DEVELOPMENT, RELIABILITY, VALIDITY, AND UTILITY OF THE FEAR-AVOIDANCE COMPONENTS SCALE (FACS) IN A CHRONIC MUSCULOSKELETAL PAIN DISORDER (CMPD) POPULATION

by

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Presented to the Faculty of the Graduate School of

The University of Texas at Arlington in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

THE UNIVERSITY OF TEXAS AT ARLINGTON

May 2015

Acknowledgements

First, I would like to thank Dr. Robert Gatchel for all his help through the 5 years it has taken me to get to this point. He has been patient with me as I “learned the ropes” and has challenged me and helped me grow into the competent researcher I am today. His trust in my decision-making has been appreciated, and I feel confident that I will be able to manage a lab of my own in the future. I would also like to thank Dr. Tom Mayer at PRIDE; his gruff criticisms and rare praise have been a driving force in my pursuit for excellence. And many thanks to my other committee members: Dr. Angela Liegey-Dougall, Dr. Shannon Scielzo, and Dr. Jared Kenworthy. All have provided thoughtful guidance in the preparation of this manuscript.

Next, I would like to thank all of my colleagues, both graduate students and PRIDE faculty, whom I have worked with throughout my PRIDE career and who have contributed to this manuscript. Of particular note is Randy Neblett, my writing partner on more than 15 projects. His patience and attention to detail as he examined every draft of every manuscript has been incredible! In addition, I would like to thank Sali Asih: without her friendship, support, and camaraderie, I may not have made it through the program. She is an exceptional woman whose dedication to PRIDE and her graduate work is unfailing. I would also like to thank Yoheli Perez for her help understanding PRIDE’s ever-changing vault of physical functioning data, Mark Williams for putting up with endless data query requests, Keith Davis for his help unraveling all unusual data, and both Paula Boyd and Tami O’Pry for their management of PRIDE’s day-to-day publication support. I could not have juggled the role of senior student without them. I would also like to thank all the ladies in the chart-room for putting up with our data pulls for this project, and for Dr. Howard Cohen for allowing us access to his patient data.

The undergraduates who have made this project possible should not be forgotten either. Thank you to Jose Cervantes, Skyler Vasquez, Adrian Albenoza, Nicole Nyguen, and McKenna Bradford (graduate student) for their time pulling charts and entering data at PRIDE, and thank you to Minsok Koo and Summer Haddad for helping with literature searches and reference management. These men and women have volunteered large amounts of their time to help me, and it has not gone unnoticed.

Lastly, I would like to thank my parents, Tami and Larry Hartzell, and my fiancé, Cameron Dodd, for all their love and support in this endeavor. My parents taught me to persevere, even when things get tough, and to always strive for my best. I would not be pursuing my terminal degree without them. And without Cameron, I probably would have starved to death, having forgotten to eat during the stressful days, or gone completely insane. I am blessed to have him in my life.

March 30, 2015

Abstract

DEVELOPMENT, RELIABILITY, VALIDITY, AND UTILITY OF THE FEAR-AVOIDANCE CHARACTERISTICS SCALE (FACS) IN A CHRONIC MUSCULOSKELETAL PAIN DISORDER (CMPD) POPULATION

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Fear-avoidance (FA) is a negative coping style where patients avoid physical and social activities out of fear that their pain may increase or that they may re-injure themselves. Although fear-avoidance often increases in chronic pain patients, and is an important predictive factor of rehabilitation outcomes, few questionnaires are designed to systematically evaluate all components of fear-avoidance, especially in a Chronic Musculoskeletal Pain Disorder (CMPD) population. Therefore, the purpose of this study is to develop and validate a new patient-reported outcome (PRO) measurement of fear-avoidance, entitled the Fear-Avoidance Components Scale (FACS) in three separate populations: CMPD, psychiatric chronic pain, and a normative sample. The FACS was found to be reliable ($r \geq .90$, $\alpha = \geq .91$) and valid. The five severity levels developed [Subclinical (0-20); Mild (21-40); Moderate (41-60); Severe (61-80); and Extreme (81-100) related well to objective lifting performance ($p \leq .03$), as well as the Tampa Scale for Kinesiophobia, a well-known FA measure, and additional PROs measuring perceived disability, insomnia, depressive symptoms, pain intensity, somatization, injustice, coping styles, and the likelihood of being diagnosed with a central sensitivity syndrome ($p \leq .01$),

all of which were posited to relate well to FA. In addition, admission demographics, occupational, and psychiatric diagnoses were examined, and the FACS was used to predict the one-year outcomes of work return and work retention successfully ($p \leq .05$). Factor analysis supported the *a priori* subscales of pain-related anxiety, activity avoidance, and victimization.

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Chapter 1

Introduction

When someone experiences a painful medical condition or injury, there are many ways he or she can cope. Some may use adaptive techniques, such as utilizing social support and confronting the situation, while others may use more maladaptive techniques. One such maladaptive coping style is fear-avoidance (FA), which occurs when patients avoid activities of daily living, either physical or social, because they are afraid of their pain. Although fear-avoidance may be considered adaptive on a short-term basis because it prevents further tissue damage and injury exacerbation, it may quickly become an undesirable coping style. Fear-avoidance is associated with many negative outcomes, such as disrupted cognitive processing of pain, an increase in depressive symptoms, catastrophizing, pain intensity, somatization, and patient-reported disability, and a decrease in physical activity and function. The latter is particularly concerning, since decreasing physical activity often creates a negative cycle, with pain increasing further due to deconditioning (loss of muscle mass and nerve coordination). Deconditioning may lead to further avoidance of physical activity which contributes to even more pain and deconditioning.

While individuals without current pain show a modicum of fear-avoidance, it is more prevalent in people with chronic pain. Fear-avoidance may even prolong to the patient's disability. It is therefore imperative to study fear-avoidance in chronic pain populations. Although several studies have examined specific chronic pain populations such as those with fibromyalgia, arthritis, or specific musculoskeletal disorders, such as knee or cervical disorders, almost no studies have been done on a Chronic Musculoskeletal Pain Disorder (CMPD) population as a whole. The CMPD population is unique for several reasons: patients typically have a longer length of disability and the majority was injured at work and may still have open worker's compensation (WC) cases or law suits that may act as barriers to recovery.

In light of these significant differences between a CMPD population and typical chronic pain populations, it is crucial that CMPD populations are studied, and although many different measures of fear, avoidance, and fear-avoidance together exist, few are tailored for CMPD patients. Current measures, such as the Tampa Scale for Kinesiophobia (TSK) (R. P. Miller, Kori, & Todd, 1991), the Fear-Avoidance Beliefs Questionnaire (FABQ) (Waddell, Newton, Henderson, Somerville, & Main, 1993), and the Pain Anxiety Symptoms Scale (PASS) (L. M. McCracken, Zayfert, & Gross, 1992), although designed for chronic pain, are not appropriate in a CMPD population, as they either do not address occupational injuries or the occupationally-focused questions are biased and/or redundant. Additionally, many of the existing measures of FA have lower psychometric properties than desired or have inconsistent or absent cut-off scores. This makes them less useful in the clinical setting, as severity score ranges provide more information. . It appears that the literature calls for a new measure of fear-avoidance, which will hopefully correct the above-mentioned flaws and yield a measure more appropriate for CMPD patients.

The purpose of the present study, therefore, was to design, implement, and evaluate a new measure of fear-avoidance, the Fear-Avoidance Components Scale (FACS) in CMPD, chronic psychiatric pain disorder, and normative samples.

Chapter 2

Chronic Pain

2.1 Prevalence of Chronic Pain

Chronic pain, defined as pain that lasts for three or more months, is a major problem worldwide. The World Health Organization estimates that 20% of individuals have some form of chronic pain (Turk & Swanson, 2007), and pain may account for up to 80% of all physician visits (Gatchel, Peng, Peters, Fuchs, & Turk, 2007). More specifically, musculoskeletal pain from overuse injuries affects 33% of adults and accounts for 29% of lost workdays (International Association for the Study of Pain, 2009b), and has become such a large issue that the International Association for the Study of Pain (IASP) declared 2009-2010 as the Global Year against Musculoskeletal Pain. It has been estimated that 54-80% of Americans suffer from spinal pain at some point in their lives (Manchikanti, Singh, Datta, Cohen, & Hirsch, 2009), and the one-year prevalence rates in Europe are between 36-65%, depending on the country (Asklöf et al., 2014).In the United States, occupational musculoskeletal injuries are highly prevalent and account for higher costs to the healthcare system than any other type of occupational disorder (Hernandez & Peterson, 2012).

Two of the most common types of chronic occupational musculoskeletal injuries are chronic low back pain (CLBP) and chronic cervical pain. New National Institute of Health (NIH) Pain Consortium guidelines defined CLBP as “a back pain problem that has persisted at least 3 months and has resulted in pain on at least half the days in the past 6 months” (Deyo et al., 2014a; Deyo et al., 2014b). Forty-five percent of musculoskeletal injuries occur in the lumbar spine (Hernandez & Peterson, 2012), and there is an 80% lifetime prevalence for acute low back pain. Of the 80% that experience at least one episode of acute low back pain, 10-15% will develop CLBP, and this small percentage of patients accounts for approximately three-quarters of the total direct and indirect medical care costs and indirect lost productivity costs (Balagué, Mannion, Pellisé, & Cedraschi, 2012; Fourney et al., 2011). These numbers indicate it is important to understand what factors influence the transition from acute or subacute low back

pain to CLBP. Fear-avoidance may be one factor impacting transition, and it is imperative more research be done (Wertli, Rasmussen-Barr, Weiser, Bachmann, & Brunner, 2013). Low back pain has been noted as the most frequent occupational problem in high income countries, and the most frequent activity-limiting problem in younger populations (Hoy et al., 2010).

Another common chronic musculoskeletal disorder is chronic cervical pain. Up to 50% of the general population will experience neck pain in any given year (Hogg-Johnson et al., 2008). Occupational cervical disorders are ubiquitous, and limit workplace activities as they tend to increase the amount of time away from work (Cassou, Derriennic, Monfort, Norton, & Touranchet, 2002; Côté et al., 2009). The prevalence of occupational neck pain ranges between 13-85%, depending on the field. Higher prevalence rates of occupational cervical disorders are found in office and computer workers (Eltayeb, Staal, Hassan, & de Bie, 2009; Gerr et al., 2002; B. N. Green, 2008; Korhonen et al., 2003; Wahlström, Hagberg, Toomingas, & Wigaeus Tornqvist, 2004) and dentists (Côté et al., 2009; M. Hayes, Cockrell, & Smith, 2009). Cervical disorders are even more common in those populations who have experienced whiplash – up to 60% of those who have whiplash develop chronic cervical pain (International Association for the Study of Pain, 2009a). Even more alarming: the rate of reoccurrence for cervical disorders is as high as 50-85% (Haldeman, Carroll, Cassidy, Schubert, & Nygren, 2009).

2.2 Cost of Chronic Pain

The cost of spinal disorders in the United States is estimated to be between $261 and $300 billion dollars, based upon calculations for both direct and indirect costs. Direct costs include medical care due to pain (Gaskin & Richard, 2011), such as physician services, medical devices, pharmaceuticals, hospital services, and diagnostic testing. Physical therapy, inpatient services, drugs and physician care account for the largest amount of money spent on direct medical costs (Dagenais, Caro, & Haldeman, 2008). Indirect costs include the calculation of lost wages, disability days, fewer hours worked (Gaskin & Richard, 2011), and the loss of household productivity that occurs when an individual cannot complete routine chores, such as cooking and

cleaning (Dagenais et al., 2008). Since chronic spinal pain is widespread, and treatment costs are high, it is important to continue research.

Many Americans suffering from chronic musculoskeletal pain were injured at work. The Department of Labor reported 34 cases of musculoskeletal disorders per 10,000 full-time workers in 2010, which increased 4% from 2009. Musculoskeletal disorders accounted for 29% of all workplace injuries and illnesses requiring time off from work in 2010, and soreness and pain accounted for 11% of total cases (Bureau of Labor Statistics, U.S. Department of Labor, 2011). It is estimated that the costs associated with lost work days and compensation for occupational musculoskeletal disorders range from $13 billion to $20 billion per year (Gatchel & Mayer, 2000).

2.3 Treatment of Chronic Pain

The first line of treatment for musculoskeletal injury is primary care, which takes place in the acute injury phase. The main goal of primary rehabilitation is to control pain and prepare the body for proper healing. Therapy includes medications such as acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, or the use of opioids (as a last resort). In addition, physical agents such as ultrasound, heat, cold, or electrical simulation may be used in the short term. If patients do not respond to primary rehabilitation, or if the injury is severe enough, patients proceed to secondary rehabilitation. Secondary rehabilitation is used in the postacute phase of injury. The goals of secondary rehabilitation include: prevention of physical deconditioning, medication habituation, and adverse psychological reactions. It also includes mobilization and strengthening of the injured area; and restoration of function once initial pain symptoms have subsided. Therapy during secondary rehabilitation consists primarily of physical therapy, although psychosocial interventions, surgery, and multidisciplinary care may be useful for a subset of patients.

Tertiary rehabilitation is only necessary in a minority of patients (10%) (T. G. Mayer & Polatin, 2000), as it is reserved for patients with chronic injuries who do not respond favorably to primary or secondary rehabilitation and for whom surgical interventions are not an option. Two types of tertiary rehabilitation are available: palliative pain management and multidisciplinary

rehabilitation. Palliative pain management focuses on pain reduction, usually through the use of narcotics, and helps patients accept a non-functional lifestyle; the goal of palliative care is not to rehabilitate the patient to a functional state but rather to ease the patient's pain. Multidisciplinary approaches are used to address the multitude of physical, psychosocial, and socioeconomic barriers to recovery. One of the most frequent barriers to rehabilitation at the tertiary level is physical deconditioning. Deconditioning happens when inactivity and disuse of the injured body part leads to a general loss of function, which becomes progressively worse as the amount of disuse and immobilization increases (T. G. Mayer & Polatin, 2000). The effects of deconditioning may include stiff, hypomobile joints, muscle atrophy, loss of endurance, tightening of connective tissues, inhibition of neural outflow, loss of cardiovascular fitness, and increased muscle spasms (T. G. Mayer & Gatchel, 1988).

It is essential that tertiary rehabilitation programs include quantification of physical functioning, psychosocial assessment, and address the patient needs in relation to the disability system. Without these three components, it is difficult to effectively rehabilitate patients (T. G. Mayer & Press, 2003); (T. G. Mayer, Gatchel, Porter, & Theodore, ; T. G. Mayer & Polatin, 2000).

2.4 Functional Restoration

One of the most effective tertiary rehabilitation programs is the functional restoration program (FRP). The FRP is an intensive interdisciplinary rehabilitation program based on a sports medicine approach that emphasizes return of patient function and productivity rather than pain reduction as its primary goal. The FRP is a biopsychosocial treatment consisting of a medically-supervised, quantitatively-directed exercise progression combined with a multi-modal disability management program (MDMP). The components of MDMP include cognitive-behavioral therapy, stress management/biofeedback training, education, and vocational reintegration (T. G. Mayer & Gatchel, 1988).

The FRP is highly efficacious. Of the 3, 500 patients who have entered a specific FRP, at the Productive Rehabilitation Institute in Dallas for Ergonomics (PRIDE), almost all have returned to work, with more than half returning to the same employer (Kolata, 2004). More recently, the

work return rate for the years 2004-2008 averaged 93%, and work retention rates averaged 84%, compared to the average 29% of patients who are working upon admission to the program (Productive Rehabilitation Institute of Dallas for Ergonomics,). PRIDE has been effective for all manner of disorders, including fibromyalgia (FM) (Hartzell et al., 2014; Howard et al., 2010), cervical disorders (Hartzell, Mayer, Asih, Neblett, & Gatchel, 2013; T. G. Mayer, Anagnostis, Gatchel, & Evans, 2002; Wright, Mayer, & Gatchel, 1999), lumbar disorders (Beaudreuil et al., 2010; T. G. Mayer et al., 1987; Roche et al., 2007; Shirado et al., 2005), and lower (T. G. Mayer, Choi, Howard, & Gatchel, 2013) and upper extremity disorders (Howard, Mayer, & Gatchel, 2012). Functional Restoration is being used in many different countries around the world, including Denmark (Bendix, Bendix, Busch, Jordan, & Bendix, 1996), Germany (Pfingsten, Hildebrandt, Leibing, Franz, & Saur, 1997), Canada (Corey, Koepfler, Etlin, & Day, 1996), France (Jousset et al., 2004), and Japan (Shirado et al., 2005).

Chapter 3

Fear-Avoidance History and Theory

3.1 Distinguishing between Fear and Anxiety

Although fear and anxiety are similar constructs, they differ in several important ways (Blanchard & Blanchard, 1990), and statistically, their constructs do not completely overlap (Carleton & Asmundson, 2009). It is also important to note that the presentation of pain-related fear or anxiety appears different in individuals who are pain-free in comparison to those individuals with chronic pain (G. J. G. Asmundson, Collimore, Bernstein, Zvolensky, & Hadjistavropoulos, 2007; Crombez, Eccleston, Baeyens, & Eelen, 1998a; Crombez, Eccleston, Baeyens, & Eelen, 1998b; L. M. McCracken, 1997). The following sections will help the reader distinguish between the concepts of fear, kinesiophobia, and anxiety, including anxiety sensitivity.

3.1.1 Fear

Fear is described as a basic or pure emotion (Izard, 1992), while anxiety is not. Fear is generally described as a reaction to a more present-oriented, immediate threat. It is an emotive state that is associated with current nociceptive stimulation, such as pain from a dental procedure. It is thought that fear is the emotional manifestation of the fight or flight response produced by the sympathetic nervous system (SNS), which generates visceral responses such as increased heart rate, respiration, and blood flow to the major muscle groups (McNeil et al., 2001).

Fear is multidimensional, with cognitive/verbal, physiological, and behavioral dimensions (Hugdahl, 1981). The cognitive fear dimension includes thoughts of danger, threat, or death, and the purpose of these thoughts is to increase attention to the threat and to begin preparation for action against the threat. Cognitions may determine how well we can cope (Lazarus & Folkman, 1984) with a threat and may determine the degree of our fear response (G. J. G. Asmundson, Norton, & Vlaeyen, 2004). The physiological response, as discussed above, is the activation of the fight or flight SNS response. The behavioral response allows us to engage in defensive behavior, including fight or flight responses, passive coping behaviors such as inaction, and

active coping behaviors, such as neutralizing the threat. Escape/defensive behavior in response to pain includes either disengaging from the pain-inducing activity or trying to modify the behavior in some way (such as bracing or limping). While these behaviors help in the short term, in the long-run they are typically maladaptive. These 3 dimensions of fear can interact with each other, often increasing the fear response. For instance, in anxiety disorders such as panic disorder, physiological arousal often increases cognitive fear, and thus fear overall (G. J. G. Asmundson et al., 2004). Physiological arousal can also be misinterpreted as evidence of pain or injury (al Absi & Rokke, 1991; Weisenberg, Aviram, Wolf, & Raphaeli, 1984), and may actually produce symptoms such as muscle tension that may aggravate damaged tissue and thus increase pain (Flor, Birbaumer, Schugens, & Lutzenberger, 1992).

Pain appears to be a fundamental fear (Taylor, 1993), meaning that many other fears can logically be broken down to the essential element of fear of pain. It is thought that pain-related fear may be a key diathesis for disabling chronic pain (Carleton & Asmundson, 2009), with fear directed at either the noxious stimuli or an object or activity that has been associated with the pain. A subset of pain-related fear is termed kinesiophobia, which is the specific fear of movement that is excessive, irrational, and debilitating. Kinesiophobia often leads to feelings of vulnerability to painful injury or reinjury (Kori, 1990).

3.1.2 Anxiety

Anxiety, although similar to fear, is thought to be oriented in the future, not the present, and occurs in response to anticipated threats that may be vague or uncertain, rather than actual, present and immediate threats (like fear) (G. J. G. Asmundson et al., 2004). However, anxiety is similar to fear in that it has cognitive, physiological, and behavioral components. It is believed, though, that anxiety requires a larger cognitive component and less of a physiological element (Barlow, 2002; McNeil et al., 2001). This physiological element may be seen through a state of preparation that is induced with anxiety and makes it easier to act should a fight or flight reaction be required, which is why the symptoms of fear and anxiety, such as increased heart rate and muscle tension, are so similar (Kleinknecht, 1986). Anxiety also differs from fear because the

behaviors induced in response to the perceived threat are more likely to be preventative behaviors rather than defensive action behaviors (Blanchard & Blanchard, 1990). These preventative behaviors can include avoidance, which shows how pain-related anxiety can influence the Fear-Avoidance Model (FAM).

