.1% and 11.4% in Sweden (Bergman et al., 2001; Kato, Sullivan, Evengard, & Pedersen, 2006; Lindell, Bergman, Petersson, Jacobsson, & Herrstrom, 2000).

The prevalence of CWP within the general population has been shown to increase with age and to be about 1.5 times higher in female than male subjects (Clauw & Crofford, 2003). There has been evidence of racial differences, at least among females, with African Americans having a higher prevalence of CWP while Caucasians had greater tenderness (Gansky & Plesh, 2007). Despite numerous studies on the general population, few studies have investigated the prevalence of CWP within specific clinical populations. In an internal medicine ward in Israel, 21% of subjects reported CWP, and 15% met criteria for fibromyalgia (Buskila et al., 2001). Macfarlane, Thomas, Croft, et al. (1999) found that 15% of subjects who presented with a new episode of back pain in a primary care facility also met criteria for CWP, while Natvig (2001) found 31% of people in the community who had low back pain also had generalized pain.

CWP appears to be an enduring phenomenon. More than half (56%) of those who met criteria continued to meet criteria at a one year follow-up (McBeth, Macfarlane, Hunt, & Silman, 2001; Papageorgiou, Silman, & Macfarlane, 2002), 57% at a three year follow-up (Bergman, 2005), and 34% at a seven year follow-up (Papageorgiou, Silman, & Macfarlane, 2002). Though the ACR definition of CWP was not used, Andersson (1996) found that subjects with pain in three or more anatomical locations were significantly less likely to be pain free at a 24-month follow-up than subjects with neck and shoulder pain only (5% recovery for the CWP group versus 37% recovery for the neck and shoulder group).

Research has documented several socioeconomic and occupational factors that are associated with CWP. Compared to no-pain and localized pain groups, CWP is associated with lower socio-economic status and lower educational level (Bergman, 2005), as well as being divorced or widowed (Hagen, Kvien, & Bjorndal, 1997; White, Speechley, Harth, & Ostbye, 1999). Additionally Mc Beth et al. (McBeth, Harkness, Silman, & Macfarlane, 2003) found that occupational factors such as high job demand (lifting, pushing, or pulling heavy weights), repetitive movement of the wrist, and kneeling, were predictive of the later development of CWP.

A number of studies have demonstrated a strong relationship between CWP and psychosocial factors, including depression, anxiety, and somatization (Andersson, Ejlertsson, Leden, & Rosenberg, 1996; Croft, Lewis, & Hannaford, 2003; Kato, Sullivan, Evengard, & Pedersen, 2006; McBeth & Silman, 1999; Ruiz Moral, Munoz Alamo, Perula de Torres, & Aguayo Galeote, 1997), catastrophizing cognitions

(Schochat & Raspe, 2003), and general psychosocial distress (Macfarlane, Morris et al., 1999). Subjects as young as 10 years old with CWP have demonstrated higher rates of depression than both non-CWP patients and no-pain control groups (Mikkelsen, Sourander, Piha, & Salminen, 1997). In a community sample of patients seeking medical care, Macfarlane, Morris, Hunt, et al. (1999) found that 25% of subjects meeting criteria for CWP had a mental disorder (primarily depression). Benjamin (2000) estimated that subjects with CWP were three times more likely to have a mental disorder than subjects who were pain-free or had failed to meet criteria for CWP. Though the ACR definition of CWP was not used, Dworkin (1990) found that elevated levels of depression, anxiety, and somatization went up incrementally with the number of painful body parts reported by people enrolled in a health maintenance organization. Manchikanti, Pampati, Beyer, and Damron (2002) found that patients with increased number of pain conditions had higher prevalence of Generalized Anxiety Disorder, Depressive Disorders, and Somatization Disorder.

Psychosocial factors, especially somatization, have been found to predict both the onset of CWP at a one-year follow-up in previously pain free subjects (McBeth, Macfarlane, Benjamin, & Silman, 2001) as well as the persistence of CWP at a one-year follow-up (McBeth, Macfarlane, Hunt, & Silman, 2001). Although there has not been any previous research on the relationship between CWP and Substance Use Disorders (Abuse and Dependence), studies have found that compared to those who are pain free patients or have localized pain, those with CWP had a much more frequent use of both anti-inflammatory and analgesic medications (Buskila, Abramov, Biton, & Neumann,

2000; Buskila et al., 2001). CWP has also been found to be associated with seldom or never drinking alcohol (Bergman, 2005).

Some authors have used a stricter definition of CWP, which has been termed the Manchester Definition (MacFarlane, Croft, Schollum, & Silman, 1996), for which the criteria is defined as pain in the axial skeleton and pain in contralateral limbs, with limb pain involving multiple painful areas. Compared to subjects being evaluated with the ACR definition of CWP, subjects who met the more restrictive criteria for the Manchester definition of CWP have demonstrated higher levels of depression, fatigue, and sleep disturbance (MacFarlane, Croft, Schollum, & Silman, 1996) and higher levels of emotional distress, hypochondriacal beliefs, somatic focus, and decreased levels of self-care (Hunt, Silman, Benjamin, McBeth, & Macfarlane, 1999). In evaluating perceived health status, Bergman (2005) found progressively worse scores on the SF-36 (a measure of health related quality of life) among groups with no chronic pain, non-CWP, ACR-CWP, CWP using the Manchester definition, and FM.

Compared to patients with localized pain, CWP patients report greater pain intensity, longer pain duration, and greater disability (Andersson, Ejlertsson, Leden, & Rosenberg, 1996). Natvig, Eriksen, and Bruusgaard (2002) found that low back pain was predictive of long-term work disability, 4 years later, only when it was accompanied by widespread musculoskeletal pain. Natvig, Rutle, Bruusgaard, and Eriksen (2000) found a linear decrease in functional status with an increase in the number of painful areas, even after adjusting for pain intensity and duration. Natvig, Bruusgaard, and Eriksen (2001) found that widespread pain was common in persons

reporting low back pain (31 %) and that these people with low back pain as a part of widespread pain had greater pain severity , longer pain duration, as well as greater functional disability. Additionally CWP, as well as localized low back pain, is associated with increased health care utilization in comparison to other pain conditions such as neck and/or shoulder pain or head ache/migraine.