Pain-related anxiety serves as a protective function initially, since without any anxiety in regards to pain, one might not avoid situations that truly should be avoided (Carleton & Asmundson, 2009). It seems that if a person naturally has higher pain-related anxiety, when exposed to pain, he or she will be more likely to respond with higher pain-related fear. If this happens too frequently, the response of pain-related fear may become overlearned and it led to more pathology (Carleton, Asmundson, Collimore, & Ellwanger, 2006).

3.1.3 Anxiety Sensitivity

Another closely related concept to pain-related anxiety is anxiety sensitivity. Anxiety sensitivity is a personality trait that is defined as the fear of anxiety-related sensations (Reiss, Peterson, Gursky, & McNally, 1986; Taylor, 1999). If one is high in anxiety sensitivity, then he or she interprets the physical sensations of anxiety as harmful, and if one is low in anxiety sensitivity, then these same signals may be interpreted as unpleasant, but not usually threatening (Keogh & Asmundson, 2004). Having high levels of anxiety sensitivity is related to increased pain intensity and negative coping skills, such as catastrophizing. Individuals high in anxiety sensitivity may take more analgesic medications (G. J. Asmundson & Norton, 1995).

Some theorists feel that pain-related anxiety and/or pain-related fear are closely related to anxiety sensitivity (G. J. Asmundson & Taylor, 1996; G. J. Asmundson, Norton, & Veloso, 1999; G. J. Asmundson, Norton, & Norton, 1999; McNeil & Rainwater, 1998; Muris, Vlaeyen, Meesters, & Vertongen, 2001; Muris, Vlaeyen, & Meesters, 2001; Zvolensky, Goodie, McNeil, Sperry, & Sorrell, 2001), especially since treatment for anxiety sensitivity has been effective in reducing fear of pain (L. M. McCracken et al., 1992; L. M. McCracken, Gross, Aikens, & Carnrike, 1996; L. M. McCracken, 1997; Watt, Stewart, Lefaivre, & Uman, 2006). It has been postulated that anxiety sensitivity may even help develop fear of pain (G. J. Asmundson et al., 1999;

Greenberg & Burns, 2003). Anxiety sensitivity and pain-related anxiety/fear differ in several ways. While anxiety sensitivity includes somatic sensations that can be misinterpreted as problematic or exhilarating (for example, a rapid heartbeat), the sensation of pain is almost always noxious (Carleton & Asmundson, 2009). However, pain-related anxiety is most likely continuous in nature, while anxiety sensitivity is more dichotomous; those with more anxiety sensitivity show clear pathology (Bernstein et al., 2006; Bernstein, Leen-Feldner, Kotov, Schmidt, & Zvolensky, 2006).

3.2 History of Fear-Avoidance

It seems that pain has always been a part of the human experience, yet it is so complex that it is still a prevalent research topic today. One component of pain that has only relatively recently come into the spotlight is fear of pain. Although researchers as early as the 1940s found that anxiety, pain, and the avoidance that follows may be related (Marks, 1969; Paulett, 1947; Rowbotham, 1946; Spear, 1967), the role of anxiety and fear in the development and maintenance of chronic pain was never theorized or studied. While many people credit Lethem (Lethem, Slade, Troup, & Bentley, 1983) with the first model of fear-avoidance, it was in fact Fordyce that created the first model (Fordyce, 1976; Fordyce, Shelton, & Dundore, 1982).

Fordyce (1982) examined pain responses through a learning perspective, and found that people learned avoidance of pain through operant conditioning. This provides a short-term benefit, as it reduces the likelihood that people will re-injure themselves and gives the initial damage time to heal. However, sometimes, through reinforcement, this avoidance behavior will continue. People may receive positive reinforcement, such as increased attention to themselves and their injuries, or perhaps negative reinforcement, such as reduced responsibilities at work and home. This reinforcement maintains the avoidance behavior. This theory was later expanded upon by Linton (Linton, Melin, & Gotestam,), who believed that both the operant conditioning model discussed above and classical conditioning played a role in FA. For instance, neutral stimuli such as bending over may become classically conditioned to be associated with pain, and thus by itself will elicit fear, although pain may not be present.

These 2 basic theories were expanded upon by Lethem and colleagues (Lethem et al., 1983). Their new model of FA, entitled the Exaggerated Pain Perception Model, theorized that the psychosocial context of pain, including life events leading up to the current painful experience, personal internalized fear of pain, personality, pain history, and knowledge of pain coping strategies, would then lead to one of 2 consequences: confrontation, which is the ability or desire to continue one's normal activities, and avoidance of one's normal activities. Lethem's FA model is shown in Figure 3.1.

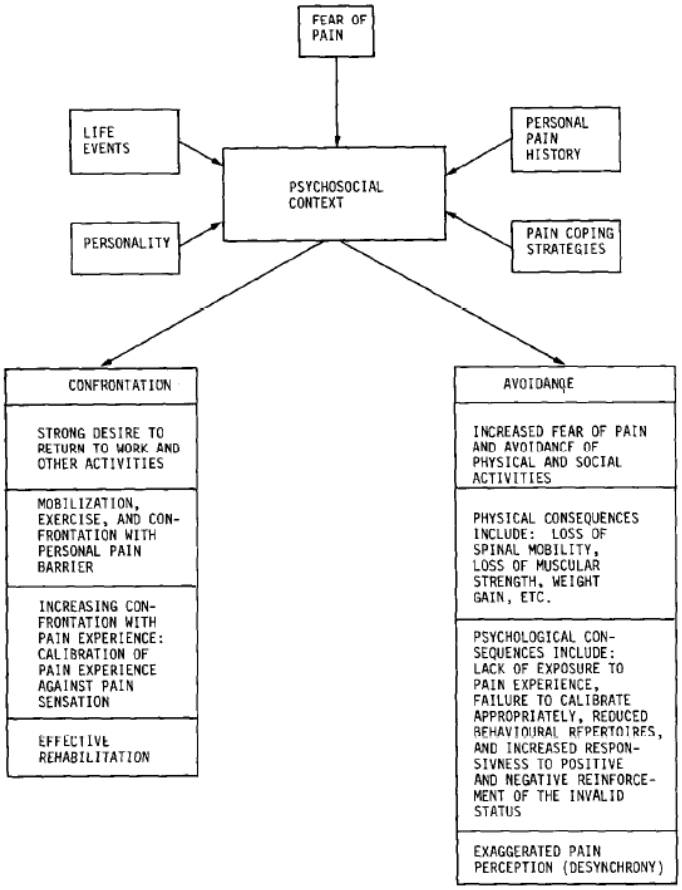

Figure 3.1 Lethem's fear-avoidance model of exaggerated pain perception (Lethem et al., 1983)

A variant to the Exaggerated Pain Perception Model came from Philips (H. C. Philips, 1987). Her main addition to the model was the idea that avoidance of pain took place because of the expectations the patient holds about pain as well as their current pain thoughts. This model, called the Chronic Pain Avoidance Behavior, is depicted in Figure 3.2 below.

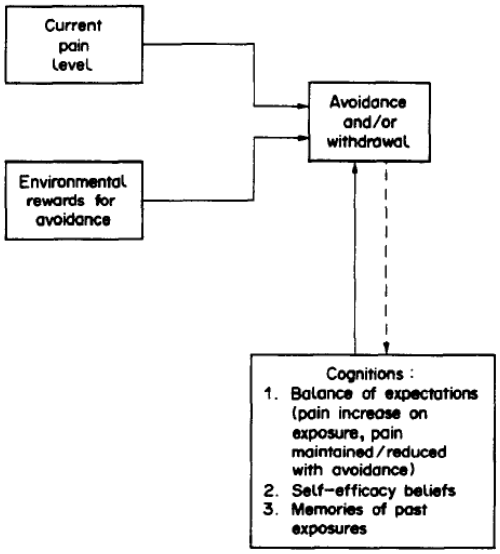

Figure 3.2 Chronic pain avoidance behavior model (H. C. Philips, 1987)

3.3 Contemporary Theories of Fear-Avoidance

3.3.1 The Fear-Avoidance Model

The Fear-Avoidance Model (FAM), shown in Figure 3.3, proposes a pathway between pain response, physical disuse, and chronic pain (Verbunt et al., 2003; J. W. Vlaeyen & Linton, 2000). When pain is perceived, an individual judges the meaning or purpose of the painful experience. Most people judge pain as undesirable and unpleasant, but not as catastrophic. This leads to the temporary avoidance of painful activities, but ultimately leads to confrontation of the pain and resumption of normal activities. However, in a minority of people, the pain is judged to be devastating, which leads to pain-related fear, activity limitations, and ultimately disability and chronic pain. Negative emotional response to the activities associated with pain (G. J. G.

Asmundson et al., 2004; Keogh, Ellery, Hunt, & Hannent, 2001; J. W. Vlaeyen & Linton, 2000; Zvolensky et al., 2001) lead to a catastrophizing response, which in turn can strengthen the cycle, and may even aid in the transition from subacute to chronic back pain (Linton & Shaw, 2011; Wertli et al., 2013). It is well-known that in acute pain patients, anxiety decreases as pain decreases, but this is not the case with chronic pain patients, who actually encounter greater anxiety and distress the longer their injury lasts (Gatchel, 1991). This may be especially true if the patient's original belief that the pain is harmful is confirmed because of anxiety symptoms that arise when they engage in the behavior (Turk & Wilson, 2010).

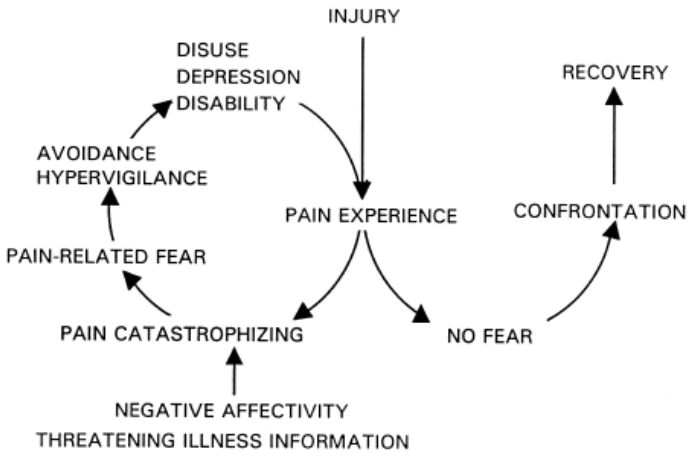

Figure 3.3 The Fear-Avoidance Model (J. W. Vlaeyen & Linton, 2000)

Since 2000, there has been one additional modification to the FAM. Norton and Asmundson (Norton & Asmundson, 2003) attempted to clarify the contributions of the autonomic nervous system (ANS) and muscle tension on the different negative experiences that lead to expectations of future pain. This revision is located in Figure 3.4 below.

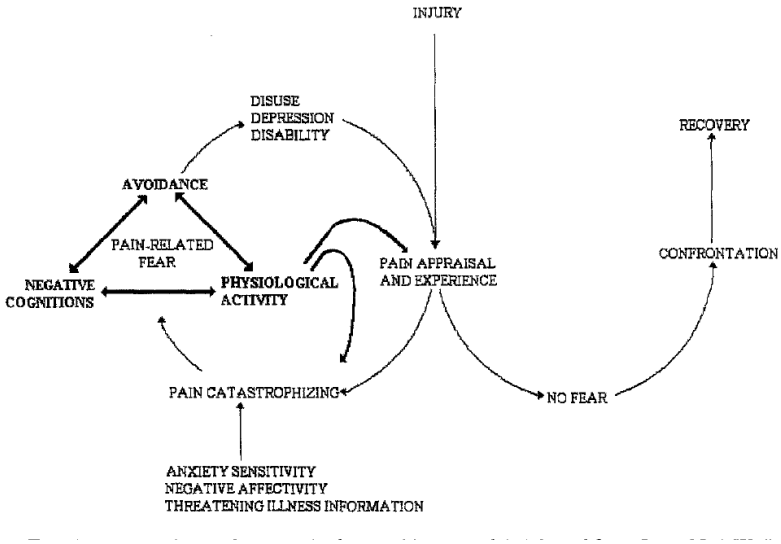

Figure 3.4 Amendments to the FAM (Norton & Asmundson, 2003)

Through use of the FAM, it has been found that pain-related fear is a contributor to chronic pain (J. W. Vlaeyen & Linton, 2000), and early identification of fear-avoidance responses is critical for successful treatment of the patient's primary painful medical condition (Linton & Boersma, 2004), although it should be noted that mild pain-related fear is common in normative populations (Roelofs, Peters, Deutz, Spijker, & Vlaeyen, 2005).

3.3.2 Avoidance and Deconditioning

When an individual avoids an activity, either physical or social (H. C. Philips & Jahanshahi, 1986), due to fear of pain, and in turn does not experience said pain, the confirming evidence reinforces the credibility of the assumption that avoidance is beneficial (Fordyce et al., 1982; G. Smeets, de Jong, & Mayer, 2000). This assumption reinforcement then shapes future actions, leading to further avoidance behavior.

Avoidance behavior can develop because of 2 separate pathways: either the patient avoids social activities, which leads to depression, lack of reinforcement, and increased chronic pain (Lewinsohn & Libet, 1972), or the patient avoids physical activities, which leads to an increase in chronic pain because of physical inactivity and deconditioning syndrome (R. J. E. M.

Smeets & Wittink, 2007; Verbunt et al., 2005). Regularly abstaining from activity may result in deconditioning, and it has been found that high fear of pain leads to restricted movement (Pope, Rosen, Wilder, & Frymoyer, 1980).

Originally termed Disuse Syndrome (Bortz, 1984), deconditioning syndrome results from muscular atrophy, decreased cardiovascular endurance, loss of coordination, loss of ligamentous flexibility, decalcification and weakening of skeletal structures, decreased ability to perform complicated, repetitive tasks, and degeneration of associated tissue to lack of use (Bortz, 1984). These effects may exacerbate pain, as deteriorated muscle states may make a patient more prone to muscle spasms and pain flare ups (T. G. Mayer, 2000). In addition to general activity, patients may also engage in guarded movement, which happens when a patient changes posturing in response to pain, such as limping or bracing oneself. This leads to abnormal motion, which may place additional strain on uninjured muscles, which then reduces movement even more (Main, 1996).

There are also psychological consequences of avoidance, including loss of self-esteem, deprivation of reinforcers, depression, distress (Martinsen, 1990), and somatic preoccupation (J. W. Vlaeyen, Kole-Snijders, Boeren, & van Eek, 1995). It appears that activity is tied to mood, as those who are more active typically are in better spirits, as are those that are aerobically fit (Crews & Landers, 1987; petruzello, 1991; Thirlaway & Benton, 1992). Somewhat similarly, cognitive avoidance can also develop. Cognitive avoidance takes place when one not only avoids the behaviors that cause pain, but also avoids thoughts of pain or painful situations. This cognitive avoidance may contribute to the development and maintenance of Post-Traumatic Stress Disorder (PTSD) (Bryant & Harvey, 1995).

3.3.3 Catastrophizing in Response to Pain

In addition to the negative emotionality and avoidance, some patients also have catastrophic thoughts about their painful medical condition that can help spur the fear-avoidance cycle onward by increasing fear of pain and injury or reinjury (G. J. G. Asmundson, Bovell, Carleton, & McWilliams, 2008). This is known as catastrophizing, and is defined as the cognitive

process of exaggerated rumination and worry (Keogh & Asmundson, 2004). Catastrophizing has both a cognitive and an affective component. Some researchers posit that catastrophizing may actually be a precursor of pain-related fear (Leeuw, Peters, Wiers, & Vlaeyen, 2007), especially since catastrophizing may trigger unnecessary activation of the SNS (Ciccone, 1984), though it is possible to have fear-avoidance beliefs without catastrophizing (Pincus, Smeets, Simmonds, & Sullivan, 2010). Some people may be predisposed to catastrophic thinking because of base characteristics they possess, such as anxiety sensitivity (discussed above), negative affectivity (L. A. Clark & Watson, 1991), and attention to and interpretation of threatening illness information. Regardless of predisposition, however, those who catastrophize more have increased negative pain experiences (L. M. McCracken et al., 1992; M. J. Sullivan, Bishop, & Pivik, 1995; M. J. Sullivan, Stanish, Waite, Sullivan, & Tripp, 1998). A relationship between higher levels of catastrophizing and an increase in negative pain experiences has been identified in a variety of pain populations, including back pain (Turner, Jensen, Warms, & Cardenas, 2002), headaches (Ukestad & Wittrock, 1996), dental pain (M. J. Sullivan & Neish, 1998; M. J. Sullivan & Neish, 1999), osteoarthritis (Keefe et al., 2000), and burn pain (Haythronthwaite, Lawrence, & Fauerbach, 2001). It has also been found that catastrophizing predicts pain intensity, disability, and distress even after controlling for physical impairments in functioning (Severeijns, Vlaeyen, van den Hout, & Weber, 2001).

Many self-report questionnaires have been developed to measure coping skills (which often include a catastrophizing subscale) or catastrophizing by itself. These include: the Coping Strategies Questionnaire (Rosenstiel & Keefe, 1983), the Pain Cognition List (J. W. Vlaeyen et al., 1990), the Pain Cognitions Questionnaire (Boston, Pearce, & Richardson, 1990), the Pain Catastrophizing Scale (M. J. Sullivan et al., 1995), and the Chronic Pain Coping Inventory (Hadjistavropoulos, MacLeod, & Asmundson, 1999; G. Tan, Jensen, Robinson-Whelen, Thornby, & Monga, 2001).

3.3.4 Hypervigilance

Like catastrophizing, hypervigilance is another component of the FAM. Although the idea of vigilance/hypervigilance did not originate with pain research (Mackworth, 1950), it has proved quite useful in the field. Hypervigilance is a state of over-alertness for painful stimuli. One is constantly scanning the environment for danger, and is more readily selecting, attending to, and responding to painful or dangerous stimuli. Being hypervigilant increases the likelihood that a threat will be detected (G. J. G. Asmundson et al., 2004), because attention is focused on things that may cause pain. In a non-hypervigilant state, these stimuli may be ignored. It is possible that with hypervigilance, stimuli may actually be misinterpreted. Negative affectivity may be associated with hypervigilance, because those with negative affect are more likely to pay attention to negative stimuli (such as potentially painful conditions) (Van Damme, Crombez, Eccleston, & Roelofs, 2004).

The cognitive-affective model of the interruptive function of pain (Eccleston & Crombez, 1999) shows that pain may actually be designed to interrupt our attention, as it can be a signal for danger (Wall, 1994). Pain interrupts our attention most, even in healthy individuals, when it is novel (Crombez, Baeyens, & Eelen, 1994; Crombez, Eccleston, Baeyens, & Eelen, 1996; Crombez, Eccleston, Baeyens, & Eelen, 1997), has threat value (Crombez et al., 1998a), and is combined with catastrophic thinking (Crombez et al., 1998a). Hypervigilance may also be tied to somatization (Barsky & Klerman, 1983), in those individuals diagnosed with central sensitivity syndromes (CSSs) such as fibromyalgia (McDermid, Rollman, & McCain, 1996; Peters, Vlaeyen, & van Drunen, 2000; Rollman & Lautenbacher, 1993) and irritable bowel syndrome (Chang, Mayer, Johnson, FitzGerald, & Naliboff, 2000; Verne, Robinson, & Price, 2001). Participants in both of these studies demonstrated high levels of hypervigilance.

There are 3 main ways to measure hypervigilance. The first 2 are patient-reported outcome (PRO) questionnaires that either 1) assess how aware one is of bodily sensations or 2) assess hypervigilance itself. The last measurement actually involves physiological measures, such as event-related potentials (ERP) in order to measure attention processing (Van Damme et

al., 2004). PRO measurement scales for hypervigilance include the Pennebaker Inventory of Limbic Languidness (Pennebaker, 1982), the Modified Somatic Perception Questionnaire (C. J. Main, 1983), the Body Consciousness Questionnaire (L. C. Miller, Murphy, & Buss, 1981), the Body Vigilance Scale (Schmidt, Lerew, & Trakowski, 1997), the Pain Vigilance and Awareness Questionnaire (Crombez & Vlaeyen, 1998; L. M. McCracken, 1997), and the Cognitive Somatic Anxiety Questionnaire (Steptoe & Kearsley, 1990) (Schwartz, Davidson, & Goleman, 1978).

3.3.5 Pain-Related Endurance Behavior

Other research groups have tried to examine the theoretical opposite of fear-avoidance: pain-related endurance behavior, or behavior that is indicative of people trying to function despite high pain levels. While this may initially seem to be beneficial, when done to an extreme, pain-related endurance behavior can have a negative rebound effect. Pain-related endurance behavior often leads to perceptions of failure, a depressed mood, and severe pain that may overload the physical components of muscles, bones, and spinal discs. This pain-related endurance behavior is negatively related to self-reported disability (showing that patients who try to “push” through their pain rate themselves as less disabled), but positively related to pain intensity (Hasenbring, Hallner, & Rusu, 2009). In fact, those who engage in endurance behavior may have their pain fluctuate wildly, with activity taking place until the patient feels he or she can go no further because of high levels of pain, and then resting completely until there is very little pain left (Harding, 1998). It has been found that patients who engage in excessive endurance behavior may have an abnormally low level of pain-related fear (G. J. Asmundson, Kuperos, & Norton, 1997).

3.4 Etiology of Fear-Avoidance

The above model of FAM provides a basic theory of why and how FA develops. However, it does not take into account a small number of other factors that are posited to cause or exacerbate FA, although no longitudinal studies have been done to prove causality. It has been hypothesized that individual fear-avoidance can be influenced by the views of the healthcare providers they are treated by, are seeing (Rainville, Carlson, Polatin, Gatchel, &

Indahl, 2000; Werner, Côté, Fullen, & Hayden, 2012), although one study found that clinician fear-avoidance ratings do not correlate well with patient ratings (Calley, Jackson, Collins, & George, 2010). In addition, many different factors determine whether a person avoids or confronts their pain. Past life experiences (especially those that pertain to pain), life stressors, personality, mood states (Bryant & Harvey, 1995; Weickgenant et al., 1993), the characteristics leading to the onset of pain, the ambiguity of the diagnosis (J. W. S. Vlaeyen, de Jong, Leeuw, & Crombez, 2004), and perhaps even the hormonal status of women in their menstrual cycle may influence fear-avoidance beliefs or behavior (Roelofs et al., 2005). Lastly, both the overprediction (L. M. McCracken & Gross, 1993) and underprediction of pain (Arntz, van Eck, & de Jong, 1991; Arntz & Peters, 1995) that may be experienced if one participates in an activity may increase avoidance of the activity due to pain.

3.5 Consequences of Fear-Avoidance

High levels of fear-avoidance appear to have many negative consequences, although it is difficult to determine causality and which came first, the fear-avoidance or the so-called consequences. Generally, however, those with high fear-avoidance have poor outcomes (Fritz, George, & Delitto, 2001; S. Z. George, Fritz, & Childs, 2008; Wertli et al., 2013). This fact has been so widely accepted in regards to low back pain that many new questionnaires designed to assess risk factors for CLBP include questions about FA and related constructs from the Tampa Scale for Kinesiophobia (TSK) and the Pain Catastrophizing Scale (PCS) (Hill et al., 2008; Hill, Dunn, Main, & Hay, 2010). For ease of reading, consequences have been divided into 5 general sections: cognitive, psychosocial, physical, occupational, and health behavior consequences.

3.5.1 Cognitive Consequences

Fear alone can influence the body's pain processing system. For instance, pain sensitivity increases when viewing any fear-related material (de Wied & Verbaten, 2001; Meagher, Arnau, & Rhudy, 2001), although there are some contradictory results (al Absi & Rokke, 1991; Rhudy & Meagher, 2000). It appears that those with high fear-avoidance have increased sensitivity (Cooper, Weaver, & Hay, 2000; McNeil et al., 2001; J. W. Vlaeyen et al.,

1999) and perception of pain (Peters, Vlaeyen, & Kunnen, 2002), as well as generally decreased pain tolerance (van den Hout, Vlaeyen, Houben, Soeters, & Peters, 2001), including intolerance to headaches (Bishop, Holm, Borowiak, & Wilson, 2001). In addition, those high in fear-avoidance have an increased sensitivity to electrical stimuli that is not innately harmful, hypervigilance in response to pain (Crombez et al., 1999), attentional bias towards pain-related information in healthy individuals, (Crombez, Hermans, & Adriaensen, 2000; Keogh et al., 2001), and have increased reaction time to stimuli and increased cognitive complaints in general (L. M. McCracken & Iverson, 2001; Peters et al., 2002). Fear of pain also can disrupt natural placebo effects (Lyby, Aslaksen, & Flaten, 2010; Lyby, Aslaksen, & Flaten, 2011; Lyby, Forsberg, Asli, & Flaten, 2012). Lastly, those high in fear of pain may engage in more escape and avoidance behavior relative to someone lower in fear of pain (McNeil et al., 2001), meaning that fear of pain may be a vulnerability factor (G. J. Asmundson, Jacobson, Allerdings, & Norton, 1996; G. J. Asmundson, Norton, & Jacobson, 1996).

3.5.2 Psychosocial Consequences

In addition to these cognitive pain-related processes, patients exhibiting high fear-avoidance are also more likely to have higher functional disability and reduced activity performance (Burns, Mullen, Higdon, Wei, & Lansky, 2000; Crombez & Vlaeyen, 1998; Crombez, Eccleston, Baeyens, Van Houdenhove, & Van, 1999; Goubert, Crombez, Hermans, & Vanderstraeten, 2003; Keen et al., 1999; Peters et al., 2002; Pfingsten et al., 2001; Samwel, Evers, Crul, & Kraaimaat, 2006; van den Hout et al., 2001; J. W. Vlaeyen & Linton, 2000; Waddell et al., 1993), even in patients with only acute low back pain (Swinkels-Meewisse et al., 2006), in older adults (Camacho-Soto, Sowa, Perera, & Weiner, 2012; F. Kovacs et al., 2008), and in those with knee osteoarthritis (Scopaz, Piva, Wisniewski, & Fitzgerald, 2009). There is, however, conflicting evidence; some studies did not find that fear-avoidance was a useful predictor (van der Windt, Kuijpers, Jellema, van der Heijden, & Bouter, 2007) of perceived disability (Costa, Maher, McAuley, Hancock, & Smeets, 2011; S. Z. George et al., 2008; Grotle, Vøllestad, & Brox, 2006; Heinrich et al., 2011).

Patients with high fear-avoidance also have a higher levels of depressive symptoms (Heinrich et al., 2011), lower health-related quality of life (Bishop et al., 2001), higher hypervigilance and somatic sensations (Aldrich, Eccleston, & Crombez, 2000; Eccleston & Crombez, 1999; J. W. Vlaeyen & Linton, 2000), and are more likely to have excessive over-the-counter analgesic use (G. J. Asmundson, Wright, Norton, & Veloso, 2001). Fear-avoidance may influence pain intensity outcomes, although results are conflicting, with some studies showing it is not a predictor (Heinrich et al., 2011), and others showing that it may be (al Absi & Rokke, 1991; L. M. McCracken et al., 1996; Weisenberg et al., 1984).

It is important to note that although high fear-avoidance places a patient at risk for elevated levels of psychosocial distress, these constructs are theoretically separate, as evidenced by only moderate correlations between fear of pain questionnaires and variables such as anxiety and depressive symptoms, or the Symptoms Checklist (McNeil et al., 2001).

3.5.3 Physical Consequences

Those with higher pain-related fear are, in general, more likely to have greater functional impairments (Crombez, Vlaeyen, Heuts, & Lysens, 1999; L. M. McCracken, Gross, Sorg, & Edmands, 1993) and have worse physical performance (Crombez et al., 1998a; Geisser, Haig, Wallbom, & Wiggert, 2004). This may be due to the fact that they have higher activity avoidance (Crombez, Vervaet, Lysens, Baeyens, & Eelen, 1998; Waddell, 1998). Having higher fear-avoidance is related to an increased number of falls in older adults (Sions & Hicks, 2011). Fear-avoidance is negatively correlated to gait speed, even after accounting for other factors that may influence it, such as age, additional medical diagnoses, body mass index (BMI), pain intensity, and depressive symptoms (Camacho-Soto et al., 2012). Those with pain-related anxiety have less range of motion in straight leg raise tasks (L. M. McCracken & Gross, 1993), and maximal performance tests of flexion and extension of the knee (Crombez et al., 1994). Fear-avoidance may not play as large a role in aerobic fitness, however (R. J. E. M. Smeets, Maher, Nicholas, Refshauge, & Herbert, 2009). As pain-related fear is reduced, so is disability (Mannion, Dvorak, Taimela, & Müntener, 2001; Woby, Watson, Roach, & Urmston, 2004).

3.5.4 Occupational Consequences

In addition to the cognitive, psychosocial, and physical consequences above, there are also many occupational consequences related to work. It has been posited that the costs of activity avoidance can include job loss, loss of economic productivity, and restriction of social activities. Fear of pain can also interfere with work status in back pain patients, although the evidence supports mixed conclusions. Some studies have found that fear of pain as measured by either the Fear-Avoidance Behavior Questionnaire (FABQ) or the TSK can influence return to work outcomes in both acute (Turner et al., 2006; Turner et al., 2008) and subacute low back pain (Du Bois, Szpalski, & Donceel, 2009; Soucy, Truchon, & Côté, 2006), as well as the number of sick days taken (F. Kovacs et al., 2007), while other studies have found that fear of pain is a nonprognostic indicator for return to work or the number of sick days an acute back pain patient has taken (Hancock, Maher, Latimer, Herbert, & McAuley, 2009; Turner et al., 2008), and for the length of time it took CLBP patients to return to work (Heymans et al., 2009).

3.6 Treatment of Fear-Avoidance

Fear-avoidance often develops over time as an acute injury transitions to a chronic condition. It is therefore important to identify and modify fear-avoidance beliefs early on (S. Z. George, Fritz, Bialosky, & Donald, 2003; Jellema et al., 2006). Addressing these fear-avoidance beliefs often leads to better outcomes (Burton, Waddell, Tillotson, & Summerton, 1999; S. Z. George et al., 2008; Staal et al., 2008). In general, two components are required for treatment of fear-avoidance: the fear network must be activated, and new information must be available to disconfirm the previously-held fear belief (Lang, Bradley, & Cuthbert, 1998), thus re-writing fear memories with something more innocuous. Although common sense may dictate that simple things like emotional and verbal reassurance may be helpful to disconfirm fears, these techniques do not work, and may in fact increase pain-related fear (Donovan & Blake, 2000; McDonald, Daly, Jelinek, Panetta, & Gutman, 1996). As such, specific techniques to reduce FA have been developed, including experience, education, graded exercise, graded exposure, and

multidisciplinary treatment. These treatments have been shown beneficial even after taking into account barriers to recovery such as reliance on safety behaviors (such as guarded movements).

3.6.1 Education and Cognitive-Behavioral Therapy

Education about the patient's chronic condition can be helpful, especially helping patients learn that their disorder can be managed, and is not a serious disease that requires protection (J. W. S. Vlaeyen et al., 2004). Education about fear avoidance beliefs in a tailored physical therapy program increases the chances that patients will return to work within 45 days after program completion (Burton et al., 1999; Coudeyre et al., 2007; Godges, Anger, Zimmerman, & Delitto, 2008). Cognitive-behavioral therapy (CBT) is also efficacious, with its usefulness at decreasing FA demonstrated in child birthing situations (Cleeton, 2001) and other aversive medical procedures (Chen, Zeltzer, Craske, & Katz, 1999; Horne, Vatmanidis, & Careri, 1994; K. E. Moore, Geffken, & Royal, 1995; Zelikovsky, Rodrigue, Gidycz, & Davis, 2000). CBT also reduces fear-avoidance (Malone, Strube, & Scogin, 1988) and catastrophizing (Spinhoven & Linssen, 1991; Tota-Faucette, Gil, Williams, Keefe, & Goli, 1993) in injury rehabilitation situations.

3.6.2 Graded Exercise

Another useful treatment for fear-avoidance is an exercise quota system, or graded exercise, which requires patients to exercise at an increasing level (Dolce, Crocker, Moletteire, & Doleys, 1986), perhaps because this allows patients to be gradually exposed to their fears of pain and harm that initially reduced their activity levels and the control they felt over them (Crowley & Kendall, 1999; S. Z. George et al., 2003; Lindström et al., 1992). While both graded exercise and graded exposure (discussed below) gradually increase behavior over time, graded exercise focuses on increasing the difficulty of the physical function activity in an exercise progression, while graded exposure gradually increases the level of fear a patient feels with the exercise. Since a patient may be physically able to perform an activity, but does not wish to perform it because of fear, graded exposure is typically a more appropriate and effective treatment, as it is more specific to fear rather than function (S. Z. George et al., 2008; Leeuw et al., 2008).

3.6.3 Graded Exposure (in vivo) Treatment

Graded exposure is the cognitive process in which fear is activated, catastrophic beliefs and expectations are challenged, and then those same beliefs and expectations are disconfirmed. Typically, one goes through graded exposure in a hierarchy, with activities chosen for disconfirmation based on fear level, not physical functioning, with the hierarchy beginning with the least fearful activity and gradually moving up to the most fearful activity (J. W. S. Vlaeyen et al., 2004). It is imperative that the clinician gather as much information as possible about the fearful activities, so that an appropriate hierarchy can be created. It is suggested that one performs a catastrophizing interview (Vasey, 1992) to obtain the required details. Approaching fear of pain subtly is also important, because many patients do not recognize their discomfort at participating in activities as a phobia, or even as indicative of pain-related fear (J. W. S. Vlaeyen et al., 2004). Graded exposure can also come in the form of a behavioral experiment, in which the patient performs an activity to challenge his or her beliefs about said activity in a series of 9 steps. It is important that graded exposure take place with a variety of different activities in a variety of different places (Mineka, Mystkowski, Hladek, & Rodriguez, 1999; M. K. Rowe & Craske, 1998), since exposure doesn't always generalize to other similar instances (Bouton, 2000; Crombez et al., 2002; Goubert, Francken, Crombez, Vansteenwegen, & Lysens, 2002). In addition, having graded exposure take place over a longer length of time can also enhance treatment results (Rowe & Craske, 1998a).

Many studies have found graded exposure to movement to be a useful technique in reduction of fear-avoidance (Lindström et al., 1992; Linton, Overmeer, Janson, Vlaeyen, & de Jong, 2002; Linton et al., 2008; J. W. S. Vlaeyen, de Jong, Geilen, Heuts, & van Breukelen, 2001). Vlaeyen et al. (J. W. S. Vlaeyen, de Jong, Geilen, Heuts, & van Breukelen, 2002) found that exposure treatment decreased pain-related fear, catastrophizing, and patient-reported disability, and increased activity levels while outside the clinic, as did Je Jong et al. (2005). On an even more simple level, sometimes, just having positive medical or dental experiences (without

formal graded exposure) can decrease fear of pain (Carr, Lemanek, & Armstrong, 1998; Thom, Sartory, & Jöhren, 2000; J. W. S. Vlaeyen et al., 2002).

3.6.4 Multidisciplinary Treatment

Multidisciplinary treatment also seems effective at reducing fear-avoidance (McCracken, 1998; Monticone et al., 2013; Monticone, Ambrosini et al., 2014; Wertli, Rasmussen-Barr, Weiser, Bachmann, & Brunner, 2014). A series of studies by Monticone et al. found in a randomized control trial that those undergoing multidisciplinary treatment, including physical therapy, occupational therapy, cognitive-behavioral therapy, and medical management significantly reduced their kinesiophobia and catastrophizing from admission to discharge, while those in the control group did not (Monticone et al., 2013; Monticone et al., 2014).

Chapter 4

Current Measures of Fear-Avoidance

There are a wide variety of fear-avoidance measures already available for clinicians to use. However, many of them are flawed or inappropriate for a CMPD population. Many reviews suggest there is a paucity of good FA literature available (G. J. Asmundson et al., 1999; Turk, 1992), and that additional FA measures are required (S. Z. George, Valencia, Zeppieri, & Robinson, 2009; Lundberg, Grimby-Ekman, Verbunt, & Simmonds, 2011; Pincus et al., 2010). All the questionnaires contained in this section are inherently somewhat biased, since all are cognitive, non-verbal PROs influenced by how well the subject understands his or her own cognitive processes and memory when recalling past painful stimuli (McNeil & Vowles, 2004). In addition, proponents of the FAM do not agree on whether questionnaires should address general fear or activity-specific fear (S. Z. George et al., 2009). Although many questionnaires have been developed, none test the FAM in its entirety.

Scales designed to measure the FAM elements of catastrophizing and hypervigilance have already been presented above in sections 3.3.3 and 3.3.4. In the current chapter, only scales measuring both fear and avoidance in the same questionnaire will be evaluated, although there are a wide variety of measures that only examine avoidance of pain (Geiser, 1992; Hasenbring et al., 2009; S. C. Hayes et al., 2004; philips, 1981; H. C. Philips & Jahanshahi, 1986; Wicksell, Renöfält, Olsson, Bond, & Melin, 2008; Zarkowska, 1981) or fear of pain (Albaret, Muñoz Sastre, Cottencin, & Mullet, 2004; Beneciuk, Robinson, & George, 2012; Crowley & Kendall, 1999; S. Z. George et al., 2009; Gil, Abrams, Phillips, & Keefe, 1989; Leeuw et al., 2007; McNeil & Rainwater, 1998; Turk, Robinson, Sherman, Burwinkle, & Swanson, 2008; Wolpe & Lang, 1964). In addition, many scales have been designed to measure fear-avoidance in dental pain patients (Aartman, 1998; Kleinknecht, Thorndike, McGlynn, & Harkavy, 1984; M. M. Rowe & Moore, 1997; Stouthard & Hoogstraten, 1990; van Wijk & Hoogstraten, 2003). These

questionnaires have not been included for further analysis in this manuscript, as the focus of this manuscript is on chronic musculoskeletal pain, rather than on dental pain.

4.1 The Tampa Scale for Kinesiophobia (TSK)

The TSK originated in an unpublished work in 1992 (R. P. Miller et al., 1991), but made its debut in published literature in 1995 (J. W. Vlaeyen et al., 1995), and has since been studied thoroughly. The TSK is presented in Table 4.1. This 17 item questionnaire captures fear of movement and reinjury and is rated on a 4 point Likert scale from 1 (strongly disagree) to 4 (strongly agree), allowing for a total score to range from 17 points (no fear) to 68 points (strong fear of reinjury). There are 2 subscales utilized in the TSK: a harm factor, which is the total of items 3, 5, 6, 9, 11, and 15, and the avoidance factor, which is the sum of items 1, 2, 7, 10, 13, 14, and 17 (Swinkels-Meewisse, Roelofs, Verbeek, Oostendorp, & Vlaeyen, 2003). The harm factor asks questions about the patient's concept of something being wrong with his or her body, and the avoidance factor captures the idea that the patient is avoiding exercise or activity that might increase his or her pain. The TSK is a valid and reliable scale in English (Ostelo, Swinkels-Meewisse, Knol, Vlaeyen, & de Vet, 2007; J. W. Vlaeyen et al., 1995), Dutch (Roelofs, Peters, & Vlaeyen, 2007; J. W. Vlaeyen et al., 1995), Norwegian (Haugen, Grøvle, Keller, & Grotle, 2008), Italian (Monticone et al., 2010), Portuguese (de Souza, Marinho, Siqueira, Maher, & Costa, 2008), and German (Hasenbring et al., 2009), with Cronbach's α = .7-.81 (Kole-Snijders, Vlaeyen, Boeren, Schuerman, & van Eek, 1993; Roelofs et al., 2004; J. W. Vlaeyen et al., 1995; J. W. Vlaeyen, Kole-Snijders, Rotteveel, Ruesink, & Heuts, 1995; Woby, Roach, Urmston, & Watson, 2005). There is moderate construct validity as well, with significant correlations between the TSK and the FABQ (r = .33-.76), (Crombez et al., 1999; Swinkels-Meewisse et al., 2003; J. W. Vlaeyen et al., 1995; Wicksell, Lekander, Sorjonen, & Olsson, 2010), the TSK and the catastrophizing subscales of the Pain Cognitions Checklist (PCL) and the Coping Strategies Questionnaire (CSQ) (J. W. Vlaeyen et al., 1995) as well as the Pain Catastrophizing Scale (PCS) (r = .6) and the PASS (r = .35). The TSK also significantly correlates to the Fear Survey Schedule (FSS), pain intensity, and pain impact (J. W. Vlaeyen et al., 1995). Men scored

significantly higher on the TSK than women (J. W. Vlaeyen et al., 1995), and patients with disability compensation had greater fear of movement than patients who did not (J. W. Vlaeyen et al., 1995). Lastly, the TSK moderately correlates with physical performance tests (r = .36-.50) (Roelofs et al., 2004).

There are many different versions of the TSK available for use. Problems with the reverse-scored items of the TSK-17 (items numbered 4, 8, 12, and 16) yield the TSK-13, which removes those items to increase the psychometric properties of the TSK (M. E. Clark, Kori, & Brockel., 1996; Geisser, Haig, & Theisen, 2000; Goubert et al., 2004; Roelofs et al., 2004; Swinkels-Meewisse et al., 2003). Two separate 11 item versions of the TSK have also been proposed (S. Z. George, Lentz, Zeppieri, Lee, & Chmielewski, 2012; Woby et al., 2005). The version proposed by Woby et al. (2005), removed items numbered 4, 8, 9, 12, 14, and 16, because they had poor psychometric properties, including inappropriate item-response trends and low corrected-item totals. Since the TSK was originally created for low back pain patients, it has also been adapted to study pain-related fear in the general population (Houben, Leeuw, Vlaeyen, Goubert, & Picavet, 2005).