CWP has been found to be associated with physical trauma. Previous research has shown that CWP and Fibromyalgia are usually preceded by low back pain (Muller, 1987). Another study found that 25% of patients with chronic low back pain went on to develop Fibromyalgia (Lapossy, Maleitzke, Hrycaj, Mennet, & Muller, 1995). Others have found that, compared to adults with lower extremity fractures, those with neck injuries had a 10-fold increased risk of developing Fibromyalgia within one year of their injury (Buskila, Neumann, Vaisberg, Alkalay, & Wolfe, 1997). Aaron, Laurence, Bradley and colleagues (Aaron et al., 1997) found that the physical trauma was a greater determinant of disability compensation for Fibromyalgia than perceived emotional trauma, symptom severity, or even functional disability. Despite these findings, many physicians believe that the role of the injury in CWP is less important than the role of the patient related factors (i.e. personality, mental health, and stress (White et al., 2000).

A large number of studies have examined non-pharmacological treatment interventions for CWP and FM. Clauw (2003) concluded that low impact aerobic exercise and cognitive behavioral treatments have been shown to be efficacious in the treatment of CWP and FM. Mannerkorpi (2003) reviewed 27 randomized control trial (RCT) studies of exercise and adjunctive treatments and found inconsistent results on

the benefits of physical exercise for patients with CWP, FM, and related disorders. Mannerkorpi concluded that low-intensity aerobic exercise can help to improve function, decrease self-reported symptoms, and reduce the number of tender points. There was some evidence that aerobic exercise combined with education and behavioral interventions, such as relaxation training, might be more effective than exercise alone. A review by Sim (2002) of 25 RCT studies in treatment of FM also found some support for moderate aerobic exercise, but, in general, they concluded that evidence for any single treatment intervention is relatively weak. They found that combined treatment approaches seemed to be more effective than single treatment approaches and recommended multidisciplinary treatment as the most efficacious.

Though multidisciplinary treatment for regional chronic pain disorders, such as low back pain, are widely used and have been shown to be more effective for increasing function and reducing pain than individual treatment modalities (Guzman et al., 2001), few studies have investigated multidisciplinary treatment for CWP and FM. In one study, a group of subjects with FM who completed an outpatient interdisciplinary treatment program made significant improvements in a number of areas including pain levels, depression, affective distress, and perceived sense of control at the conclusion of treatment and at a six month follow-up; however all outcome data was self-reported and there was no control group against which to compare the improvements of these patients (Turk, Okifuji, Sinclair, & Starz, 1998). Wennemer (2006) found improvements in a self-report measure of physical functioning, a number of range-of-motion (ROM) measures, and a six minute walking test in 20 subjects with FM who

completed a functionally oriented multidisciplinary rehabilitation program, though there was no six month or one year follow-up data reported. In a recent meta-analysis, Karjalainen et al. (1999) reviewed the effectiveness of multidisciplinary treatment for CWP and FM. Seven studies, which included a total of 1050 patients, met strict selection criteria, including randomized control trials (RCTs). The authors determined that the methodological quality of these seven studies was low. Based on this limited evidence, multidisciplinary treatments were found to be ineffective compared to reference interventions. The authors determined that no quantifiable benefit of multidisciplinary treatment was demonstrated for CWP patients.

1.7 Limitations of Previous Research

Despite the extensive literature on CWP, many questions remain unanswered. For example, there have been no previous studies assessing the prevalence of CWP within a chronic disabling occupational spinal disorder (CDOSD) population in tertiary level care. Furthermore, there is a lack of studies comparing interdisciplinary treatment outcomes assessed at one year post-treatment between patients with CDOSDs who meet criteria for CWP and those failing to meet criteria (non-CWP subjects). Though a number of studies have investigated low impact physical therapy interventions, few studied have investigated high intensity strength training in the treatment of CWP. A relationship has been found between Axis I disorders and CWP, but no previous studies have investigated the prevalence of and relationship between Axis II Personality Disorders and CWP.

1.8 Current Study/Hypothesis

The present study sought to evaluate the prevalence of CWP within a CDOSD patient sample. Additionally several predictions are made based on previous research: it is expected that the CWP group will on average be older in age, more likely be female, more likely work in a occupation with greater job demand (involve heavier lifting), and will self-report greater pain intensity and disability than the non-CWP group. Consistent with previous literature, it is also expected that the CWP will have a higher prevalence of Mood Disorders (particularly MDD) and Anxiety Disorders.

Although there has not been any previous research addressing the relationship between CWP and Substance Use Disorders, it is expected that the CWP group will have a higher prevalence than the non-CWP group. It is also expected that the CWP group will have a higher prevalence of Axis II Personality Disorders than the non-CWP group. It is also expected that the CWP group will have lower rates of Program Completion than the non-CWP group and will have poorer 1-Year treatment outcomes demonstrated by lower rates of return-to-work, work retention, settlement of workers compensation, and higher rates of healthcare utilization than the non-CWP group.

CHAPTER 2

METHOD

2.1 Subjects

Subjects in this study consisted of 2,730 patients with chronic occupational spinal disorders who consented to and began a prescribed course of treatment at the Productive Rehabilitation Institute of Dallas for Ergonomics (PRIDE), a tertiary rehabilitation referral facility that utilizes a functional restoration approach. This study included patients who completed the treatment program (“completers”; n = 2365) and those who failed to complete the program (“non-completers”; n = 365). Patients had to meet the following criteria to be admitted into the rehabilitation program: (1) Four or more months had elapsed since the work-related injury, (2) primary or secondary non-operative care had failed to resolve the chronic disability, (3) surgery was either not an option or had failed to restore function, and (4) the patient continued to experience severe functional limitations. Subjects in this study were 2,730 consecutive patients discharged from the treatment program within a time period from January 1992 through December 2002.

2.2 Measures

Dallas Pain Questionnaire. The Dallas Pain Questionnaire or Million Visual Analog Scale (MVAS) is a 15 item self-report of pain and disability that was developed by Million, Hall, Haavik-Nilsen, Jayson, and Baker (1981). A subject indicates his/her

response to each question by picking a point on a line representing a range of possible answers (scored 0 to 10 for each question). For instance, endpoints of the scale are “No Problems” to “Totally Cannot Work” for questions related to disability. Scores of zero to 39 indicate “mildly disabling” pain, 40 to 84 indicate “moderately disabling” pain, and 85 and above “severely disabling” pain.

Dallas Pain Drawing. The Dallas Pain Drawing is a measure of pain that presents the front and back of a person upon which patients mark the location(s) that the patient has experienced pain within the last seven days. Patients are also to indicate the intensity of the pain by picking a point on a line representing a range of possible answers from “no pain” to “worst pain possible,” located at the bottom of the page. Pain drawings have been the standard tool for assessing anatomical sites with pain for the determination of whether or not criteria for CWP has been met (Benjamin, Morris, McBeth, Macfarlane, & Silman, 2000; Croft, Rigby, Boswell, Schollum, & Silman, 1993).

Structured Clinical Interview for DSM-IV Non-Patient Version (SCID-NP). The SCID-NP (First, Spitzer, Gibbon, & Williams, 1995) is a semi-structured interview designed to assess the presence of current (i.e., during the past month) and lifetime (i.e., any time during entire lifespan) DSM Axis I psychiatric disorder, such as MDD, Anxiety Disorder, Substance Use Disorders. The questions are read to the patient by the clinician, and the clinician makes a diagnosis based on the responses. Differing slightly from a fully structured interview, subsequent follow-up questions may be asked to clarify a patients’ response to the question. This procedure allows the clinician to continue gathering relevant information until the diagnostic decision can be clearly

made. In sum, the semi-structured SCID-NP offers a balance between consistent procedures and flexibility that allows cross-study comparisons between different groups of researchers while also taking into account the clinical expertise of the evaluator.

Most of the SCID Axis I diagnoses demonstrated fair to excellent test-retest reliability kappa values (0.44 to 0.78), with only dysthymia having a kappa value within the poor range (0.35) (Zanarini et al., 2000). Previous versions of the SCID have demonstrated good test-retest reliability, with coefficients exceeding 0.60 for current and lifetime diagnoses in patient samples (Williams et al., 1992); there was an 82% and 86% agreement between raters for MDD and Generalized Anxiety Disorder, respectively (Riskind, Beck, Berchick, Brown, & Steer, 1987); and inter-rater agreement exceeding 0.70 for a number of the most commonly diagnosed disorders (Skre, Onstad, Torgersen, & Kringlen, 1991). Studies in which joint interviews or videotaped interviews were used to assess reliability reported inter-rater agreement ranging from 0.70 to 1.0 for particular diagnostic groups (Segal, Hersen, & Van Hasselt, 1994; Strakowski, Keck, McElroy, Lonczak, & West, 1995; Stukenberg, Dura, & Kiecolt-Glaser, 1990). Although widely used, few studies have investigated the validity of the SCID. However, the SCID was developed to be consistent with DSM-IV diagnostic criteria. In addition, Kranzler, Ronald, & Burleson (1995) found that diagnoses obtained using the SCID demonstrated superior validity when compared with the standard clinical interview in a sample of substance abusers.

Consistent with the methods for Dersh, Mayer, Theadore, Polatin, and Gatchel (2007), the SCID-NP evaluator determined whether each diagnosed Axis I psychiatric

disorder was present prior to the injury (pre-existing) or subsequent to the injury (post-injury). This information was derived from the knowledge of the date of the patients' compensable spine injury and careful questioning about when the onset of psychiatric symptoms began.

Structured Clinical Interview for DSM-IV Personality Disorders (SCID-II).

The SCID-II (First, Gibbon, Spitzer, Williams, & Benjamin, 1995) consists of a 120-item questionnaire that is completed by the patient followed by a structured evaluation in which the clinician follows up on any items related to a diagnosis approaching threshold. From the results of the self-report questionnaire and the structured interview, Axis II DSM Personality Disorder (PD) diagnoses are derived (i.e., Borderline, Narcissistic, and Antisocial). Although there may be concerns about false negative responses with the use of a self report questionnaire, Jacobsberg, Perry, & Frances (1995) found that the rates of false negatives were very low for all diagnoses, providing support for the validity of clinician only following up on items nearing threshold for meeting diagnosis. The inter-rater reliability and internal consistency of the SCID-II appear to be adequate with kappa values ranging from 0.48 to 0.98 for categorical diagnosis and internal consistency coefficients ranging from 0.71 - 0.94 (Maffei et al., 1997).

It should be noted that the DSM-IV versions of the SCID did not become available until 1995 (SCID-NP) and 1997 (SCID-II). Because the patient sample that will be evaluated in the present study had SCID evaluations from 1993 through 2002, some subjects were evaluated with previous versions of the SCID (i.e., SCID-NP;

(Spitzer, Williams, Gibbon, & First, 1989a) and SCID-II; (Spitzer, Williams, Gibbon, & First, 1989b). However, the diagnostic criteria for the mental disorders most relevant to chronic pain patients have remained extremely consistent from the DSM-III-R to the DSM-IV, resulting in great similarity between current and previous versions of the SCID.