Many different cut-off scores for the TSK have been proposed, although none have shown full support, and none have utilized severity levels. A median split of 37 is currently in use (Barke, Baudewig, Schmidt-Samoa, Dechent, & Kroner-Herwig, 2012; Bunketorp, Carlsson, Kowalski, & Stener-Victorin, 2005; Lundberg, Larsson, Ostlund, & Styf, 2006; J. W. Vlaeyen et al., 1995; J. W. Vlaeyen et al., 1999), although a recent study has found that a score of 17 points or less is associated with lower risk (Helmhout et al., 2010; Wertli et al., 2013), with moderate risk spanning from 17-37 points and high risk > 37 points. A simple 37 point cut-off has also been used (Bränström & Fahlström, 2008; Lundberg et al., 2006), as has a cut-off of 39 or 40 (depending on data distribution) (J. W. S. Vlaeyen & Linton, 2012). A large normative database of TSK scores for clinical populations, including upper extremity disorders, chronic low back pain, fibromyalgia, and osteoarthritis, has also been created (Roelofs et al., 2011).

There are many limitations to the TSK. First, although its psychometric properties are deemed adequate, they are not extremely high. Second, the TSK is not often used for work-related outcome measurement (Wertli et al., 2013), which means that it cannot easily be applied in occupational populations, such as CMPD. Third, the TSK does not include all the concepts of the FAM. As seen in Table 4.1, the concepts of catastrophizing and hypervigilance are not included. Fourth, there is a lack of consensus on where cut-off scores should be placed on the TSK (if they should be used at all), and whether the above-mentioned scores are valid and reliable. Lastly, the TSK examines kinesiophobia rather than fear-avoidance, which sets it apart from other measures in this section. Despite these limitations, however, it remains a popular measure, and the wealth of data for the TSK cannot be discounted.

Table 4.1 Items on the TSK

Item Number	Item Description
1	I'm afraid that I might injure myself as I exercise.
2	If I were to try to overcome it, my pain would increase.
3	My body is telling me I have something dangerously wrong.
4	My pain would probably be relieved if I were to exercise.
5	People aren't taking my medical condition seriously enough.
6	My accident has put my body at risk for the rest of my life.
7	Pain always means I have injured my body.
8	Just because something aggravates my pain does not mean it is dangerous.
9	I am afraid that I might injure myself accidentally.
10	Simply being careful that I do not make any unnecessary movements is the safest thing I can do to prevent my pain from worsening.
11	I wouldn't have this much pain if there weren't something potentially dangerous going on in my body.
12	Although my condition is painful, I would be better off if I were physically active.
13	Pain lets me know when to stop exercising so that I don't injure myself.
14	It's really not safe for a person with a condition like mine to be physically active
15	I can't do all the things normal people do because it's too easy for me to get injured.
16	Even though something is causing me a lot of pain, I don't think it's actually dangerous.
17	No one should have to exercise when he/she is in pain.

4.2 The Fear Avoidance Beliefs Questionnaire (FABQ)

The FABQ is a 16 item PRO that focuses on how patients' beliefs affect their physical activity and work performance. Each item is answered on a 7 point Likert scale, from "strongly agree" to "strongly disagree" (Waddell et al., 1993). The FABQ was primarily developed based upon fear-avoidance theories, but also included some items meant to measure disease conviction, which includes beliefs about how serious one's illness is and how it affects the patient's life. Items included on the FABQ, and their subscale, are located in Table 4.2.

There are 2 subscales for the FABQ: the first is the work subscale (FABQ-W), which consists of 7 items and yields a range from 0-42, and the second subscale is the physical activity subscale (FABQ-P), which consists of 4 items and yields a total score of 24. However, a validation study of a German translation found that the FABQ has three separate subscales: work as cause, work prognosis, and physical activity. Test-retest reliability was quite high for all scales ($r \geq .83$) (Pfingsten, Kröner-Herwig, Leibing, Kronshage, & Hildebrandt, 2000; Swinkels-Meewisse et al., 2003; Waddell et al., 1993), although others again have combined the two work subscales because of high intercorrelations (Hasenbring et al., 2009).

The FABQ showed high test-retest reliability, with 71% of individual answers identical, with $k = .74$, $p < .001$ in the original study (Waddell et al., 1993), and alpha coefficients of .82-.97 (Askary-Ashtiani, Ebrahimi-Takamejani, Torkaman, Amiri, & Mousavi, 2014; Cleland, Fritz, & Childs, 2008; K. Lee, Chiu, & Lam, 2006). The FABQ is reliable and valid in many languages, including Persian (Askary-Ashtiani et al., 2014; Rostami et al., 2014), Chinese (K. Lee et al., 2006), Swiss-German (Pfingsten et al., 2000; Staerkle et al., 2004), Spanish (F. M. Kovacs et al., 2006; F. M. Kovacs et al., 2008), Italian (Monticone et al., 2012), Greek (Georgoudis, Papathanasiou, Spiropoulos, & Katsoulakis, 2007), and French (Chaory et al., 2004).

The FABQ is associated with gait speed in the elderly, as well as self-reported disability measures such as the Roland Morris Disability Questionnaire (Camacho-Soto et al., 2012), pain severity, self-reported disability, and work loss (Waddell et al., 1993); , some studies have found poor correlations with pain intensity (Askary-Ashtiani et al., 2014; Chaory et al., 2004; F. M.

Kovacs et al., 2008; Monticone et al., 2012; Pfingsten et al., 2000; Staerkle et al., 2004). In addition, the FABQ exhibits moderate to strong correlations with both physical and mental quality of life, and has a moderate relationship to depressive symptoms (Askary-Ashtiani et al., 2014). The FABQ also appears more predictive in males than in females (Waddell et al., 1993).

There are many different versions of the FABQ available. The first is the FABQ-short, which takes the average of items from the FABQ work scale (Turner et al., 2008). Another is the FABQ-RTW (Heinrich et al., 2011). Many cut-off scores have also been proposed for the FABQ (Wertli et al., 2013). A score of < 20 on the FABQ-W scale indicates low risk, while a score of 25 points or higher indicates high risk (S. Z. George et al., 2008). Using higher cut-off scores, such as 28 or 32 points, were associated with poor short-term, but not long-term, outcomes (Fritz & George, 2002). A cut-off score of 14 points has been found effective for the FABQ-P (Klaber Moffett, Carr, & Howarth, 2004).

A major advantage of the FABQ is that is can be utilized to measure work outcomes (Wertli et al., 2013). However, this can also be problematic, because it requires patients to either be presently working or having been so recently employed that they have an accurate memory of their work activities. Especially if patients fill out the FABQ based upon their hypothetical future return to work, this would result in bias (Waddell et al., 1993). In a population such as CMPD, which has a large number of patients either unemployed, whether because of disability or other factors, such as being a housewife or retired, the FABQ is not an ideal questionnaire. Although it does make an attempt to link occupational data with fear-avoidance, many of the questions overlap with easily obtainable and objectively validated variables, such as whether the patient has a worker's compensation claim or was injured at work. Including those items are redundant in an occupational health clinic and serve only to add to the patient's self-report load. Lastly, nowhere in the FABQ items does it mention fear at all, which makes it questionable as a measure of fear-avoidance. For this reason, as well as a lack of items on components of the FAM such as catastrophizing and hypervigilance, the FABQ is not an ideal questionnaire for assessment of fear-avoidance.

Table 4.2 FABQ items and their subscales

Subscale	Item
Physical Activity	My pain was caused by physical activity.
Physical Activity	Physical activity makes my pain worse.
Physical Activity	Physical activity might harm my back
Physical Activity	I should not do physical activities which (might) make my pain worse.
Physical Activity	I cannot do physical activities which (might) make my pain worse.
Work	My pain was caused by my work or by an accident at work.
Work	My work aggravated my pain.
Work	I have a claim for compensation for my pain.
Work	My work is too heavy for me.
Work	My work makes or would make my pain worse.
Work	My work might harm my back.
Work	I should not do my normal work with my present pain.
Work	I cannot do my normal work with my present pain.
Work	I cannot do my normal work till my pain is treated.
Work	I do not think that I will be back to my normal work within 3 months.
Work	I do not think that I will ever be able to go back to that work.

4.3 The Pain Anxiety Symptoms Scale (PASS)

The PASS is a 40 item PRO that assesses anxiety and fear responses to chronic or recurrent pain and was designed to measure the Three-Systems Model of fear. The PASS was patterned from many commonly utilized anxiety measures (L. M. McCracken et al., 1992). There are 4 dimensions to the PASS: cognitive anxiety, fear of pain, escape/avoidance, and somatic/physiological pain-related fear or anxiety. The PASS is scored on a 6 point scale with 0

(never) anchoring at the bottom and 5 (always) anchoring at the top. When scoring the PASS, 5 items are reverse-coded, with a higher total score indicating higher levels of pain-related anxiety. Both the English (L. M. McCracken, Faber, & Janeck, 1998; Osman, Barrios, Osman, Schneekloth, & Troutman, 1994; Osman, Breitenstein, Barrios, Gutierrez, & Kopper, 2002) and the German translation of the PASS has been found to be reliable and valid (α = .94) (Hasenbring et al., 2009; L. M. McCracken et al., 1992), with the English version validated in non-clinical populations as well (Larsen, Taylor, & Asmundson, 1997). The PASS shows high treatment responsiveness (Brede, Mayer, Neblett, Williams, & Gatchel, 2011).

The PASS is related to cognitive anxiety symptoms (Greenberg & Burns, 2003), pain severity (L. M. McCracken et al., 1996), trait anxiety, self-reported disability, somatization, health-related quality of life, depressive symptoms (Brede et al., 2011; L. M. McCracken et al., 1996), and catastrophizing. In addition, the PASS is related to anxiolytic and tranquilizer use, and to the presence of anxiety disorders, including panic disorder, as well as the Axis II borderline and avoidant personality disorders (Brede et al., 2011). It is a good predictor of self-reported disability and interference due to pain (L. M. McCracken et al., 1992), and with the reduction of PASS scores, activity level increases while pain intensity, affective distress, and depressive symptoms decrease. However, the PASS does not relate to objective physical activity level (L. M. McCracken, Gross, & Eccleston, 2002), and occupational measures, although those who have higher PASS scores were less likely to be working at the beginning of treatment (Brede et al., 2011). Women were more likely to score higher on all subscales except for the Fear subscale (Carleton & Asmundson, 2009).The PASS was later shortened to a 20 item version (PASS-20), which correlates well with the original PASS and has a high alpha coefficient (α = .85) (L. M. McCracken & Dhingra, 2002).

While the PASS has been proved reliable and valid, and has high correlations with many other measures, there are several weakness associated with it. First, only one study has examined meaningful score ranges (Brede et al., 2011), although two have examined median splits (J. S. Thomas & France, 2007; J. S. Thomas, France, Sha, & Wiele, 2008). Second, the

PASS may not be measuring fear-avoidance, but rather is a measure of general psychosocial distress. In addition, the differences between pain-related fear and anxiety are enough to question the inclusion of the PASS as a fear-avoidance measure that follows the FAM.

Chapter 5

Methods

5.1 Development of the Fear-Avoidance Components Scale (FACS)

An interdisciplinary team, which included physicians (psychiatrist, orthopedic surgeon, and rehabilitation specialist), clinical psychologists, health psychologists, and psychophysiological specialists, who had worked exclusively with individuals with chronic pain conditions, developed the items for the FACS. To help determine the important components of FA that should be included in a comprehensive FA PRO measure, the team first reviewed Vlaeyen and colleagues' (2000) Cognitive Behavioral Fear-Avoidance Model, including cognitive (pain catastrophizing), affective (pain-related fear/anxiety), and behavioral (avoidance) constructs. Second, items were reviewed from well-studied FA-related PRO measures, including the TSK, FABQ, PASS, and PCS (discussed above), in order to determine the important components of FA that should be incorporated in the FACS. In addition, items from the Injustice Experience Questionnaire (IEQ), designed to assess the FA-related concept of one's perception of victimization and blame related to an injury (M. J. L. Sullivan et al., 2008), were reviewed. The present version of FACS can be found in Appendix A.

Sample items from the TSK, FABQ, PASS, PCS, and IEQ, the FA components that those items appear to measure, and the resulting FACS items are displayed in Table 5.1. Specific types of FA-related activities, and the physical level of those activities (from light to strenuous), were measured. Three reasons were assessed for avoiding these activities: 1) pain only (without fear); 2) fear of pain; or 3) fear of injury or re-injury. Specific beliefs and feelings about one's painful medical condition, which can produce FA, were also assessed. These include: perceptions of one's vulnerability to injury or re-injury; helplessness and/or lack of control; feeling that others do not understand one's painful medical condition; that someone else is to blame; that the situation/condition is unfair; and that one's painful medical condition is permanent rather than transient. Beliefs about pain as a warning signal of harm and danger, and pain-related

fear/anxiety/catastrophizing, including somatic symptoms of pain-related anxiety, were assessed. Both Vlaeyen et al.'s (2012) concepts of "fear" as an emotional reaction to a specific and immediate threat (e.g., FACS item #5 - I don't attempt certain activities because I am fearful that I will injure (or re-injure) myself), and "anxiety" as a future-oriented affective state in which the source of threat is anticipated (e.g., FACS item #3 - I believe that my pain will keep getting worse until I won't be able to function at all), were also represented.

Table 5.1 Development of the Fear Avoidance Components Scale (FACS) items

Fear avoidance components	**Items from previous patient-report outcome measures**	**Resulting FACS items**
Activity Avoidance		
Activity avoidance due to pain (without specifying fear)	PASS - I try to avoid activities that cause pain PASS - I will stop any activity as soon as I sense pain coming on FABQ – I should not do physical activities which (might) make my pain worse	1) I try to avoid activities and movements that make my pain worse
Activity avoidance due to pain-related fear	No specific items found	11) I don't attempt certain activities and movements because I am fearful that my pain will increase
Activity avoidance due to fear of injury (or re-injury)	TSK - I can't do all the things normal people do because it's just too easy for me to get injured TSK - I'm afraid that I might injure myself accidentally (or if I exercise) TSK – I'm afraid that I might injure myself if I exercise FABQ – Physical activity might harm my neck	5) I don't attempt certain activities because I am fearful that I will injure (or re-injure) myself

Table 5.1 – Continued

Fear avoidance components	Items from previous patient-report outcome measures	Resulting FACS items
Beliefs and feelings about one's painful medical condition		
Vulnerability to injury or re-injury	TSK - My accident has put my body at risk for the rest of my life TSK - It's really not safe for a person with a condition like mine to be physically active	8) My painful medical condition puts me at risk for future injuries (or re-injuries) for the rest of my life
A perception of one's painful medical condition as permanent, rather than transient	TSK – My accident has put my body at risk for the rest of my life IEQ - I feel that this has affected me in a permanent way IEQ - My life will never be the same PCS - It's terrible and I think it's never going to get any better PCS - I worry all the time about whether the pain will end	9) Because of my painful medical condition, my life will never be the same
Someone else is to blame	IEQ - I am suffering because of someone else's negligence	12) It is someone else's fault that I have this painful medical condition
Sense of unfairness	IEQ - It all seems so unfair	7) It is unfair that I have to live with my painful medical condition
Other people don't understand	TSK - People aren't taking my medical condition seriously enough IEQ - Most people don't understand how severe my condition is	14) No one understands how severe my painful medical condition is
Helplessness / lack of control over pain	PCS - There's nothing I can do to reduce the intensity of the pain	10) I have no control over my pain

Table 5.1 – Continued

Fear avoidance components	Items from previous patient-report outcome measures	Resulting FACS items
Beliefs and feelings about one's painful medical condition		
Interpretation of pain as harmful and dangerous	TSK - My body is telling me I have something dangerously wrong TSK - I wouldn't have this much pain if there weren't something potentially dangerous going on in my body TSK - Pain always means I have injured my body PASS – When I feel pain I think I might be seriously ill	13) The pain from my medical condition is a warning signal that something is dangerously wrong with me
Pain-related anxiety / catastrophizing	PASS - I worry when I am in pain PASS - Pain sensations are terrifying PCS - I can't seem to keep it out of my mind PCS - It's awful and I feel that it overwhelms me PCS - I become afraid that the pain will get worse	2) I worry about my painful medical condition 3) I believe that my pain will keep getting worse until I won't be able to function at all 4) I am overwhelmed by fear when I think about my painful medical condition
Somatic symptoms of pain-related anxiety / catastrophizing	PASS – I begin trembling when engaged in activity that increases pain PASS – Pain seems to cause my heart to pound or race PASS – When I sense pain I feel dizzy or faint PASS – Pain makes me nauseous	6) When my pain is bad, I have other symptoms such as nausea, difficulty breathing, heart pounding, trembling, and/or dizziness

Table 5.1 – Continued

Fear avoidance components	Items from previous patient-report outcome measures	Resulting FACS items
Type of activities, and level of activities, that one is avoiding		
	FABQ - Physical activity makes my pain worse	"Due to my painful medical condition I have avoided the following….."
Heavy activities		15)….strenuous activities (like doing heavy yard work or moving heavy furniture)
Moderate activities		16)…. moderate activities (like cooking dinner or cleaning the house)
Light activities		17)…. light activities (like going to the movies or going out to lunch)
Normal duties / chores at home and/or work	FABQ – I cannot do my normal work with my present pain	18)….my full duties and chores at home and/or at work
Recreational activities / exercise	TSK - Pain lets me know when to stop exercising so that I don't injure myself	19)….recreation and/or exercise (things that I do for fun and good health)
Activities involving one's painful body parts		20)….activities where I have to use my painful body part(s)

Based upon the items seen in Table 5.1 above, an initial version of the FACS was created, which is located in Appendix A. The FACS has 20 items, measured on a 5 point Likert scale, which results in a total of 100 points (range 0-100). Each item requires the participant respond with one of the following choices: (5) completely agree; (4) mostly agree; (3) slightly agree; (2) slightly disagree; (1) mostly disagree; (0) completely disagree. Higher scores were intended to indicate higher levels of FA. In addition to the total score (which represents a general level of FA), responses to individual FACS items provide clinically relevant information, including the types of activities avoided, why the activities are avoided, and what pain-related affect and belief systems are involved. The FACS was hypothesized to have 3 subscales based upon the general FA-related concepts they were intended to assess. These subscales were formed *a priori* and were as follows: Pain-Related Anxiety, Activity Avoidance, and Victimization. The items in each subscale are located in Table 5.2 below.

Table 5.2 Proposed FACS subscales

Subscale1: Pain-Related Anxiety	
2	I worry about my painful medical condition
3	I believe that my pain will keep getting worse until I won't be able to function at all
4	I am overwhelmed by fear when I think about my painful medical condition
6	When my pain is really bad, I also have other symptoms such as nausea, difficulty breathing, heart pounding, trembling, and/or dizziness
8	My painful medical condition puts me at risk for future injuries (or re-injuries) for the rest of my life
9	Because of my painful medical condition, my life will never be the same
10	I have no control over my pain
13	The pain from my medical condition is a warning signal that something is dangerously wrong with me
Subscale 2: Activity Avoidance	
1	I try to avoid activities and movements that make my pain worse
5	I don't attempt certain activities because I am fearful that I will injure (or re-injure) myself
11	I don't attempt certain activities and movements because I am fearful that my pain will increase
15	...strenuous activities (like doing heavy yard work or moving heavy furniture)…
16	…moderate activities (like cooking dinner or cleaning the house)…
17	…light activities (like going to the movies or going out to lunch)…
18	…my full duties and chores at home and/or at work…
19	…recreation and/or exercise (things that I do for fun and good health)…
20	…activities where I have to use my painful body part(s)…
Subscale 3: Victimization	
7	It is unfair that I have to live with my painful medical condition
12	It is someone else's fault that I have this painful medical condition
14	No one understands how severe my painful medical condition is

5.2 Participants

5.2.1 Chronic Musculoskeletal Pain Disorder (CMPD) Patients

Patients referred to a regional interdisciplinary FRP consented to the collection of information for treatment management and clinical research purposes. Because the information was collected as part of the standard medical record, the study was granted an exemption from review by the University of Texas at Arlington Institutional Review Board (IRB). Patients were eligible for treatment if a minimum of 4 months had passed between the date of injury and treatment; if their primary or secondary treatments were previously unsuccessful; if they were suffering from severe pain and functional limitations; and if they had the ability to communicate in

either English or Spanish. Patients signed a Health Insurance Portability and Accountability Act (HIPAA) authorization before entering the program. Patients did not receive payment or reward for participation in this study, other than the benefit from completion of the FRP.