PRIDE One-Year Interview. The PRIDE One-Year Interview is a semi-structured telephone interview (Mayer, Prescott, & Gatchel, 2000) conducted one year after the treatment program that assesses the following six outcome measures: 1) return to work, defined as working at any time post-treatment up until the one-year interview, 2) work retention, defined as working at the time of the follow-up interview, 3) health care utilization, defined as seeking out additional health care from a new provider or additional visits to the same provider beyond scheduled appointments, 4) additional surgeries to the original injured area; 5) recurrent injuries to the original area, and 6) status of workers' compensation claim.

2.3 Procedure

All patients received an initial evaluation consisting of a medical history, a physical examination, a psychological intake interview, a disability assessment interview, and a quantitative functional evaluation. The medically-directed functional restoration treatment program consists of quantitatively-directed exercise progression supervised by physical and occupational therapists in conjunction with a component of multimodal disability management. Multimodal disability management includes individual counseling, group therapeutics, and education focusing on disability

management, vocational reintegration, stress management, improvement in coping skills, and future fitness maintenance.

Within the first week of rehabilitation, all patients are given the following self-administered measures: Dallas Pain Drawing, a self-report instrument assessing anatomical pain locations as well as perceived pain intensity; Million Visual Analog Scale (MVAS), a visual analog questionnaire of disability; the Structured Clinical Interview for DSM-IV-Non-Patient Version (SCID-NP); and the Structured Clinical Interview for DSM-IV Personality Disorders (SCID-II). All patients were also administered an additional Dallas Pain Drawing and MVAS at the completion of the program in order to provide post-treatment information. In addition, one year after completion of the program, subjects were contacted and asked about health and socioeconomic outcomes using a structured telephone interview.

Patients were partitioned into two groups (CWP or non-CWP) according to information obtained from the Dallas pain drawing completed by patients at the beginning of the treatment program. CWP was determined according to ACR criteria (Wolfe et al., 1990): pain in the upper body, lower body, left side, right side, and axial spine. The non-CWP group consisted of CDOSD patients who failed to meet criteria for CWP. Pain location(s) were assessed from patients' Dallas Pain Drawing completed at the beginning of the treatment program.

Demographic information such as age, gender, years of education, pre-treatment surgery, marital status, race, job demand, region of spinal injury, number of spinal injuries, and legal representation status were gathered by various sources such as patient

interviews and referring doctors' notes. The patients' length of disability was determined by calculating the length of time (in months) between the date of the patients' injury and the date the patient entered the treatment program. Job demand (lifting requirements) was coded as follows: sedentary/light - lifting 0-15 pounds frequently or 0-25 pounds occasional, light/medium - lifting 16-25 pounds frequently or 26-50 pounds occasionally, medium/heavy – lifting 26-50 frequent or 51-100 pounds occasionally, and heavy/very heavy - lifting more than 50 pounds frequently or more than 100 pounds occasionally. Region(s) of compensable spinal region was coded as follows: cervical – injury limited to cervical region, lumbar and/or thoracic – injured area limited to lumbar or thoracic region or combination of both, multiple spinal – injury to cervical region and at least one (or both) lumbar or thoracic region, multiple musculoskeletal- injury to one or more spinal regions and at least one additional body area such as upper or lower extremities.

Psychiatric diagnoses were coded as dichotomous, patients either met criteria for a diagnosis or failed to meet criteria for both post-injury Axis I disorders and also Axis II disorders. The 1-Year socioeconomic outcomes, assessed by the semi-structured telephone interview, were also coded as dichotomous variables, for example patient either returned to work or failed to return to work.

2.4 Statistical Analysis

CWP was a dichotomous variable: the patient either met the criteria for CWP or failed to meet criteria for CWP. Prevalence of CWP in this cohort was presented using descriptive statistics. For categorical demographic variables: gender, job demand,

attorney retention, pre-treatment surgery, marital status, and race, a Chi-Square statistic was calculated to determine if there were any significant differences between the CWP and non-CWP groups. Odds-ratios were also reported (when appropriate) for effect size. For continuous demographic and psychosocial variables: age, years of education, number of compensable injured anatomical locations, pain intensity (pre and post-treatment), and MVAS (pre and post-treatment) independent samples *t-tests* were conducted to evaluate differences between the CWP and non-CWP groups and *Cohen's d* is reported for effect size.

Each psychiatric disorder was coded as a dichotomous variable for which a Chi-square statistic was calculated to determine any significant differences between the two groups and odds-ratios were also reported. For Program Completion status as well as each of the 1-Year outcomes a Chi-Square statistic was calculated to determine if there were any significant differences between the CWP and non-CWP groups.

To further distinguish between the CWP and non-CWP groups, a direct logistic regression was conducted on the pre-treatment variables (including both demographic variables and psychiatric diagnoses) to determine which combination of variables best differentiated between the non-CWP and CWP groups.

CHAPTER 3

RESULTS

3.1 Demographic and Pre-Treatment Characteristics

First, demographic and pre-treatment characteristic variables were evaluated in this study of CDOSD patients (n = 2370; see Appendix A). Within this cohort of CDOSD patients 32.2 % of the patients met ACR criteria for CWP. Significant differences between the CWP and non-CWP groups were found for gender, race, marital status, Pre-treatment MVAS, legal representation status, region of compensable spinal injury, and number of compensable injured anatomical locations. Compared to non-CWP patients, those with CWP had significantly greater scores on the MVAS at pre-treatment [Mean (SD) = 92.19 (24.07) vs. 98.07 (22.30)] and greater pain intensity [Mean (SD) = 6.56 (1.93) vs. 7.00 (1.82)]. Compared to the non-CWP group, the CWP group was 1.5 times (95% CI: 1.3, 1.7) more likely to be female and were 1.5 times (95% CI: 1.2, 1.9) more likely to retain an attorney. Additionally compared to non-CWP patients, those with CWP had greater number of compensable injured anatomical locations, [Mean (SD) = 1.28 (0.69) locations vs. 2.46 (1.03) locations]. Significant differences were found between the two groups for race and for the spinal region with compensable injury and these differences will be further explained in terms of the logistic regression. No significant differences were found between the two groups for age, years of education, length of disability, and pre-rehabilitation surgery.