As seen in Figure 5.1, a total of 568 patients completed at least one FACS (either at admission or discharge) between the timeframe of February 2011 and September 2014. Of those patients, only 426 patients completed the FACS at admission, and of those 426 patients, only 342 completed the FRP, yielding a 20% non-completion rate. Additionally, when one-year outcome analysis and prediction takes place, all patients who were designated as "quality of life," meaning that they did not have clear return to work goals, will be excluded for analyses. Therefore, at one-year, 284 patients were be available for analysis.

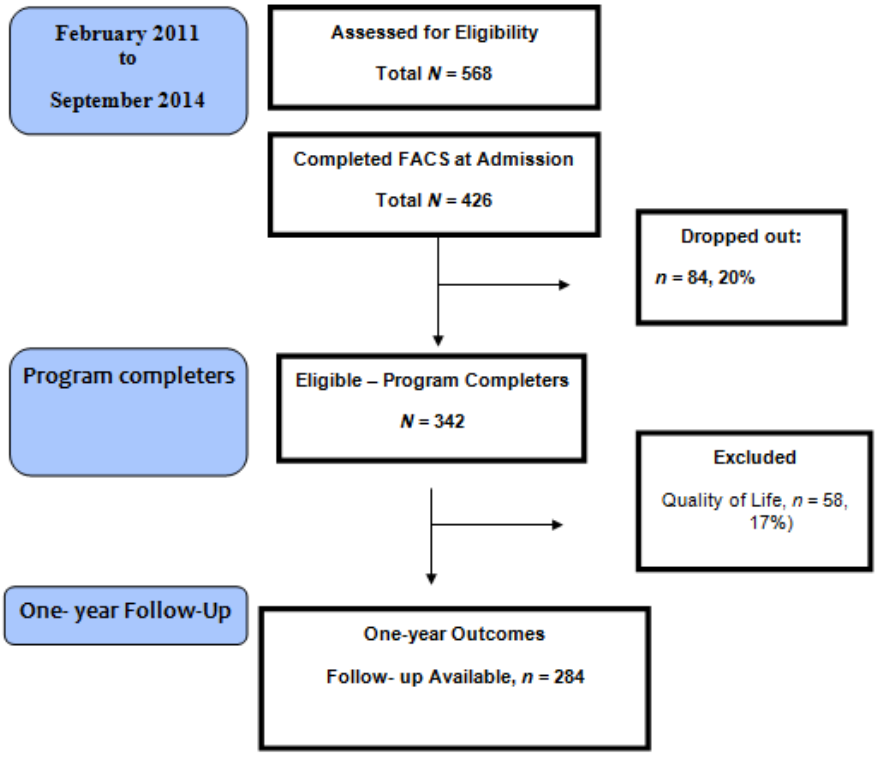

Figure 5.1 Flowchart of CMPD patients

5.2.2 Psychiatric Chronic Pain Comparison Sample

This comparison sample was collected at a practice that specialized in the assessment and treatment of complex psychiatric and psychophysiological disorders, including chronic musculoskeletal and post-operative pain, treatment-resistant neuropathic pain, treatment-resistant headache, rheumatologic and neurologic disorders, and central sensitization symptoms. The majority of patients also presented with comorbid affective disorders, personality disorders, chemical dependency, head injury, and/or childhood abuse and trauma. A total number of 290 patients were collected in a consecutive cohort sample from 2013-2014, with 13 patients excluded due to age (restricted to years 18-75), leaving a total sample of 277 patients. As with the CMPD sample, since all information collected was part of the standard medical record, the study was granted an exemption from review by the IRB.

5.2.3 Non-Patient Comparison Sample

The non-patient community sample was drawn from graduate students, staff, and faculty members at both the University of Texas at Arlington (UTA) and PRIDE. These participants had current or past painful medical conditions, but were understood to be largely functional. The data collection for the non-patient community sample was approved through the UTA IRB, and all participants provided written informed consent prior to participation. Of the 397 subjects asked to participate, 110 agreed to participate, were deemed eligible and completed the FACS, yielding a 28% response rate. Non-patients were broken down into 3 groups based upon their response to a question about their painful medical condition, which read:

> "Please circle the category of a past or present painful medical condition (e.g., back pain, headaches, broken bone, etc.) which applies to you: 1) no longer painful; 2) now with some pain, but does not interfere with daily activities; 3) now with pain, and does interfere with daily activities; 4) have not had a past painful medical condition."

Of the total sample, 26 people reported a past medical condition that was no longer painful, 52 people reported that they had some pain, but it did not interfere with their daily activities, 23 people reported that current pain did interfere with their daily activities, and 8 indicated that they have not had a past painful medical condition. A comparison of these normative population sub-groups is shown in Table 5.3. It was found that those who currently had pain that interfered with their daily life had significantly higher FACS scores than those who no longer had pain or those that had never had a painful medical condition (both *p*s < .001). In addition, those who currently had pain that interfered with their daily lives were significantly older than those whose condition was no longer painful ($p < .001$), and differed significantly on FACS scores.

Table 5.3 Comparison of normative population subgroups

Variable	**No longer painful n = 26**	**Some pain n = 52**	**Pain with interference n = 23**	**No painful medical condition n = 8**	***F* / χ^2value**	***p* value**	**Effect Size**
Total FACS score, mean (SD)	13.2 (14.7)	18.3 (13.6)	24.9 (14.8)	0.0 (0.0)	4.13	.01	.13
Age, mean (SD)	28.1 (8.7)	36.8 (14.5)	43.5 (19.1)	27.5 (3.9)	4.65	.00	.15
Gender, *n* (% male)	13 (50%)	18 (35%)	7 (30%)	2 (25%)	3.53	.47	.18

5.3 Procedures

5.3.1 Chronic Musculoskeletal Pain Disorder (CMPD) Patients

The FRP is an interdisciplinary rehabilitation program that adopts a sports medicine approach and was based on the biopsychosocial model, which views dysfunction and occupational illness as a complex interaction of biological, psychological, and social variables (Gatchel et al., 2007; Turk, 1996). The primary goal of the FRP was to restore function and reduce disability in a CMPD population, rather than eliminate pain, although decreases in pain

were often a secondary product from the FRP. The FRP addresses the psychological, physical, financial, legal, and work-related complications acting as barriers to recovery in the chronic pain patient. Treatment was guided by a physician, who served as the medical director, with nurses serving as an extension of the physician. In addition, patients participated in physical therapy, occupational therapy, group stretching, and a multi-modal disability management program, which included individual and group counseling using a CBT approach; stress management techniques; biofeedback; educational sessions on the nature of pain, stress, and disability; and vocational reintegration (done by a case manager). The FRP is interdisciplinary rather than multidisciplinary because all clinicians are housed in the same building and have direct communication with each other (Deschner & Polatin, 2000).

There were three major phases to the FRP. In Phase I, the focus was upon removing barriers to recovery and conducting disability education, which was guided by a psychology staff member. The psychology staff also began treating any underlying psychopathology, with counseling and/or pharmacotherapy. In addition, stretching and goals for range of motion (ROM) increases were emphasized by the physical therapy (PT) and occupational therapy (OT) staff. Within the initial phase, baseline physical function assessments and an initial occupational assessment and interview took place. Frequent assessments of physical and psychosocial functioning helped maintain program objectivity and provided patients with feedback on how treatment progressed.

Phase II of the FRP was the intensive rehabilitation phase. It focused on the enhancement of strength, endurance, and aerobic capacity, using an individualized graded exercise plan. PT and OT played the largest part in Phase II, with psychology staff assisting to help decrease barriers to recovery and medication reliance. The primary goal of OT was not to focus on the injured body part specifically, as PT did, but instead to coordinate whole body movement to hone job skills and activities of daily living (ADLs). Functional Capacity Evaluations (FCEs) were regularly performed to show objective improvement.

Phase III of the FRP was follow-up. In this phase, the patient was gradually "weaned" off of the FRP program. Emphasis was placed on continuing exercise regimens at home and the upcoming return to work. A recurrence of symptom magnification, non-compliance, and regression often took place during this phase due to patients' anxiety about the future, so counseling and case manager involvement was crucial during Phase III (Deschner & Polatin, 2000; T. G. Mayer & Gatchel, 1988; T. G. Mayer & Polatin, 2000).

5.3.2 Psychiatric Chronic Pain Comparison Sample

Upon arrival at their initial appointment, patients completed their test packet. Then, a comprehensive review was conducted by a single psychiatrist, Dr. Howard Cohen, who had extensive experience and training in the diagnosis of mental health disorders and chronic pain conditions. His patients were queried about their present complaints, current and past medications, medical and psychiatric history, and their current diagnoses. The presence or absence of a psychiatric disorder was determined by the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) (American Psychiatric Association, 2000).

5.3.3 Non-Patient Comparison Sample

Non-patients were approached by a PRIDE staff member or UTA graduate student about participation in data collection, either in person or by email. If approached by email, the following prompt was used, with the contact information modified appropriately:

> "Hi all,
>
> We're doing a study in my lab on patients who are afraid of moving because of their pain. We created a new questionnaire (Fear-Avoidance Criteria Scale) and I would love your help to compare the patient population to a "normal" population. It will only take about 5-10 minutes of your time!

If you have ever had a painful medical condition (e.g. back pain, headaches, broken bone, etc.), will you please fill out the attached forms? Please fill out the FACS Questionnaire two days in a row (i.e. fill it out today, and then fill out again tomorrow) and then return it, along with the Demographics sheet and the **last page** of the Informed Consent document, to me. You can either email them or mail them back to me at the following address:

Thank you so much, in advance!"

5.4 Materials and Measures

5.4.1 Chronic Musculoskeletal Pain Disorder (CMPD) Patient Sample

5.4.1.1 Assessment of Physical Functioning

Assessment of physical functioning provided an objective measure of a patient's abilities at the beginning of the FRP and helped measure progress as the patient continued through the program. Physical functioning assessments also showed the degree of effort used to perform physical tasks. When suboptimal effort was identified, with no medical reason, it alerted the clinical team that additional psychosocial barriers to functional recovery were most likely present. It was important to assess physical functioning because deficits were predictive and associated with disability (Polatin & Mayer, 1992).

An FCE was used to assess physical functioning for all CMPD patients. All physical measurement scores were converted to percent normal by dividing the raw score by a normative score unless otherwise indicated below. Normative scores were calculated taking into account age and gender, and were based on a series of studies on normative samples (Kishino et al., 1985; T. G. Mayer, 2000; S. S. Smith, Mayer, Gatchel, & Becker, 1985); (T. G. Mayer, Gatchel,

Keeley, & Mayer, 1993; T. Mayer, Gatchel, Betancur, & Bovasso, 1995). Tables of normative scores can be found in Tables 5.4 & 5.5.

Table 5.4 Physical measure normative scores for males

Gender	**Male**			
Age groups	**18-29**	**30-44**	**45-59**	**60-99**
Physical Measures:				
Floor to Waist Isokinetic Lift	94	94	85	75
Waist to Shoulder Isokinetic Lift	73	73	66	58
Trunk Extension	140	140	126	112
Floor to Waist PILE*	45	45	41	36
Waist to Shoulder PILE*	34	34	31	27

* PILE: Progressive Isoinertial Lifting Evaluation

Table 5.5 Physical measure normative scores for females

Gender	**Female**			
Age groups	**18-29**	**30-44**	**45-59**	**60-99**
Physical Measures:				
Floor to Waist Isokinetic Lift	62	62	56	50
Waist to Shoulder Isokinetic Lift	37	37	33	30
Trunk Extension	97	97	87	78
Floor to Waist PILE*	40	40	36	32
Waist to Shoulder PILE*	28	28	25	22

* PILE: Progressive Isoinertial Lifting Evaluation

5.4.1.1.1 Progressive Isoinertial Lifting Evaluation (PILE). The PILE task was a measure of lifting capacity with no restriction of activity (unlike the isokinetic tasks described below), which allowed both lifting strength and agility to be measured, leading to a better true measure of lifting capacity. During this task, the patient lifted weights in a plastic box from floor to waist height (FW; 0-30 inches) and from waist to shoulder height (WS; 30-54 inches). Patients were not aware of the amount of weight in the box, although in reality, women began with a 5 pound load and men began with a 10 pound load, with the initial weight added every 20 second period. Each 20 second period had 4 lifting cycles in it, which consisted of 2 lifting movements to return to the starting point; for example, floor to waist, then waist to floor. The test ended when one of three endpoints was achieved: a) psychophysical endpoint: pain or fatigue; b) aerobic end point: achievement of 85% maximum heart rate (determined by age calculations); or c) safety end point: achievement of 45-50% of body weight lifted (T. G. Mayer et al., 1988; Polatin & Mayer, 1992). The maximum final force from FW and WS was recorded, and the raw data was converted to percent normal.

In order to calculate percent normal data, patients were first assigned an ideal weight value based on height and gender. Ideal weights are listed in Table 5.6. If a patient's actual body weight was less than or equal to the ideal body weight, then the adjusted body weight value was the patient's actual body weight, since the data normalization process was skewed by overweight but not underweight values. If the patient's actual body weight was greater than the ideal body weight, however, the adjusted body weight value was the ideal body weight value. Normative scores were then calculated by dividing the final force by the adjusted body weight, multiplying by 100, and then dividing by a normative value that took into account age and gender (T. G. Mayer et al., 1988). Normative values are shown in Tables 5.4 and 5.5. PILE scores have shown high responsiveness to FR treatment, with patients often exhibiting normal or supernormal physical capacity at discharge.

Table 5.6 Ideal weights used to calculate PILE scores

Female		Male	
Height (in)	**Weight (lbs)**	**Height (in)**	**Weight (lb)**
58	111	62	144
59	114	63	147
60	117	64	150
61	120	65	154
62	124	66	157
63	126	67	162
64	129	68	167
65	134	69	171
66	137	70	175
67	141	71	180
68	145	72	185
69	149	73	190
70	154	74	195
71	159	75	200
72	163	76	205

If the patient used only submaximal effort, their final heart rate was relatively low and there was a large discrepancy between the target heart rate and final heart rate. This can be validated against the results from the aerobic capacity test, thus allowing identification of patients with submaximal effort.

5.4.1.1.2 Isokinetic Lift Task. The isokinetic lift tasks held speed and acceleration constant so that torque or force became the only tested variable, allowing for easy calculation of individual differences (Polatin & Mayer, 1992). In order to measure lift, the Biodex System 4 Lift Attachment

(Biodex Medical Systems, a) was used. Testing took place for both WS and FW at 20 inches per second and was measured in force to body weight (Biodex Medical Systems, b). This machine was demonstrated to be a valid measure of isokinetic torque (Drouin, Valovich-mcLeod, Shultz, Gansneder, & Perrin, 2004).

5.4.1.1.3 Trunk Strength. Trunk strength was measured isokinetically in peak torque to body weight. As in the isokinetic lift task, speed and ROM were fixed in order to measure torque or force (J. Keeley, 1991). The Biodex System 3 Back Attachment machine (Biodex Medical Systems, a) measured trunk strength for the extension at 60 degrees per second. Patients were stabilized with a belt along the upper thigh and pelvis, and with a lumbosacral pad that maintains pelvic tilt (J. Keeley, 1991). Isokinetic trunk strength (extension) was measured at sixty degrees per second. Please note this variable was only collected if patients had a compensable lumbar injury.

5.4.1.2 Medical Case Management Evaluation

Demographic and occupational data were collected by the case management and nursing departments at program admission. Relevant demographic information collected included age, ethnicity, area (s) of injury, gender, education, marital status, and information about pre-admission surgeries. Occupational data included information collected about disability compensation, whether the patients' workers' compensation case was settled (if applicable), whether the patient was working at program admission, whether the patient's original job was available to return to at the end of the FRP, length of disability (the amount of time that has elapsed from the injury to rehabilitation), total temporary disability (the length of time elapsed from injury with no work at all), the patient's average weekly income, job satisfaction, and job demand, which was classified as "blue collar" or "white collar."

5.4.1.3 Psychosocial Intake Evaluation

After the patient was accepted into the FRP, he or she underwent an initial Mental Health Evaluation (MHE). Patients completed packets of PRO questionnaires assessing psychosocial measures of pain, perceived disability, health-related quality of life, depressive symptoms,

somatization, kinesiophobia, perceived injustice, and insomnia, which were collected at admission and discharge. In addition, a small selection of patients (n = 24) were asked about the utility of the FACS.

5.4.1.3.1 Perceived Pain Intensity. Patients marked their pain intensity on a 10mm visual analog scale (VAS) line, with the anchor points of “no pain” and “worst possible pain.” Pain intensity was scored by measuring the distance from the “no pain” endpoint to the patient’s marking. The VAS was usually easily understood and was useful in measuring subjective pain (M. P. Jensen, Karoly, & Braver, 1986). It has moderate to high test-retest reliability depending on the literacy level of the patient (α = .71-.94) and has demonstrated high correlations with other pain rating styles (*r* = .71-.78) (Gillian, Mian, Kendzerska, & French, 2011).

5.4.1.3.2 The Patient Disability Questionnaire (PDQ). The PDQ was a measure of functional status and was designed for use in a CMPD population, rather than just for low back pain populations, as the Oswestry Disability Index is (see below). In addition, the PDQ was designed to understand the biopsychosocial aspects of disability (Anagnostis, Gatchel, & Mayer, 2004). Sample items included: “Are there emotional problems caused by your pain that interfere with your family, social, or work activities?” and “Does your pain interfere with personal care (such as bathing, dressing, etc.)?” Responses to 15 items were scored on a 10cm VAS scale, and total scores ranged from zero, indicating optimal functioning, to 150, indicating total disability. The PDQ was broken up categorically into 3 groupings: Mild/Moderate (0-70), Severe (71-100), and Extreme (101-150). The PDQ was also broken down into two components: functional status and psychosocial status. The PDQ was responsive to meaningful clinical change, corresponded with psychosocial and socioeconomic outcomes, such as pain anxiety sensitivity (B. E. Mayer, 2011), coping style (Choi, Mayer, Williams, & Gatchel, 2013), insomnia (RW.ERROR - Unable to find reference:1708), somatization (Hartzell et al., 2013), psychopathology (Ellis HB, Howard KJ, Khaleel MA, & Bucholz, 2012), surgery outcomes (Brede, 2012), and work retention (Brede, 2011), as well as the PILE (Gatchel, Mayer, & Chou, 2012). The PDQ also demonstrated high

construct-related validity and reliability. The reliability coefficient was .98 for the PDQ, and inter-rater reliability was α = .96 (Anagnostis et al., 2004; Gatchel, Mayer, & Theodore, 2006).

5.4.1.3.3 The Oswestry Disability Index (ODI). While the ODI was one of the oldest and most frequently studied disability questionnaires (J. C. Fairbank & Pynsent, 2000), and demonstrated excellent psychometric properties, it had several limitations, such as the inability to distinguish low-scoring patients (floor effect) and its narrow focus on only low back pain (Gatchel et al., 2006). The ODI was made up of ten sections asking about functional limitations due to pain. Each section had a series of six possible responses, each describing a greater degree of functional difficulty than the previous response, and patients were asked to mark one box that most closely matched their functional level within each section. The total score (max 50) was doubled and then expressed as a percentage. Established ranges on the ODI were as follows: minimal disability (0-20%), moderate disability (20-40%), severe disability (40-60%), crippled (60-80%), and bed-bound or exaggerating (80-100%) (J. C. Fairbank, Couper, Davies, & O'Brien, 1980). The correlational coefficient for test-retest reliability was r = .99 for the tests given on the same day (J. C. Fairbank et al., 1980), but dropped to r = .83 if tested within four days (J. C. Fairbank & Pynsent, 2000).

5.4.1.3.4 The Beck Depression Inventory (BDI). The BDI (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) measured depressive symptoms and was frequently used as a screening tool in pain centers, although it may overestimate depressive symptoms because of the similarity between somatic symptoms of depression and physical symptoms of chronic pain (Wesley, Gatchel, Garofalo, & Polatin, 1999). The BDI consisted of 21 items scaled on a 0-3 point scale, with zero indicating the depressive symptom was not present and three indicating that the symptom was severe. Total scores ranged from 0-63, with cut-offs of no depression (0-9), mild to moderate depression (10-18), moderate to severe depression (19-29), and severe depression (>30). The BDI has shown high internal consistency, moderate stability, and high criterion, concurrent, construct, and discriminate validity, with α scores ranging from .76-.95 in one meta-analysis (Beck, Steer, & Garbin, 1988).