3.2 Psychiatric Diagnoses

The association of Axis I Psychiatric Disorders and CWP is presented in Appendix B. Compared to the non-CWP group, the CWP group was 1.4 times (95% CI: 1.1, 1.6) more likely to have at least one Axis I Disorder. As predicted, compared to the non-CWP group, the CWP group was 1.4 times (95% CI: 1.2, 1.7) more likely to have at least one Mood Disorder. For specific Mood Disorders, the CWP was 1.5 times (95% CI: 1.2, 1.7) more likely to have MDD than non-CWP. Compared to the non-CWP group, the CWP group was 1.5 times (95% CI: 1.1, 2.2) more likely to have at least one anxiety disorder, though no significant differences were found for any of the specific Anxiety Disorders. Contrary to expectation, no significant differences were found between the two groups for any of the Substance Use disorders. Additionally no significant differences were found between the two groups for any of the Axis II Personality Disorders (see Appendix C).

3.3 Program Completion Status and 1-Year Treatment Outcomes

At least partial outcome data was available for 93.5 % (n = 2552) of the cohort. No significant differences were found between the two groups in providing 1-year outcome data $\chi^2 (1, n = 2730) = .016, p = .901$. Appendix D presents the association of CWP with one-year socioeconomic and health outcomes. No significant differences were found between the two groups for completion status. (48.7 % vs. 57.7 %; $\chi^2 = 1.34(1), p = .257$). For program completers (n = 2365) the CWP group self-reported greater pain intensity at post treatment Mean (SD) = 4.66 (2.24) vs. 5.00 (2.11), $p < .001$ and greater disability on the MVAS at post-treatment, Mean (SD) = 62.67 (30.56)

vs. 69.74 (28.11), $p < .001$. For 1-year outcomes no significant differences were found between the two groups for return to work, work retention, healthcare utilization, additional surgeries to the original area, additional injuries to the original area, or workers compensation claim status.

3.4 Prediction of Group Membership

The ability of the variables to predict CWP or non-CWP group membership was examined using a logistic regression. A direct logistic regression analysis was performed on CWP as outcome and nine predictor variables consisting of the variables significantly different between the CWP and non-CWP groups in the univariate analysis: gender, marital status, race, region (s) of compensable spinal injury, legal representation status, pre-treatment MVAS score, pre-treatment pain intensity, post-injury MDD, and post-injury Anxiety Disorder. Although significant in univariate test, the variable number of compensable injured anatomical sites was excluded from the analysis because it was highly correlated ($r = .81$) with region(s) of compensable spinal injury. There was no evidence that multicollinearity was a problem between these factors. A test of the full model with all nine predictors against a constant-only model was statistically significant $\chi^2 (15) = 949.63$, $p < .001$, indicating that the predictors, as a set, reliably distinguished between non-CWP and CWP patients. The Nagelkerke R-Square of this model was .545.

A reduced model was derived from the variables that significantly predicted CWP group membership and included the following variables: region(s) of spinal

injury, race, marital status, and pre-treatment MVAS. A test of the reduced model against a constant-only model was statistically significant $\chi^2 (10) = 945.68, p < .001$ though it was not significantly different from the full model $\chi^2 (5) = 3.95, p = .556$. The overall classification success rate was 82.6 %. The sensitivity of this model was 80.9 % while the specificity was 83.4 %. The Hosmer & Lemeshow Goodness of Fit Test was not significant $\chi^2 (8) = 6.01, p = .646$ indicating that the model did fit the data. Appendix E presents the regression coefficients, Wald statistics, and odds-ratios (with 95% confidence intervals) for each of the four variables. For each one unit increase in pre-treatment MVAS score there is a 1.4 % increase in odds of meeting criteria for CWP. Those with compensable injuries to multiple spinal regions or multiple musculoskeletal areas have increased odds (Approximately 73 and 7 respectively) of meeting criteria for CWP than those who have an injury limited to the cervical spinal region. Compared to those with an injury restricted to the cervical spinal region, those with lumbar only injury have odds reduced by a factor of .498. Additionally compared to Caucasians, Hispanics are at increased odds (by a factor of 1.9) of meeting criteria for CWP. Compared to those who are single, those who are married have reduced odds, by a factor of .662, of meeting criteria for CWP

CHAPTER 4

DISCUSSION

The current study sought to further understand the CWP population. Specifically, the main objectives of the current study were to examine the prevalence of CWP within a CDOSD population in tertiary level care and to assess interdisciplinary treatment outcomes for those meeting criteria and those failing to meet criteria for CWP. In addition, the current study examined the relationship between CWP and various psychiatric disorders (i.e., Axis I and Axis II disorders). Finally, this research sought to identify the variables most valuable in predicting group membership in CWP and non-CWP groups.

4.1 Demographic and Pre-Treatment Characteristics

Thirty-two percent of the patients in this cohort met criteria for CWP which is substantially higher than the population estimates which range from 11-14 % (Croft, Rigby, Boswell, Schollum, & Silman, 1993; Macfarlane, Morris et al., 1999; Wolfe, Ross, Anderson, Russell, & Hebert, 1995) and is also higher than reported within an Israeli internal medicine ward in which CWP was reported by 21% of the patients (Buskila et al., 2001). This current sample is remarkably consistent with Natvig et al. (2001) in which 31% those reporting low back pain also had widespread pain.

Univariate analysis replicated previous findings for the association of CWP with several of the demographic variables including female gender

(Clauw & Crofford, 2003), being more likely to retain an attorney (White & Harth, 1999), and self-reporting greater disability (Andersson, Ejlertsson, Leden, & Rosenberg, 1996). As expected the CWP group also had a significantly higher number of injured anatomical sites. Additionally, significant differences were found between the two groups for race, marital status, and region(s) of compensable spinal region which will be discussed in terms of the logistic regression. Job demand, years of education, length of disability, pre-rehabilitation surgery, and pain intensity were not found to have a greater association with CWP than CDOSD.

4.2 Psychiatric Diagnoses

Next, the association between CWP and post-injury psychiatric Axis I disorders was examined. As found with previous research on CDOSD patients, there was a high prevalence of post-injury Axis I disorders in these CDOSD patients (Dersh, Gatchel, Mayer, Polatin, & Temple, 2006; Von Korff et al., 2005). A significantly higher percentage of the CWP group had at least one Axis I Disorder than the non-CWP group. In terms of Mood Disorders, consistent with previous studies, the CWP group had a significantly higher prevalence of Mood Disorders with the most prevalent being MDD (Benjamin, Morris, McBeth, Macfarlane, & Silman, 2000; Dworkin, Von Korff, & LeResche, 1990; Macfarlane, Morris et al., 1999). Dysthymia and Bipolar were very rare in this cohort and were not found to be significantly associated with CWP.

Consistent with previous research, the CWP group had a significantly higher prevalence having at least one Anxiety Disorder (Dworkin, Von Korff, & LeResche, 1990), though it was not found to be associated with any of the specific Anxiety Disorders. Although there have been no previous studies on the relationship between CWP and Substance Abuse and Substance Dependence Disorders, several studies have indicated that CWP patients more frequently use analgesic drugs than patients with localized pain (Buskila, Abramov, Biton, & Neumann, 2000; Buskila et al., 2001). Consistent with Dersh, Mayer, Theodore, Polatin, and Gatchel (2007) the prevalence of post-injury drug and alcohol abuse was extremely low in CDOSD patients. The prevalence of Drug Dependence was high for both groups, mostly due to opioid dependence. Despite evidence in the general population of increased analgesic drug use in those with CWP, there was no evidence that CWP patients had a higher prevalence of Substance Use Disorders than non-CWP patients. Although previous research has consistently demonstrated a strong association between CWP and Somatization (McBeth, Macfarlane, Benjamin, & Silman, 2001) (McBeth, Macfarlane, Hunt, & Silman, 2001), this relationship was not found in this cohort. Somatoform Disorders, other than Pain Disorder are rarely diagnosed in CDOSD patients as a result of the nearly universal diagnosis of Pain Disorder, which limited the ability to evaluate the two groups in terms of other Somatoform Disorders (Dersh, Gatchel, Mayer, Polatin, & Temple, 2006; Dersh, Gatchel, Polatin, & Mayer, 2002).

4.3 Program Completion Status and One-Year Treatment Outcomes

It has been suggested that patients with CWP and related disorders should be treated differently than other chronic pain populations. Specifically it has been suggested that physical therapy treatments for CWP be limited to low-level interventions and avoid high-impact weight training (Clauw & Crofford, 2003; Mannerkorpi & Iversen, 2003). Additionally, drop-out rates (Mannerkorpi & Iversen, 2003) and poorer treatment outcomes (Wolfe et al., 1997) are common among CWP patients undergoing intensive physical therapy. Some have even concluded there is no evidence that multidisciplinary treatment is effective for treating CWP (Karjalainen et al., 1999). Results from the present study provide evidence against these postulations. The CWP group completed the treatment program and performed just as well on one-year outcomes as the non-CWP group.

Socioeconomic and health outcomes were assessed for both groups one year after completion of the treatment program. Despite having significantly higher levels of perceived pre-treatment disability, greater pre-treatment pain intensity, and a higher number of injured anatomical sites, the CWP group did not have lower completion rates nor poorer treatment results in terms of return-to-work, work retention, or healthcare utilization one-year post treatment. Furthermore there were no differences between the two groups for new surgeries or new injuries to the original area. Despite having a higher percentage of attorney retention before treatment, the CWP group did not

significantly differ from the non-CWP group in terms of settlement status of the workers' compensation claim at the one-year follow-up. These findings are surprising since the majority of the research literature suggests an inability to treat many of these patients.

4.4 Prediction of Group Membership

Results from the logistic regression were surprising. Some of the most consistent predictors of CWP (e.g. female gender, pain intensity, older age, and depression) found in previous research were not found to be significant predictors of CWP versus non-CWP status. Although previous research has demonstrated the importance of psychosocial variables in the development and maintenance of CWP, as well as other pain conditions, these results highlight the importance of the injury related variables (e.g. location and number of injured areas). Those with compensable injuries to multiple spinal regions or multiple musculoskeletal areas have increased odds (by factors of 73 and 7 respectively) of meeting criteria for CWP than those who have an injury limited to the cervical spinal region. This suggests that CDOSD patients with compensable injuries in several locations of the body CWP were at much greater odds of having CWP. It is important to keep in mind that compensable injured anatomical sites is independent of the Dallas pain drawing, which includes any pain that may or may not be related to the injury, from which determination of CWP criteria was satisfied.

Compared to those with an injury restricted to the cervical spinal region, those with lumbar only injury have reduced odds of meeting criteria for CWP. These findings

lend support to previous findings demonstrating that patients with cervical injuries are at increased odds of developing CWP (Buskila, Neumann, Vaisberg, Alkalay, & Wolfe, 1997). Previous studies have demonstrated that those that have multiple painful anatomical sites, generalized pain in addition to low back pain, or meet criteria for CWP self-report greater disability than those who are pain-free or have localized pain (Andersson, Ejlertsson, Leden, & Rosenberg, 1996; Natvig, Bruusgaard, & Eriksen, 2001; Natvig, Rutle, Bruusgaard, & Eriksen, 2000). Consistent with these findings, those reporting greater self-reported disability at pre-treatment were at increased odds of meeting criteria for CWP.