5.4.1.3.5 The Central Sensitization Inventory (CSI). The CSI was created to measure the likelihood of a patient being diagnosed with a central sensitivity syndrome (CSS). The measure consisted of 2 parts. Part A included 25 health-related symptoms common to CSSs. Responses on Part A were scored on a Likert scale from 0 (never) to 4 (always), and yielded a total score of 100. Part B asked patients if they had ever received certain diagnoses, including 7 CSS diagnoses (tension headaches/migraines, fibromyalgia, irritable bowel syndrome, restless leg syndrome, temporomandibular joint disorder, chronic fatigue syndrome, and multiple chemical sensitivities), and 3 CSS-related disorders (depression, anxiety/panic attacks, and neck injury). Subjects were asked whether they have ever been diagnosed with the disorder and if so, in what year (T. G. Mayer et al., 2012). The CSI was reliable and valid in both a CMPD population (T. G. Mayer et al., 2012) and a psychiatric chronic pain sample (Neblett et al., 2014; Neblett et al., 2013). Those patients scoring above 40 were more likely to have a CSS, with high sensitivity and adequate specificity, allowing the CSI to be used as a screener to help diagnose patients with CSSs without wasting valuable time, cost, and effort in a multitude of tests that may not yield results (Neblett et al., 2014; Neblett et al., 2013).

5.4.1.3.6 The Patient Health Questionnaire (PHQ) Somatization Module. The PHQ was first developed to help primary care physicians easily diagnose psychiatric disorders (Spitzer, Kroenke, & Williams, 1999). While there were many modules to the PHQ, only the somatization module (Kroenke, Spitzer, & Williams, 2002) was utilized in this study, since the remaining modules overlap well with the psychiatric diagnoses given by clinicians (Asih. et al., 2014; Choi, Mayer, & Gatchel, 2011; Choi, Mayer, Williams, & Gatchel, 2014). The PHQ Somatization module asked about 13 common somatic symptoms that were scored on a scale from 0-2, with 0 being “not bothered at all” and 2 being “bothered a lot” by each particular symptom. The total score for the somatization module ranged from 0-26. Although the PHQ somatization module was originally created to include clinician rating of whether the patient’s endorsement had a medical etiology or if the symptom was medically unexplained, this was quite difficult (Körber, Frieser, Steinbrecher, & Hiller, 2011), and thus the PHQ Somatization module was only used as a PRO in this study. In

a CMPD population, this tactic has worked well, and the PHQ Somatization module has demonstrated a relationship between psychosocial and socioeconomic outcome measures (Hartzell et al., 2013).

5.4.1.3.7 The Insomnia Severity Index (ISI). The ISI was designed to measure the severity of both nighttime and daytime insomnia components. It was measured on a 5 point Likert scale from 0 (not at all) to 4 (extremely), and generated a total score range from 0 to 28 (Bastien, Vallières, & Morin, 2001). Previously, a 15 point cut-off score for threshold insomnia had been used (S. Smith & Trinder, 2001), but more recently, severity levels have been developed: No Clinically Significant Insomnia (0-7); Sub-threshold Insomnia (8-14); Moderate Clinical Insomnia (15-21); and Severe Clinical Insomnia (22-28) (Asih, Neblett, Mayer, Brede, & Gatchel, 2014). The ISI also helped determine between the 3 types of insomnia: Early (difficulty initiating sleep); Middle (difficulty staying asleep); and Late Insomnia (early morning waking). Questions about the types of insomnia were rated from 0 (none) to 4 (very severe), with a score of 3, indicating a severe disturbance, chosen as a cut-off. Patients scoring above 3 on each of the insomnia questions were likely to have that type of insomnia (Morin et al., 2009).

5.4.1.3.8 The Tampa Scale for Kinesiophobia (TSK). The TSK-13 was used in the current study as a measure of kinesiophobia. The TSK-13 was chosen instead of the full questionnaire (the TSK-17), because the psychometric properties increased when the reverse-scored items were removed (Geisser et al., 2000; Goubert et al., 2004; Roelofs et al., 2007; Swinkels-Meewisse et al., 2003) The TSK-13 is scored from 0 -52. Please see section 4.1 for a full review of the TSK.

5.4.1.3.9 The Injustice Experience Questionnaire (IEQ). The IEQ was a 12 item measure of perceived injustice, which was defined as a set of cognitions with attributions of blame, magnitude of loss, and irreparability of loss. It was scored on a 5 point Likert scale, from 0 (not at all) to 4 (all the time) for a total of 48 points. There were 2 subscales to the IEQ: blame/unfairness and severity/irreparability. In its initial validation study, the IEQ appeared reliable and valid ($\alpha = .92$). Those who had been in an accident were more likely to have higher IEQ scores, and the IEQ was

significantly correlated to pain catastrophizing, depressive symptoms, kinesiophobia, and self-reported disability (M. J. L. Sullivan et al., 2008).

5.4.1.3.10 The Multidimensional Personality Inventory (MPI). The MPI was a 61 item measure of the chronic pain experience. Section I included 5 scales that covered pain severity and the cognitive and affective responses to pain. These 5 scales were: pain severity, interference, life control, affective distress, and support. Section II assessed the patients' perceived support from significant others, including perceived punishing, distracting, and solicitous responses from the significant others. Section III assessed daily activities to understand the patient's general activity level. All sections of the MPI were scored and classified into 3 main subgroups using the developed computer program (Kerns, Turk, & Rudy, 1985). These 3 main MPI subgroups were as follows: Adaptive Coper (AC); Interpersonally Distressed (ID); and Dysfunctional (DYS). Additionally, two other styles may result, which were typically thought of as invalid: Hybrid (HY) and Unanalyzable. The MPI has been shown to be both reliable and valid (Choi et al., 2013; Kerns et al., 1985; T. G. Mayer, Asih, Williams, & Gatchel, 2014).

5.4.1.3.11 The Psychosocial Clinical Interview. The clinical interview, conducted by a qualified clinician, integrated the above PRO measures with a personal patient assessment. The patient was assessed for symptoms of depression, anxiety, stress, and psychiatric disorders (as diagnosed in the DSM-IV-TR) (American Psychiatric Association, 2000), as well as assessed on his or her home and family life and presence of social support. The psychologist also determined patient motivation for recovery, including financial disincentives for return to work, secondary gain issues, and malingering symptoms (Gatchel, 1991).

5.4.1.4 Structured One-Year Follow-Up Interview

Socioeconomically-relevant outcomes were assessed approximately one-year after discharge in a structured interview, either in person or by telephone, in order to determine the extent to which the individual had recovered from the disability phase and returned to more normal daily activities. Outcomes fell into three major domains: work status; additional healthcare utilization; and WC-related issues. Work status was determined as return-to-work (or obtaining

new employment) at any time during the year following FRP discharge; and work retention, which assessed whether the patient was still working at the time of the one-year follow-up interview. Additional healthcare utilization examined new surgery to the original site of injury, seeking healthcare from a new provider, and the associated number of visits to the new provider. The WC claim-related issues included the percent of patients with recurrent injury claims and the rate of WC case settlement (T. G. Mayer, Prescott, & Gatchel, 2000; T. G. Mayer et al., 1985; T. G. Mayer et al., 1987).

5.4.1.6 FACS Validation Questionnaires

Two different additional questionnaires were used to help assess the validity of the FACS. The first examined patients' ratings of the FACS' utility, while the second was meant to validate FACS questions that dealt with the reason for avoidance: either because of pain only (without fear); fear of pain, or fear of injury or re-injury.

5.4.1.6.1 Patient Ratings of FACS Utility. A small subset of CMPD patients (n =24) were also asked about the utility of the FACS with four simple questions. These questions were: 1) "the items on the test were easy to understand;" 2) "the rating system (from "completely agree" to "completely disagree") was easy to understand; 3) "the items on the test were relevant and appropriate for people with painful medical conditions;" 4) "the length of the test was appropriate." Each was answered as a dichotomous yes or no, and if the patient answered no, a comments section was provided for their additional feedback.

5*.4.1.6.2 Clinician Ratings of FA Type.* A small subset of CMPD patients (n = 40) were rated for the type of FA they exhibit (Pincus et al., 2010). FA types included: Misinformed Avoider; Learned Pain Avoider; Affective Avoider; and No or Minimial Activity Avoidance. Two occupational therapists (M & S) rated patients, using the following checklist, depicted in Table 5.7. If the therapists answered "no" to #1, then the patient was categorized as having no or minimal activity avoidance. If the therapist answered "yes" to #1, 2, and/or 3, then the patient was categorized as a learned avoider. If the therapist answered "yes" to #1 & 5, but "no" to #6 & 7, then the patient was categorized as a misinformed avoider. If the therapist answered "yes" to #1, 6, and/or 7, then

the patient was categorized as an affective avoider. If the therapist answered “yes” to #1 & 4, but the patient denies fear of re-injury or pain, then further investigation is needed.

Table 5.7 Checklist for FA type

1.	Is activity avoidance observed (in the gym, etc.) or reported by the patient?
2.	If yes to #1, has the patient attributed activity avoidance to pain?
3.	If yes to #1, is activity avoidance accompanied by pain behaviors?
4.	If yes to #3, are the pain behaviors exaggerated (i.e., patient is exhibiting distress?
5.	Has the patient expressed fear of re-injury?
6.	Has the patient expressed distorted beliefs about pain/injury?
7.	Has the patient demonstrated exaggerated emotions regarding pain/injury?

5.4.2 Psychiatric Chronic Pain Comparison Sample

Patients included in the psychiatric chronic pain sample were asked to fill out a test-packet that asked for information about their patient-reported disability, depressive symptoms, insomnia symptoms, likelihood of having a CSS, fear-avoidance beliefs and behaviors, past medical history, social history, and pain levels. Patient-reported disability was assessed by the PDQ, depressive symptoms were assessed by the BDI, insomnia symptoms were assessed using the ISI, central sensitivity likelihood was assessed by the CSI, and fear-avoidance was measured by the newly-developed FACS. The remainder of the information came from the Patient Comfort Assessment Guide, which is discussed below.

5.4.2.1 The Patient Comfort Assessment Guide

The Patient Comfort Assessment Guide was a nonproprietary patient-reported instrument of pain symptoms, developed by Purdue Pharma, Ltd. with the help of Dr. Narcessian at the Kessler Institute for Rehabilitation. The Patient Comfort Assessment Guide asked questions about the patient’s worst, least, average, and current pain (Partners Against Pain, 2011).

5.4.3 Non-Patient Comparison Sample

Non-patients were asked to complete the FACS (located in Appendix A) as well a Demographics information sheet that asked about the participant's age, gender, and included a question about their past or present painful medical condition.

5.5 Analytic Plan

All data, unless otherwise specified, were analyzed with Statistical Package for the Social Sciences (SPSS) version 18, with the significance level set at $p = .05$. Due to the large number of two-level factorial designs, the Holm Step-down procedure was used to determine the need for adjusted *p* values (Holm, Mark, & Adolfsson, 2005). However, when the Holm Step-Down procedure was run, it was found that no variable changed from significant to non-significant; therefore, uncorrected *p* values were reported.

5.5.1 Initial Reliability and Validity Analyses

Test-retest analyses were undertaken, with correlational comparisons made for each of the 20 FACS items, along with an overall sum score, using Pearson's *r.* A value of .75 or higher was considered reliable (Nunnally & Bernstein, 1994). Internal consistency was evaluated using Cronbach's alpha (Cronbach, 1951), for both the overall measure and each subscale, with adequate α considered between .7 and .9 (Nunnally & Bernstein, 1994). Corrected item total was also performed, which assessed how well each item fit into its subscale by determining the correlation of an item with the average of the subscale, without including the same item (to avoid auto-inflation). Corrected item total correlations were considered adequate if above .2, as any correlations below .2 may indicate that items assessed a different construct.

5.5.2 Factor Analysis

Initial factor analyses were undertaken, once reliability and validity analyses were completed, with *a priori* subscales determined in advance. An exploratory factor analysis (EFA) was done, using both principle component analysis (PCA) and principle axis factoring (PAF) and using both Promax and Oblimin rotations. Only the EFA style and rotation that best fits the CMPD patient population data was reported. An initial screener for the number of factors was done by

looking at the eigenvalues: only eigenvalues greater than one were considered. The cutoff for factor loadings was set at .4. Any items that did not fit well, as determined by either Cronbach's alpha, corrected item total, or the EFA, were temporarily removed to determine if removal of the item increased the relative strength of the FACS as a whole.

After the initial factor analysis was complete, a second confirmatory factor analysis (CFA) was also undertaken to confirm the results of the EFA described above. The CFA utilized SPSS version 22 Analysis of Moment Structures (AMOS) software, and overall model fit was examined with Chi-Square results, as well as model fit indices. Model fit indices included: the normed fit index (NFI), which was deemed acceptable if between .9 and .95, the root mean square error of approximation (RMSEA), accepted at a value of .8, the comparative fit index (CFI), deemed appropriate at .09, the *p* of close fit (PCLOSE), accepted at .01, and the Hoteller Index, which required a value of 150 to be acceptable.

5.5.3 Analysis of Item Response and Sensitivity/Specificity

The next step in the analytic plan was to compare scores from each sample using one-way analyses of variance (ANOVAs) and to examine a histogram and the response frequencies for each item. In addition, item means and response trends were examined. This enabled the researchers to better understand how participants were responding to the FACS and helped determine cut-off scores or severity levels. After this was done, a receiver operating characteristic (ROC) was utilized to help determine a cut-off score that discriminated between the CMPD population and the non-patient comparison sample as well as the psychiatric chronic pain sample and the non-patient comparison sample. In addition to using the area under the curve (AUC) scores, the screening accuracy of the FACS was examined, using the cut-off scores found. The number and percentage of true positives (those participants that had a score above the cut-off and were expected to have a score above the cut-off), false negatives (those participants that had a score below the cutoff but were expected to have a score above the cut-off), false positives (those participants that had a score above the cut-off but were expected to have a score below the cut-off), and true negatives (those participants that had a score below the cut-off and were

expected to have a score below the cut-off) were determined. Using these values, the sensitivity and specificity of the FACS was determined. Likelihood ratios were also computed. Positive likelihood was calculated by dividing the number of true positives by the number of false positives, and negative likelihood was calculated by dividing the number of false negatives by the number of true positives (Attia, 2003).

5.5.4 Determination of Severity Levels

Once cut-off scores were determined, the next step was to determine severity levels. In part, as stated above, this was done by examining how total FACS scores fall in the distribution for each sample, and took into account the ROC analysis results for dichotomous cut-off scores. In addition, determination of severity levels took place with input from the FRP clinicians who routinely used the FACS for their diagnosis and assessment procedures. In addition, severity levels were validated by how well they related to the various psychosocial assessments used in the CMPD and psychiatric chronic pain sample, as well as how the FACS severity levels related to the physical lifting tasks. In order to do this, pattern mixture modeling was employed, which took into account the effect of FRP non-completion, time, and the four covariates that were found significant (age, education, attorney retention, and marital status). In addition, the psychosocial and physical variables explored by the pattern mixture modeling were also analyzed separately at admission and discharge, regardless of whether the severity level by time interaction was significant. One-way analyses of variance (ANOVAs) were used for continuous variables, with the independent variable (IV) being the FACS severity levels and the dependent variable (DV) being the demographic, occupational, psychosocial, physical, or socioeconomic outcome measure that was continuous. Post-hoc tests for continuous variables were computed using the Bonferroni correction for multiple comparisons, and effect size was computed using partial eta-squared (η^2).

In determining comparisons for variables that were categorical in nature, independent Chi-Square tests (χ^2) tests were utilized, with the IV being the FACS severity levels and the DV being the demographic, occupational, psychosocial, physical, or socioeconomic outcome measure that was categorical. Only those variables with a standardized residual > ±2 were

considered a significant difference between groups. Effects size for categorical variables were measured using Cohen's W (Cohen, 1992).

5.5.5 Response to Treatment Analyses

Responsiveness to treatment, which was defined as the capacity to detect an important change in a variable of interest, was determined using two methods. First, pattern mixture modeling was used, using all the parameters above, to measure how patients' responses on the FACS changed from admission to discharge. Second, an examination of whether patients changed severity level from admission to discharge was undertaken. Since the total numbers of patients at admission and discharge differed, the number of patients in the severity level was divided by the total number of patients available for analysis during the time point and then multiplying by 100 to achieve a percent (Hartzell et al., 2013).

5.5.6 One-year Outcome Prediction

The last step in the validation of the FACS was determining whether discharge FACS scores from the CMPD population can be utilized as a predictor of one-year socioeconomic outcomes, such as return to work and work retention. In order to test this, hierarchical binary logistic regression analyses were performed. The first block in the model contained various known predictors of work return and work retention, including length of disability, total temporary disability, whether the patient had surgery prior to FRP admission, whether the patient was working at admission, whether their original job was available to return to, and whether the patient was receiving disability benefits. The second block contained the FACS (Hair, Black, Babin, Anderson, & Tatham, 2006). In order to assess the addition of each block of variables associated with the outcome variable, a Pearson Chi-Square statistic was used, and the percentage of variance accounted for in each block was compared using Nagelkerke's R^2. Lastly, the Wald statistic and its significance were reported, providing information about whether the FACS remained a useful predictor after all the other variables were added into the model. Effect size for all binary logistic regression analyses was calculated by odds ratio.

5.5.7 Comparison between the FACS, TSK, & IEQ

The FACS' power in predicting the discharge psychosocial and physical lifting outcomes compared to other known measures of FA, such as the TSK and IEQ, was examined using multiple regression analyses. Overall model fit was examined with Adjusted R^2 and the FACS' unique predictive power will be assessed using change ANOVAs ($F\Delta$) and change R^2. Then the significance of individual predictors was examined via *t*-tests and their associated *p* values.

5.5.8 Assumptions

All assumptions were met for all analyses, except for sample size and normality in a minority of analyses. A power analysis, conducted with G*Power 3.1, (Faul, Erdfelder, Lang, & Buchner, 2007; Faul, Erdfelder, Buchner, & Lang, 2009), specified a minimum of 568 patients total in order to detect a medium effect size in logistic regression. Although this assumption was not met, bootstrapping was utilized to adjust for the low Ns. For all other analyses, including factor analysis, the minimum sample size of 200 was met. Missing data were dealt with in a pairwise fashion, with patients not included in each analysis if they were missing data for the target variable only. Although several variables did not meet the assumption of normality, they were only slightly skewed, and transformation by square-rooting the variables actually increased the skew in the opposite direction. Therefore, no corrections for normality were made, which also helped aid in the interpretability of results.

Chapter 6

Results

6.1 Initial Reliability and Validity Analyses

6.1.1 Test-retest Reliability

Of the total 568 CMPD patients, only 306 were administered the FACS twice in a short span of time (at their initial doctor's visit and again at admission to the FRP). Of those 306 patients, only 131 patients completed two copies of the FACS within 5 days of each other, and these patients were the only ones included in test-retest analyses shown in Table 6.1 below. Results indicate that the test-retest results were high, $r = .90$ for CMPD patients and $r = .94$ for non-patient comparison subjects.

Table 6.1 Test-retest reliability

Population	*r*	n*	Number of days between tests *M (SD)*
CMPD Patients	.90**	131*	2.21 (1.57)
Non-Patients	.94**	61	1.84 (2.03)

**n* is lower than the total sample because only patients who completed the first and second administrations of the test within 5 days or less were included
** $p < .01$

Table 6.2 shows the test-retest reliability for each item on the FACS in the CMPD patient population, as well as the corrected item total, which represents the correlation of the specific item to the average of the scale, without including the specific item to avoid inflation of an item which perfectly correlates with itself). Corrected item total is meant to measures how well the item fits with the rest of the scale or subscales. Results show that all items were significantly correlated with each other ($p < .01$). However, some values are somewhat low (i.e. item #5 or #20). Corrected item totals for each item were all above .2, and thus were deemed adequate.