As found in previous research, some differences were found for race and marital status. Compared to Caucasians, Hispanics are at increased odds (by a factor of 1.9) of meeting criteria for CWP consistent with Gansky (2007). The increased odds of meeting criteria for CWP for Hispanics may result from confounding environmental factors such as lower socio-economic status or living in compromised housing areas which have been found to be associated with CWP (Bergman, 2005). Compared to those who are single, those who are married have reduced odds of meeting criteria for CWP. This may be explained by studies that have demonstrated that CWP is associated with having lower social support (Bergman, 2005). Previous studies have found a similar relationship between marital status and CWP, though they found that it was associated with being divorced or widowed (Hagen, Kvien, & Bjorndal, 1997; White, Speechley, Harth, & Ostbye, 1999).

4.5 Directions for Future Research

One of the notable strengths of the current study is the interdisciplinary nature of the treatment program whereas previous studies utilized more specialized treatment programs. By taking an interdisciplinary approach to treatment, the current research provides support for Turk and Rudy's (1987) postulation that pain treatment must integrate psychological factors with physical components. It is possible that the treatment outcomes for the CWP group are comparable to those outcomes of the non-CWP group due to concurrently addressing the psychosocial factors connected with the injury (e.g., fear of re-injury).

It is not clear why Functional Restoration was effective in treating CWP patients when other interdisciplinary programs employing similar types of treatment such as cognitive behavioral techniques, physical therapy, and occupational therapy have failed. As described in Karjalainen et al. (1999) the treatment programs in previous investigations are poorly described, limiting the ability to determine what component(s) included in Functional Restoration are lacking in other interdisciplinary programs treating CWP. It may be possible that other interdisciplinary programs might lack a strong return to work directive. The importance of a strong return to work directive is evident in Catchlove and Cohen (1982), where a program lacking a strong return to work directive resulted in dramatically lower return to work rates than a program including a strong return to work directive, even though the programs were identical in all other aspects. Future research should investigate further what may be lacking in other less successful interdisciplinary programs.

Additionally, previous research has indicated that localized pain, CWP, and Fibromyalgia lie on a continuum of increasing psychological distress and disability (Jacob & Zeev, 2006; Macfarlane, 1999). It is unknown if patients who meet a more stringent criteria of CWP (such as the Manchester definition) or criteria for Fibromyalgia would have poorer completion rates or poorer 1-year outcomes than patients with CDOSD's. Future studies should explore this possibility.

4.6 Conclusions

The implications of this research within the clinical field are noteworthy. This thesis has demonstrated that individuals with CWP can not only complete an intensive interdisciplinary treatment program but can also benefit from these programs, as assessed by one-year outcomes, contrary to Karjalainen (1999). This study also provides more detailed information about the CDOSD population by looking specifically at those who meet criteria for CWP and those who do not. Consistent with previous findings, CWP was associated with a higher prevalence of MDD, Anxiety Disorder, higher pain intensity, and greater self-reported disability. Despite the implications of previous research, meeting the ACR threshold criteria for CWP was not found to be associated with poorer treatment outcomes compared to patients failing to meet threshold criteria in patients with CDOSDS. Although studies have found certain demographic and psychosocial variables to be predictive of CWP, within this cohort, the variables predictive of CWP were region(s) of spinal injury, pre-treatment MVAS scores, race, and marital status.

APPENDIX A

DEMOGRAPHIC CHARACTERISTICS OF STUDY PATIENTS

Variables % (n)	NON-CWP 67.8 % (1852)	CWP 32.2 % (878)	χ^2 or t	df	p-value	O.R. (95% CI) or Cohen's d
Age in years (SD)	42.29 (9.81)	42.96 (9.83)	-1.66	2728	.096	NS
Gender [% Female (n)]	36.8 (682)	46.2 (406)	22.03	1	< .001	1.5 (1.3, 1.7)
Race [% (n)]			9.94	3	.019	N/A
Caucasian	64.5 (1194)	60.6 (532)				
African-American	14.6 (271)	18.6 (163)				
Hispanic	17.7 (327)	18.7 (164)				
Other	3.2 (60)	2.2 (19)				
Marital Status [% (n)]			10.20	3	.017	N/A
Single	13.1 (191)	13.1 (88)				
Married	62.7 (916)	56.8 (382)				
Separated/Divorced	23.0 (336)	27.9 (188)				
Widowed	1.2 (18)	2.2 (15)				
Job Demand [% (n)]			7.50	3	.058	N/A
Light	10.5 (182)	13.3 (111)				
Light/Medium	25.7 (445)	26.2 (218)				
Medium/Heavy	37.6 (652)	38.2 (318)				
Heavy/Very heavy	26.2 (455)	22.3 (186)				
# Injured Areas (SD)	1.28 (0.69)	2.46 (1.03)	-35.39	2728	< .001	<i>d</i> = 1.35
Spinal Region [% (n)]			1309.38	3	<.001	N/A
Cervical Only	8.9 (164)	2.5 (22)				
Lumbar/Thoracic	75.3 (1394)	14.9 (131)				
Multiple Spinal	1.6 (29)	46.8 (411)				
Multiple Musc.	14.3 (265)	35.8 (314)				
Yrs of Education (SD)	11.59 (3.00)	11.80 (3.07)	-1.49	2102	.136	Ns
LOD mths (SD)	16.03 (22.90)	14.75 (17.63)	1.46	2723	.145	NS
Pre-surgery [% (n)]	30.4 (546)	27.3 (231)	2.60	1	.107	NS
Pre-Pain Intensity(SD)	6.56 (1.92)	7.00 (1.82)	-5.51	2655	.000	<i>d</i> = 0.21
Pre-MVAS (SD)	92.19 (24.07)	98.07 (22.30)	-6.03	2660	<.001	<i>d</i> = 0.23
Attorney Ret. [% (n)]	18.7 (313)	25.9 (209)	16.93	1	< .001	1.5 (1.2, 1.9)

APPENDIX B

ASSOCIATION OF CWP WITH POST-INJURY DSM AXIS I DIAGNOSES

Variables	NON-CWP 68 % (1430)	CWP 32 % (664)	χ^2	df	p-value	O.R. (95% CI)
Axis I Disorder (exc. Pain)	56.6 (809)	63.9 (424)	9.93	1	.002	1.4 (1.1, 1.6)
Mood Disorders	48.7 (696)	57.7 (383)	14.74	1	<.001	1.4 (1.2, 1.7)
MDD [% (n)]	48.1 (688)	57.5 (382)	16.10	1	<.001	1.5 (1.2, 1.8)
Dysthymia [% (n)]	0.1 (1)	0.0 (0.0)	.465	1	.496	NS
Bipolar [% (n)]	0.4 (6)	0.3 (2)	.167	1	.683	NS
Anxiety Disorders	5.5 (79)	8.1 (54)	5.19	1	.023	1.5 (1.1, 2.2)
Panic Disorder [% (n)]	2.4 (35)	3.6 (24)	2.26	1	.133	NS
GAD [% (n)]	1.7 (24)	1.8 (12)	0.05	1	.833	NS
PTSD [% (n)]	1.0 (15)	2.1 (14)	3.73	1	.054	NS
Substance Use Disorders	17.5 (250)	15.1 (100)	1.91	1	.167	NS
Abuse						
Alcohol [% (n)]	0.8 (11)	0.2 (1)	3.05	1	.081	NS
Drug † [% (n)]	0.3 (4)	0.0 (0)	1.86	1	.173	NS
Opioid [% (n)]	0.3 (4)	0.0 (0)	1.86	1	.173	NS
Dependence						
Alcohol [% (n)]	1.1 (16)	0.6 (4)	1.28	1	.258	NS
Drug † [% (n)]	15.9 (228)	14.5 (96)	0.77	1	.382	NS
Opioid [% (n)]	15.4 (220)	14.2 (94)	0.54	1	.464	NS
Somatoform (exc. Pain)	0.8 (11)	0.2 (1)	3.05	1	.081	NS
Somatization	0.3 (4)	0 (0)	1.86	1	.173	NS
† includes opioid						

APPENDIX C

ASSOCIATION OF CWP WITH AXIS II DIAGNOSES

Variables [% (n)]	NON-CWP 68.7 (1432)	CWP 31.3 (652)	χ^2	df	p-value	O.R. (95% CI)
Axis II [% (n)]	64.1 (918)	66.4 (433)	1.04	1	.307	NS
Paranoid [% (n)]	26.9 (385)	27.8 (181)	.173	1	.677	NS
Schizoid [% (n)]	2.2 (31)	1.5 (10)	0.93	1	.336	NS
Schizotypal [% (n)]	3.8 (54)	4.6 (30)	0.78	1	.372	NS
Antisocial [% (n)]	5.0 (71)	3.4 (22)	2.64	1	.104	NS
Borderline [% (n)]	27.0 (387)	24.1 (157)	2.02	1	.156	NS
Histrionic [% (n)]	13.5 (194)	15.8 (103)	1.86	1	.173	NS
Narcissistic [% (n)]	12.2 (174)	14.4 (94)	2.05	1	.152	NS
Avoidant [% (n)]	11.7 (167)	10.6 (69)	0.52	1	.471	NS
Dependent [% (n)]	6.1 (87)	5.2 (34)	0.61	1	.436	NS
OCD [% (n)]	15.3 (219)	16.9 (110)	0.84	1	.360	NS

APPENDIX D

ASSOCIATION OF CWP WITH ONE-YEAR TREATMENT OUTCOMES

Variables [% (n)]	NON-CWP 68.2 (1614)	CWP 31.8 (751)	χ^2	df	p-value	O.R. (95% CI)
Return to Work [% (n)]	87.6 (1276)	85.8 (574)	1.28	1	.257	NS
Work Retention [% (n)]	80.7 (1172)	79.5 (526)	0.46	1	0.5	NS
Seeking Healthcare from New Provider [% (n)]	24.8 (373)	26.2 (181)	0.49	1	0.49	NS
New Surgeries [% (n)]	3.0 (45)	2.6 (18)	0.26	1	0.68	NS
New Injury [% (n)]	2.5 (36)	2.4 (16)	0.01	1	0.90	NS
Claim Settled [% (n)]	94.8 (1451)	93.1 (661)	2.72	1	0.10	NS

APPENDIX E
PREDICTIVE MODEL OF CWP

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.	
							Lower	Upper
Constant	-2.956	.409	52.21	1	.000	.052		
PREANLG	.014	.003	20.457	1	.000	1.014	1.008	1.020
Cervical *			526.321	3	.000			
Lumbar	-.697	.276	6.391	1	.011	.498	.290	.855
Multiple Spinal	4.296	.342	157.593	1	.000	73.409	37.537	143.565
Multiple Musculoskeletal Caucasian *	1.912	.271	49.741	1	.000	6.768	3.978	11.515
African American			15.511	3	.001			
Hispanic	.331	.177	3.491	1	.062	1.393	.984	1.971
Other	.628	.177	12.562	1	.000	1.873	1.324	2.651
Single *	-.363	.408	.790	1	.374	.696	.313	1.548
Married			11.839	3	.008			
Divorced/ Separated	-.412	.151	7.478	1	.006	.662	.493	.890
Widowed	.067	.164	.168	1	.682	1.069	.776	1.473
	.545	.372	2.147	1	.143	1.724	.832	3.573

* Indicates Reference Group

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BIOGRAPHICAL INFORMATION

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