Table 6.2 Test-retest reliability for each test item, CMPD patients (N = 131)

	Question	Pearson *r*	Corrected Item Total
1	I try to avoid activities and movements that make my pain worse	.74**	.72
2	I worry about my painful medical condition	.78**	.78
3	I believe that my pain will keep getting worse until I won't be able to function at all	.50**	.78
4	I am overwhelmed by fear when I think about my painful medical condition	.73**	.79
5	I don't attempt certain activities because I am fearful that I will injure (or re-injure) myself	.39**	.73
6	When my pain is really bad, I also have other symptoms such as nausea, difficulty breathing, heart pounding, trembling, and/or dizziness	.69**	.52
7	It is unfair that I have to live with my painful medical condition	.75**	.66
8	My painful medical condition puts me at risk for future injuries (or re-injuries) for the rest of my life	.70**	.72
9	Because of my painful medical condition, my life will never be the same	.74**	.78
10	I have no control over my pain	.72**	.75
11	I don't attempt certain activities and movements because I am fearful that my pain will increase	.74**	.80
12	It is someone else's fault that I have this painful medical condition	.78**	.49
13	The pain from my medical condition is a warning signal that something is dangerously wrong with me	.71**	.67
14	No one understands how severe my painful medical condition is	.80**	.58
15	...strenuous activities (like doing heavy yard work or moving heavy furniture)…	.77**	.77
16	…moderate activities (like cooking dinner or cleaning the house)…	.73**	.79
17	…light activities (like going to the movies or going out to lunch)…	.68**	.63
18	…my full duties and chores at home and/or at work…	.79**	.81
19	…recreation and/or exercise (things that I do for fun and good health)…	.71**	.81
20	…activities where I have to use my painful body part(s)…	.41**	.81

** Significance at $p < .01$

6.1.2 Internal Consistency

Internal consistency is depicted in Table 6.3. As shown below, internal consistency was quite high for the total FACS (α .91-.92) for both the CMPD and the non-patients. However, when

the *a priori* subscales were examined individually, internal consistency dropped somewhat in the CMPD patients for the all three. In the non-patients, the victimization subscale had much lower internal consistency (α = .59), however, given that the victimization subscale only consisted of three items, this is still in an acceptable range. For the psychiatric chronic pain patients, internal consistency for the total scale was slightly lower than the other two populations, but the subscales did not drop quite as much, with the exception of the victimization subscale.

Table 6.3 Internal consistency values

Population	***α***
CMPD Patients	
• Total FACS	.92
• Pain-related Anxiety	.87
• Activity Avoidance	.88
• Victimization	.75
Psychiatric Chronic Pain Patients	
• Total FACS	.89
• Pain-related Anxiety	.82
• Activity Avoidance	.85
• Victimization	.57
Non-Patient Sample	
• Total FACS	.91
• Pain-related Anxiety	.92
• Activity Avoidance	.91
• Victimization	.59

6.1.3 Patient Feedback on FACS Utility

The frequency of responses to the 4 FACS utility questions presented in section 5.4.1.3.12 is shown in Table 6.4 below. Results showed that most patients viewed the FACS favorably and thought the test and rating system were easy to use, that the questions were appropriate for someone in their situation, and that the test was an appropriate length. However, 5 people did have comments about the FACS. Comments included patients thinking that the FACS was too long, confusing, not personalized enough, not detailed enough, or not administered in a private enough place.

Table 6.4 Frequency and percent of patients' ratings of the FACS usability (n = 24)

Question	N (% yes)
The items on the test were easy to understand.	23 (96%)
The rating system (from "Completely Agree" to "Completely Disagree") was easy to understand.	24 (100%)
The items on the test were relevant and appropriate for people with painful medical conditions.	24 (100%)
The length of the test was appropriate.	22 (92%)

6.1.4 Clinician Ratings of Fear-Avoidance Type

Although the therapists were able to agree on whether the patient had any type of fear-avoidance or not (r = .56, p < .01), and they agreed upon the subcategories of FA, r = .35, p = .03), the ratings did not significantly correspond to the FACS significantly when both therapists' ratings were taken into account; only one therapist's ratings significantly correlated with the FACS at admission, r = -.43, p = .0 (but not at initial doctor's visit). When this relationship was further examined by correlating each question with it's appropriate FA rating type, it was found that being rated as a misinformed avoider did significantly correlate with question #5 on the FACS at admission, r = .72, p < .001; being rated as a learned avoider did significantly correlate with question #1 on the FACS at admission, r = .74, p < .001; and being rated as an affective avoider did significantly correlate to Question #11 on the FACS at admission, r = .74, p < .001. This indicates that these items, designed to tease apart the reasons why patients were avoiding activities, have validity when compared to clinician ratings.

6.2 Factor Analysis

6.2.1 Exploratory Factor Analysis

All assumptions for EFA were met, including multicollinearity (Kaiser value = .92 and Bartlett's test of sphericity, χ^2 (190) = 2,329.33, p< .001) and a sample size of a least 200 participants. The EFA was completed on CMPD patients only, with approximately half the CMPD

sample utilized (N = 214) so that the other half (N = 287) could be analyzed using CFA and used for validation. Additional CFA analyses were conducted on the psychiatric chronic pain sample and the non-patient comparison sample.

A large number of EFA variations were run, in order to find the best possible outcome. PCA was run with Varimax rotation and all items, removal of items 7 & 12, removal of only item 7, and removal of only item 12. PCA with Oblmin rotation was run, but failed to converge within 25 iterations. Next, PAFs were run. This was first done with Varimax rotation, in several different variations: all items, removal of item 6, removal of items 16 & 17, removal of items 6, 16, and 17, removal of item 16 alone, removal of item 17 alone, and removal of items 6, 12, & 17. Lastly, PAF with Oblimin rotation was conducted, in the following variations: all items, removal of items 8 & 11, removal of items 6, 8, 10, & 11, removal of items 3 & 4, removal of item 8 alone, removal of item 11 alone, removal of item 3 alone, removal of item 4 alone, removal of items 3, 4, 8, & 11, removal of items 3, 4, 6, 8, 10, & 11, and removal of items 3, 4, 6, 8, 10, 11, 16, & 17. Of all of these EFA variations, the best fitting models were the PAF with Varimax rotation that utilized all items and the PAF with Oblimin rotation that removed items 3, 4, 6, 8, 10, 11, 16, & 17. The results from these analyses are presented in the following paragraphs.

Results for inclusion of all FACS items using PAF with Varimax resulted in a 4 eigenvalues greater than 1, and thus a four-factor solution. These four factors accounted for 67% of the variance. Results of this factor analysis, including item loadings and cross-loadings, are presented in Table 6.5, with item loadings presented in bold and cross-loadings shaded across rows. It appeared that factor 1 was comprised of the *a priori* subscale of activity avoidance (except for avoidance of light and moderate activities), factor 2 included items that made up the pain-related anxiety subscale, factor 3 was comprised of only 3 items – light, moderate, and fully duty activity avoidance – and factor 4 was comprised of the *a priori* victimization subscale. Though there were a few cross-loadings, this analysis seemed to better fit the *a priori* subscales better than any other EFA style and still maintain all 20 items.

Table 6.5 PAF with varimax rotation, all items

Item Number and Description	Factor			
	1	2	3	4
1: I try to avoid activities and movements that make my pain worse	**.66**	.29	.09	.10
2: I worry about my painful medical condition	**.46**	**.58**	.17	.14
3: I believe that my pain will keep getting worse until I won't be able to function at all	.27	**.72**	.17	.15
4: I am overwhelmed by fear when I think about my painful medical condition	.10	**.80**	.22	.19
5: I don't attempt certain activities because I am fearful that I will injury (or re-injure) myself	**.63**	.37	.07	.10
6: When my pain is really bad, I also have other symptoms such as nausea, difficulty breathing, heart pounding, trembling, and/or dizziness	.15	.39	.39	.13
7: It is unfair that I have to live with my painful medical condition	.29	.38	.05	**.61**
8: My painful medical condition puts me at risk for future injuries (or re-injuries) for the rest of my life	.39	**.45**	.13	.38
9: Because of my painful medical condition, my life will never be the same	**.40**	**.56**	.15	.19
10: I have no control over my pain	.31	**.51**	.33	.25
11: I don't attempt certain activities and movements because I am fearful that my pain will increase	**.71**	**.47**	.10	.15
12: It is someone else's fault that I have this painful medical condition	.09	.09	.08	**.54**
13: The pain from my medical condition is a warning signal that something is dangerously wrong with me	.11	**.56**	.28	**.50**
14: No one understands how severe my painful medical condition is	.14	**.54**	.30	**.49**
15: strenuous activities (like doing heavy yard work or moving heavy furniture	**.67**	-.05	.37	.20
16: moderate activities (like cooking dinner or cleaning the house)	.34	.23	**.67**	.22
17: light activities (like going to the movies or out to lunch)	.11	.28	**.76**	.08
18: my full duties and chores at home and/or work	**.46**	.13	**.64**	.06
19: recreation and/or exercise (things I like to do for fun and good health)	**.69**	.17	.37	.17
20: activities where I have to use my painful body part(s)	**.69**	.15	.33	.14

The other solution that appeared useful was achieved through PAF with Oblimin rotation. This resulted in a 2 factor solution, indicated as such both by the Eigenvalues and the Scree Plot, and accounted for 58% of the variance, As seen in Table 6.6, this solution demonstrated no cross-loadings, and Factor 1 appears to be an avoidance factor, while Factor 2 demonstrates a factor that includes information about catastrophizing, blame, and injustice.

Table 6.6 PAF Oblimin rotation, removal of items 3, 4, 6, 8, 10, 11, 16, 17

Item Number and Description	Factor	
	1	2
1: I try to avoid activities and movements that make my pain worse	**.58**	.08
2: I worry about my painful medical condition	**.43**	.36
5: I don't attempt certain activities because I am fearful that I will injury (or re-injure) myself	**.55**	.18
7: It is unfair that I have to live with my painful medical condition	.09	**.65**
9: Because of my painful medical condition, my life will never be the same	.35	**.40**
12: It is someone else's fault that I have this painful medical condition	-.01	**.46**
13: The pain from my medical condition is a warning signal that something is dangerously wrong with me	-.06	**.82**
14: No one understands how severe my painful medical condition is	-.02	**.82**
15: strenuous activities (like doing heavy yard work or moving heavy furniture	**.76**	-.10
18: my full duties and chores at home and/or work	**.70**	-.02
19: recreation and/or exercise (things I like to do for fun and good health)	**.86**	-.02
20: activities where I have to use my painful body part(s)	**.83**	-.04

6.2.2 Confirmatory Factor Analysis (CFA)

6.2.2.1 CFA Results for CMPD Patients.

When the factor results from the PAF with Varimax rotation and all items, as shown in Table 6.7 below, initial Chi-Square results indicated that the overall model was not a good fit, χ^2 (168) = 666.58, $p < .001$. Additional model fit indices also determined that this model was not a

good fit. The second factor analysis option, also located in Table 6.7, which utilized PAF with Oblimin rotation and the removal of 8 items, also indicated poor model fit, χ^2 (43) = 125.55, p < .001, as did the model indices, with the exception of RMSEA, which indicated mediocre fit, and CFI, which indicated acceptable fit. When the factor structure was analyzed as unidimensional, it was found to be a poor fit, χ^2 (170) = 780.38, p < .001, as was all of the other model fit indices.

Table 6.7 Model fit indices for CMPD patients

Fit Indicator	Acceptable Level	*A*ll items	Removal of 8 items	One Overall Factor
Normed Fit Index (NFI)	> .95 good .9-.95 marginal < .9 poor	.69	.86	.63
Root Mean Square Error of Approximation (RMSEA)	.01 – excellent .05 – good .08 – mediocre	.11	.08	.11
Comparative Fit Index (CFI)	.09 – acceptable	.74	.90	.68
p of close fit (PCLOSE)	If the value is greater than .01, than it is considered a close fit	.00	.001	.00
Hoteller Index	200 – good fit 75 – very poor fit	86	154	74

6.2.2.2 CFA Results for Psychiatric Chronic Pain Patients

Model fit indices are shown in Table 6.8 for the psychiatric chronic pain patients. The overall model was not a good fit when examined by Chi-Square, χ^2 (117) = 520.22, p < .001. However, two of the fit indices showed that including all items was somewhere between a mediocre and good fit when examined by RMSEA (.07), and it was a good fit when examined by the Hoeteller Index (226). When eight items were removed, the overall model still indicated a poor fit when examined by Chi-Square, χ^2 (43) = 96.73 p < .001, but several other indices showed that the fit may be better. RMSEA showed a fit somewhere between good and excellent (.04), the CFI

was nearly acceptable (.88), PCLOSE indicated a close fit (.96), and the Hoteller Index showed good fit (503). When a unidimensional model was attempted, it was found to be a poor fit, χ^2 (170) = 804.00, $p < .001$, both overall and with all indicators except for the Hoteller index, which indicated a good fit (Hoteller Index = 206).

Table 6.8 Model fit indices for psychiatric chronic pain patients

Fit Indicator	Acceptable Level	*A*ll items	Removal of 8 items	One Overall Factor
Normed Fit Index (NFI)	> .95 good .9-.95 marginal < .9 poor	.55	.81	.60
Root Mean Square Error of Approximation (RMSEA)	.01 – excellent .05 – good .08 – mediocre	.07	.04	.07
Comparative Fit Index (CFI)	.09 – acceptable	.59	.88	.65
p of close fit (PCLOSE)	If the value is greater than .01, than it is considered a close fit	.00	.96	.00
Hoteller Index	200 – good fit 75 – very poor fit	226	503	206

6.2.2.3 CFA Results for Non-Patient Comparison Sample.

When the factor results from the PAF with Varimax rotation and all items was used, as shown in Table 6.9 below, initial Chi-Square results indicated that the overall model was not a good fit, χ^2 (117) = 352.85, $p < .001$. Upon additional examination of the model fit indices, it was also shown that this model was not a good fit. The second factor analysis option, which utilized PAF with Oblimin rotation and the removal of 8 items, also indicated poor model fit, χ^2 (43) = 105.18, $p < .001$, as did the model indices located in Table 6.9 below, with the exception of CFI. Lastly, when the FACS was tested to see if it may be unidimensional, that was a poor fit as well, χ^2 (170) = 552.21, $p < .001$, with all other model fit indices indicating poor model fit as well.

Table 6.9 Model fit indices for non-patients

Fit Indicator	Acceptable Level	*A*ll items	Removal of 8 items	One Overall Factor
Normed Fit Index (NFI)	> .95 good .9-.95 marginal < .9 poor	.73	.85	.66
Root Mean Square Error of Approximation (RMSEA)	.01 – excellent .05 – good .08 – mediocre	.12	.10	.13
Comparative Fit Index (CFI)	.09 – acceptable	.80	.91	.73
p of close fit (PCLOSE)	If the value is greater than .01, than it is considered a close fit	.00	.001	.00
Hoteller Index	200 – good fit 75 – very poor fit	57	78	54

6.3 Analysis of Item Response and Sensitivity/Specificity Analyses

6.3.1 Item Means and Response Trends

Item means and response trends for the non-patient sample is located in Table 6.10 below. The item mean did not rise above a three for any item, and the vast majority of subjects scored either a “0” or a “1” on the items, with approximately 10% scoring a “2” or a “3”, 5% scoring a “4”, and approximately 3% scoring a “5.”

Table 6.10 Non-patient item means and response trends

	Scores for each item						
Item	0 N (%)	1 N (%)	2 N (%)	3 N (%)	4 N (%)	5 N (%)	Mean (SD)
1	19 (16%)	17 (14%)	11 (9%)	27 (22%)	33 (27%)	14 (12%)	2.9 (1.4)
2	28 (23%)	35 (29%)	12 (10%)	25 (21%)	12 (10%)	8 (7%)	2.0 (1.4)
3	42 (40%)	30 (29%)	16 (15%)	10 (10%)	6 (6%)	0 (0%)	1.3 (1.2)
4	60 (58%)	23 (22%)	12 (12%)	5 (5%)	3 (3%)	1 (1%)	.9 (1.2)
5	29 (24%)	29 (24%)	14 (12%)	26 (22%)	19 (16%)	3 (3%)	2.2 (1.4)
6	55 (50%)	17 (16%)	7 (6%)	16 (15%)	8 (7%)	7 (6%)	1.5 (1.7)
7	56 (53%)	16 (15%)	12 (11%)	15 (14%)	5 (5%)	2 (2%)	1.3 (1.5)
8	34 (31%)	29 (26%)	14 (13%)	22 (20%)	8 (7%)	4 (4%)	1.8 (1.5)
9	49 (44%)	30 (27%)	10 (9%)	18 (16%)	1 (1%)	3 (3%)	1.2 (1.3)
10	42 (37%)	26 (23%)	20 (17%)	22 (19%)	2 (2%)	3 (3%)	1.5 (1.3)
11	24 (20%)	21 (18%)	16 (13%)	32 (27%)	20 (17%)	6 (5%)	2.3 (1.4)
12	75 (74%)	9 (9%)	2 (2%)	10 (10%)	2 (2%)	3 (3%)	.8 (1.4)
13	55 (52%)	26 (25%)	15 (14%)	4 (4%)	5 (5%)	1 (1%)	.9 (1.2)
14	47 (44%)	31 (29%)	14 (13%)	10 (9%)	2 (2%)	4 (4%)	1.2 (1.2)
15	39 (34%)	18 (16%)	8 (7%)	22 (19%)	9 (8%)	18 (16%)	2.2 (1.8)
16	64 (60%)	20 (19%)	8 (8%)	7 (7%)	5 (5%)	3 (3%)	.9 (1.3)
17	69 (68%)	16 (16%)	5 (5%)	6 (6%)	5 (5%)	1 (1%)	.7 (1.1)
18	63 (60%)	16 (15%)	7 (7%)	10 (10%)	6 (6%)	3 (3%)	1.0 (1.5)
19	46 (41%)	20 (18%)	8 (7%)	21 (19%)	17 (15%)	1 (1%)	1.8 (1.6)
20	36 (31%)	14 (12%)	13 (11%)	24 (21%)	17 (15%)	12 (10%)	2.3 (1.7)

Item means and response trends for the psychiatric chronic pain patients are located in Table 6.11 below. When compared to the non-patients above and the CMPD patients below, a much less strict distinction between groups was found; the scores were much more evenly distributed and the psychiatric chronic pain patients paint a “middle of the road” picture. Item means were between .7 on Question 12 and 4.2 on Question 1, showing a wider range than either of the other samples as well.

Table 6.11 Psychiatric chronic pain patients item means and response trends

	Scores for each item						
Item	0 N (%)	1 N (%)	2 N (%)	3 N (%)	4 N (%)	5 N (%)	Mean (SD)
1	6 (3%)	4 (2%)	4 (2%)	21 (12%)	45 (46%)	95 (54%)	4.2 (1.2)
2	6 (3%)	9 (5%)	9 (5%)	33 (19%)	44 (25%)	74 (42%)	3.8 (1.3)
3	19 (11%)	15 (9%)	19 (10%)	45 (26%)	27 (15%)	50 (29%)	3.1 (1.6)
4	37 (21%)	29 (17%)	25 (14%)	30 (17%)	24 (14%)	30 (17%)	2.4 (1.8)
5	26 (15%)	13 (7%)	10 (6%)	20 (11%)	51 (29%)	56 (32%)	3.3 (1.8)
6	43 (25%)	15 (9%)	13 (8%)	31 (18%)	25 (14%)	47 (27%)	2.7 (1.9)
7	51 (30%)	11 (6%)	16 (9%)	26 (15%)	20 (12%)	49 (28%)	2.6 (2.0)
8	28 (16%)	24 (14%)	13 (7%)	37 (21%)	24 (14%)	49 (28%)	2.9 (1.8)
9	17 (10%)	17 (10%)	9 (5%)	33 (19%)	33 (19%)	63 (37%)	3.4 (1.7)
10	10 (6%)	23 (13%)	22 (12%)	33 (19%)	44 (25%)	42 (24%)	3.2 (1.5)
11	11 (6%)	4 (2%)	10 (6%)	26 (15%)	46 (26%)	78 (45%)	3.9 (1.4)
12	131 (77%)	13 (8%)	4 (2%)	9 (5%)	4 (2%)	10 (6%)	.7 (1.4)
13	78 (45%)	25 (15%)	10 (6%)	33 (19%)	12 (7%)	15 (9%)	1.5 (1.7)
14	26 (15%)	19 (11%)	13 (8%)	29 (16%)	40 (23%)	46 (27%)	3.0 (1.8)
15	14 (8%)	7 (4%)	2 (1%)	10 (6%)	33 (19%)	106 (62%)	4.1 (1.5)
16	28 (16%)	17 (10%)	14 (8%)	38 (22%)	37 (21%)	39 (23%)	2.9 (1.7)
17	39 (22%)	31 (18%)	17 (10%)	32 (18%)	23 (13%)	32 (18%)	2.4 (1.8)
18	22 (13%)	22 (13%)	12 (7%)	28 (16%)	46 (27%)	41 (24%)	3.0 (1.7)
19	20 (12%)	11 (6%)	13 (8%)	23 (13%)	48 (28%)	58 (34%)	3.4 (1.7)
20	14 (8%)	9 (5%)	8 (5%)	26 (15%)	32 (18%)	85 (49%)	3.8 (1.6)

Table 6.12 depicts the item means and response trends for the CMPD patients. In direct contrast with the non-patient subject table, Table 6.12 shows that the item mean did not drop below a 2.5 and that a much larger percentage (approximately 30%) scored a “5.” Only 5-10% of patients scored a “0,” “1,” or “2,” and approximately 20% scored either a “3” or a “4.”

Table 6.12 CMPD patients' item means and response trends at admission

	Scores for each item						
Item	0 N (%)	1 N (%)	2 N (%)	3 N (%)	4 N (%)	5 N (%)	Mean (SD)
1	4 (2%)	3 (1%)	3 (1%)	20 (8%)	55 (22%)	160 (65%)	4.4 (1.0)
2	9 (4%)	5 (2%)	9 (4%)	29 (12%)	65 (27%)	127 (52%)	4.1 (1.2)
3	27 (11%)	26 (11%)	24 (10%)	44 (18%)	47 (19%)	76 (31%)	3.2 (1.7)
4	41 (17%)	29 (12%)	27 (11%)	49 (21%)	42 (18%)	51 (21%)	2.7 (1.8)
5	6 (3%)	10 (4%)	6 (3%)	26 (11%)	43 (18%)	153 (63%)	4.3 (1.2)
6	55 (23%)	31 (13%)	20 (8%)	37 (15%)	45 (19%)	55 (23%)	2.6 (1.9)
7	34 (14%)	22 (9%)	14 (6%)	38 (16%)	32 (13%)	101 (42%)	3.3 (1.9)
8	27 (11%)	9 (4%)	12 (5%)	44 (18%)	41 (17%)	110 (45%)	3.6 (1.7)
9	22 (9%)	13 (5%)	11 (5%)	40 (16%)	53 (22%)	106 (43%)	3.7 (1.6)
10	18 (7%)	20 (8%)	22 (9%)	32 (13%)	58 (24%)	96 (39%)	4.2 (1.2)
11	8 (3%)	5 (2%)	10 (4%)	23 (9%)	62 (25%)	136 (56%)	2.5 (2.1)
12	82 (35%)	10 (4%)	20 (9%)	24 (10%)	33 (14%)	63 (27%)	2.5 (1.9)
13	60 (25%)	24 (10%)	23 (10%)	37 (16%)	44 (19%)	49 (21%)	3.2 (1.8)
14	33 (14%)	16 (7%)	21 (9%)	41 (17%)	51 (21%)	79 (33%)	3.2 (1.8)
15	18 (7%)	2 (1%)	5 (2%)	15 (6%)	26 (11%)	176 (73%)	4.3 (1.4)
16	35 (15%)	18 (8%)	22 (9%)	53 (22%)	58 (24%)	55 (23%)	3.0 (1.7)
17	53 (22%)	37 (15%)	33 (14%)	43 (18%)	41 (17%)	36 (15%)	2.4 (1.8)
18	25 (10%)	15 (6%)	14 (6%)	41 (17%)	53 (22%)	92 (38%)	3.5 (1.7)
19	19 (8%)	10 (4%)	17 (7%)	36 (15%)	50 (21%)	110 (46%)	3.7 (1.6)
20	16 (7%)	6 (3%)	12 (5%)	31 (13%)	38 (16%)	140 (58%)	4.0 (1.5)

6.3.2 Comparison of Scores

Table 6.13 shows the means and standard deviations of the three samples' FACS scores, broken down into subpopulations. As discussed above in Section 5.2.3, the non-patients did significantly differ on their total FACS scores. It was thus decided that those who had never

had a painful medical condition (n = 11), and those whose medical condition was no longer painful (n = 36), be excluded from the remaining analyses, leaving only 87 non-patients for analyses. The psychiatric chronic pain patients were examined in two different ways. First, FACS scores were compared by their employment category, with those patients who were employed scoring lower on the FACS than those who were disabled ($p < .001$). Second, FACS scores were compared by perceived disability (PDQ) scores, with those in the mild PDQ severity level having significantly lower FACS scores than either the moderate or severe/extreme PDQ severity levels.

FACS scores for CMPD patients were also examined a number of different ways. The mean FACS score for CMPD patients at FRP admission was 68.0. At discharge, patients were categorized by TSK, PDQ, and employment status. Although it was found that there was no difference in FACS scores among CMPD patients who were or were not working, it was found that at discharge, all TSK severity levels differed significantly (all ps $\leq .01$) on total FACS scores, with those in the subclinical TSK group having the lowest FACS scores and those in the severe TSK group having the highest FACS scores. Additionally, those CMPD patients who scored in the severe/extreme PDQ group at discharge had significantly higher FACS total scores than those in either the mild or moderate PDQ severity levels (ps $< .001$).

Table 6.13 FACS scores by subpopulations

Population	M (SD)	F	*p* value	Effect Size
Non- Patients		3.73	.03	.08
• Some pain, no interference	18.4 (13.8)			
• Some pain and interference	24.9 (14.8)			
Psychiatric Chronic Pain Patients, Total	59.8 (23.6)	5.45	.00	.07
• Unemployed	59.8 (23.7)			
• Employed	56.2 (24.2)			
• Disabled	70.0 (20.4)			
• Retired	55.2 (23.5)			
Psychiatric Chronic Pain Patients		14.28	.00	.28
• Mild PDQ scores	45.2 (24.1)			
• Moderate PDQ scores	61.9 (17.1)			
• Severe/Extreme PDQ scores	73.7 (16.5)			
CMPD Patients, Total admission	68.0 (19.7)	N/A	N/A	N/A
CMPD Patients, Total Discharge	40. 2 (27.0)	112.00	.00	.36
• Mild PDQ scores	25.3 (20.6)			
• Moderate PDQ scores	47.8 (18.8)			
• Severe/Extreme PDQ scores	65.2 (27.3)			
CMPD Patients, Discharge		20.67	.00	.17
• Subclinical	58.6 (19.2)			
• Mild TSK scores	68.1 (16.2)			
• Moderate TSK scores	76.6 (14.7)			
• Severe TSK scores	80.4 (18.0)			
CMPD Patients, Admission Employment Status		2.62	.11	.01
• Working at Admission	65.5 (16.6)			
• Not Working at Admission	69.5 (19.2)			

6.3.3 ROC Analyses

When an ROC analysis was run to discriminate between the CMPD patients and the non-patient comparison sample, the area under the curve (AUC) was .95, $p < .001$. Section 1 of Table 6.14 shows the sensitivity and specificity for a variety of cut-off points when discriminating between CMPD patients and the non-patient comparison sample. Results showed that a cut-off of 41 maximized both sensitivity and specificity, with a positive likelihood ratio (LR) of 8.67 and a negative LR of .11. A similar analysis was attempted to discriminate between the psychiatric chronic pain patients and the non-patients, AUC = .87, $p < .001$. These results, depicted in Section 2, showed that a cut-off of 33 maximized sensitivity and specificity, with a positive LR of

4.0 and a negative LR of .29. Next, sensitivity and specificity was determined when trying to differentiate between the CMPD and psychiatric chronic pain population. Results are depicted in Section 3. A cut-off of 65 was found to best discriminate between the two patient samples, with an AUC of .64, $p < .001$. The positive LR for a cut-off of 65 was 1.45, while the negative LR was .69.

The next several ROC attempts utilized only the CMPD or psychiatric chronic pain patients, and attempted to discriminate between certain patient attributes, such as lifting performance, elevated pain and disability levels, and employment status. As shown in Section 4 of Table 6.15, when patients were separated by whether or not they met a 30% change from admission to discharge on their PILE test, there as a non-significant area under the curve (AUC = .54, $p = .72$), indicating a failed attempt. The next ROC analysis run discriminated between CMPD patients who had elevated perceived disability and pain intensity and those who did not, AUC = .73, $p < .001$, with a cut-off score of 73 maximizing sensitivity and specificity (presented in Section 5 of Table 6.15). For the cut-off score of 73, the positive LR was calculated as 2.0, while the negative LR was .50. Lastly, the employment status of the psychiatric chronic pain patients was used as a discriminating factor. The results were not significant, AUC = .50, $p = .98$. Nevertheless, sensitivity and specificity are presented below in Section 6 of Table 6.14.

Table 6.14 Sensitivity and specificity of FACS cut-off scores when discriminating between CMPD patients and non-patients

Analysis	Cut-off	Sensitivity	Specificity
1. CMPD v. Non-Patient	40	91%	89%
	41	90%	90%
	42	89%	90%
	43	88%	90%
2. Psychiatric Chronic Pain v. Non- Patient	31	85%	74%
	32	82%	78%
	33	82%	79%
	35	79%	84%
3. CMPD v. Psychiatric Chronic Pain	63	66%	56%
	64	63%	57%
	65	59%	60%
	66	58%	63%
	67	56%	64%
4. CMPD: 30% change in PILE scores	65	60%	53%
	66	50%	56%
	67	50%	58%
	68	40%	61%
	69	40%	65%
5. CMPD: Elevated Pain Intensity and Perceived Disability	71	69%	64%
	72	67%	66%
	73	66%	67%
	74	66%	70%
	75	60%	72%
6. Psychiatric Chronic Pain: Employment Status	61	51%	48%
	62	50%	50%
	63	49%	50%

Examining this data, and following the Angoff method, which requires input from subject matter experts, it appeared that a good breakdown for severity levels might occur at the following points: 20, 40, 60, & 80 (yielding a quintile distribution analysis). The average of those non-patients that now had some pain fell right around the cut-off score of 20, while the differentiation between mild PDQ scores and moderate or severe/extreme scores was placed around the cut-off score of 40. These severity levels are depicted for each patient population in Figure 6.1, shown below. Although many alternative cut-off methods were initially contemplated, none fit the distribution of subject samples quite as well and were subsequently rejected.

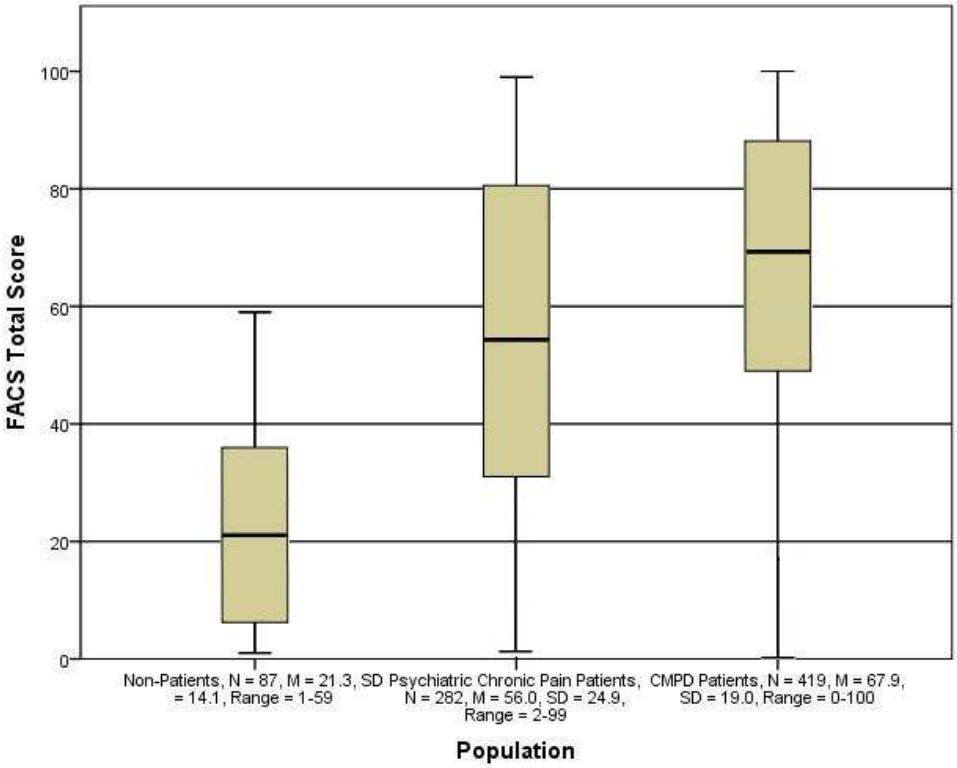

Figure 6.1 FACS severity levels

Table 6.15 shows the breakdown of how the three samples fell into the quintile severity levels. It was found that 91% of the non-patients scored below 40 on the FACS, while only 9% of CMPD patients at admission scored below 40 and only 23% scored below 40 in the psychiatric chronic pain population.

Table 6.15 Quintile severity levels for patient and non-patient samples

Cut-Offs	CMPD Patients at admission, n (%)	CMPD Patients at discharge, n (%)	Non-patients, n (%)	Psychiatric Chronic Pain Patients, n (%)
0-20	13 (3%)	95 (24%)	59 (64%)	17 (6%)
21-40	26 (6%)	84 (21%)	25 (27%)	47 (17%)
41-60	89 (16%)	124 (31%)	8 (9%)	75 (27%)
61-80	177 (42%)	62 (16%)	0 (0%)	94 (33%)
81-100	120 (28%)	35 (9%)	0 (0%)	49 (17%)

6.4 Validation of Severity Levels

Validation of the FACS severity levels took place by examining their relations to a wide variety of measures, to help provide construct validity through convergent and divergent relations between measures. In this section, demographic information for both patient populations will be examined, as well as occupational and psychiatric diagnosis information at admission for the CMPD cohort. Psychosocial information for both patient populations will also be examined, with the data examined via correlation as well as through pattern mixture modeling and univariate analysis. In the CMPD population, lifting performance will also be evaluated through pattern mixture modeling and univariate analysis. Finally, socioeconomic outcomes, examined one year after FRP discharge, will be analyzed, and it will be determined whether the FACS can predict any outcomes.

6.4.1 Demographic Differences between Severity Levels

6.4.1.1 CMPD Patients. There were few significant differences among the FACS severity levels on demographic information, as shown in Table 6.16. However, those in the subclinical severity level were significantly younger than patients in all other severity levels, $p \leq .001$. While a significant difference appeared for years of education ($p = .03$), when the Bonferroni correction was run on the post-hoc analyses, differences between groups were no long significant. Similarly, once post hoc analyses were determined using standardized residual, no significant differences remained in the attorney retention variable. Significant differences were detected in marital status,

with those who were separated from their spouse more likely to have a FACS score in the subclinical severity level ($z = 2.1$), those who were widowed were more likely to score in the mild severity level ($z = 3.6$), and those who were cohabitating were more likely to score in the extreme severity level ($z = 2.6$).

Table 6.16 Demographics by FACS severity level at FRP admission

Variable	Subclinical 0-20 n = 13	Mild 21-40 n = 26	Moderate 41-60 n = 87	Severe 61-80 n = 175	Extreme 81-100 n = 119	F/χ^2 Value	p value	Effect Size
Age, mean (SD)	40.1 (18.1)	48.1 (14.4)	48.4 (13.5)	46.4 (12.5)	47.8 (11.3)	6.60	.00	.03
Gender, n (%)						2.59	.63	
Male	25 (60%)	32 (47%)	83 (56%)	132 (55%)	79 (51%)			
Female	17 (41%)	36 (53%)	64 (44%)	106 (45%)	74 (49%)			
Area of Injury, n (%)						16.93	.65	
Lumbar only	4 (36%)	6 (25%)	21 (26%)	51 (31%)	36 (33%)			
Cervical only	0 (0%)	1 (4%)	1 (1%)	5 (3%)	4 (4%)			
Extremity only	2 (18%)	9 (38%)	29 (36%)	39 (24%)	26 (24%)			
Multiple spinal	1 (9%)	3 (13%)	5 (6%)	12 (7%)	4 (4%)			
Multiple musculoskeletal	3 (27%)	4 (17%)	20 (25%)	53 (33%)	34 (31%)			
Other	1 (9%)	1 (4%)	5 (6%)	3 (2%)	6 (6%)			
Ethnicity, n (%)	9 (69%)					17.54	.34	
Caucasian	3 (23%)	22 (88%)	52 (61%)	102 (62%)	63 (53%)			
African	1 (8%)	2 (8%)	19 (22%)	29 (18%)	33 (28%)			
American	0 (0%)	1 (4%)	15 (17%)	30 (18%)	18 (15%)			
Hispanic	0 (0%)	0 (0%)	0 (0%)	2 (1%)	3 (3%)			
Asian		0 (0%)	0 (0%)	1 (1%)	1 (1%)			
Length of Disability, mean (SD)	13.4 (46.8)	9.9 (35.5)	10.9 (7.9)	70.2 (55.2)	13.0 (32.9)	.34	.85	
Total Temporary Disability, mean (SD)	27.2 (47.5)	18.5 (37.6)	22.3 (34.2)	22.1 (41.3)	24.9 (40.9)	.18	.95	
Education, mean years (SD)	12.9 (3.8)	13.0 (2.0)	12.7 (3.9)	12.5 (5.1)	10.9 (5.2)	2.67	.03	.03
Marital Status, n (%)						39.48	.01	.30
Single	0 (0%)	4 (16%)	11 (13%)	25 (15%)	14 (12%)			
Married	8 (62%)	10 (40%)	44 (52%)	88 (53%)	53 (47%)			
Separated	2 (15%)	1 (4%)	4 (5%)	2 (1%)	7 (6%)			
Divorced	3 (23%)	5 (20%)	23 (27%)	40 (24%)	21 (19%)			
Widowed	0 (0%)	4 (16%)	1 (1%)	4 (2%)	4 (4%)			
Cohabitating	0 (0%)	1 (4%)	2 (2%)	8 (5%)	14 (12%)			
Attorney Retained at admission, n (%)						11.50	.02	.19
No	9 (100%)	12 (71%)	60 (92%)	110 (80%)	76 (75%)			
Yes	0 (0%)	5 (29%)	5 (8%)	27 (20%)	26 (26%)			
Pre- admission Surgery, n (%)						1.31	.86	
No	6 (50%)	10 (46%)	35 (47%)	88 (54%)	61 (51%)			
Yes	6 (50%)	12 (55%)	40 (53%)	76 (46%)	58 (49%)			

6.4.1.2 Psychiatric Chronic Pain Patients

Demographic differences in the psychiatric chronic pain patients by FACS severity levels are depicted in Table 6.17. Significant differences existed among the FACS severity levels in

education level. Those in the extreme severity level were more likely to have only some high school education (z = 3.3) and those in the mild severity level were more likely to have a Bachelor's degree (z = 2.6). In addition, payment type for psychiatric services significantly differed among severity levels (p = .02), with those in the mild group more likely to be enrolled in the Department of Assistive and Rehabilitative Services (DARS), which is a type of vocational retraining funded by the state of Texas (z = 3.8), and those in the extreme severity level more likely to have payment type specified as "other" (z = 2.7). Significant differences were also identified in the employment status variable (p = .01); those in the mild group were less likely to be disabled (z = -2.3), and those in the extreme group were more likely to be disabled (z = 2.5). Lastly, as with the CMPD patients, those who were in the mild severity level were significantly younger than patients in any other severity level (all ps ≤ .001).

Table 6.17 Demographic variables by FACS severity levels in psychiatric chronic pain patients

Demographic Variables	**Subclinical 0-29 N = 37**	**Mild 30-39 N= 44**	**Moderate 40-49 N= 71**	**Severe 50-59 N= 69**	**Extreme 60+ N= 69**	**F/χ^2 Value**	**p value**	**Effect Size**
Gender *n* (%)						5.52	.25	
• Female	4 (31%)	21 (58%)	33 (58%)	39 (64%)	21 (66%)			
• Male	9 (69%)	15 (42%)	24 (42%)	22 (36%)	11 (34%)			
Age mean yr (*SD*)	40.1 (18.1)	48.0 (14.4)	48.4 (13.6)	46.4 (12.5)	48.1 (11.1)	6.71	.00	.03
Ethnicity, *n* (%)						23.81	.10	
• Caucasian	15 (88%)	41 (95%)	56 (88%)	67 (80%)	28 (67%)			
• African American	1 (6%)	2 (5%)	6 (10%)	9 (11%)	12 (29%)			
• Hispanic	1 (6%)	0 (0%)	2 (3%)	5 (6%)	2 (5%)			
• Asian	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)			
• Other	0 (0%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)			
Education, *n* (%)						46.16	.00	.41
• Some high school	0 (0%)	2 (5%)	1 (2%)	2 (3%)	6 (17%)			
• High school degree	2 (14%)	3 (8%)	12 (21%)	14 (18%)	11 (31%)			
• GED	2 (14%)	2 (5%)	1 (2%)	6 (8%)	1 (3%)			
• Associate's degree or trade school	0 (0%)	3 (8%)	5 (9%)	12 (15%)	5 (14%)			
• Some college	2 (14%)	4 (10%)	13 (23%)	21 (26%)	4 (11%)			
• Bachelor's degree	5 (36%)	19 (49%)	14 (25%)	17 (21%)	5 (14%)			
• Graduate degree	3 (21%)	6 (15%)	10 (18%)	8 (10%)	3 (9%)			
Insurance Type, *n* (%)						32.56	.02	.37
• Worker's Compensation	0 (0%)	1 (3%)	1 (2%)	4 (5%)	0 (0%)			
• Private	8 (62%)	24 (77%)	37 (66%)	52 (70%)	21 (55%)			
• Medicaid	4 (31%)	6 (19%)	18 (32%)	18 (24%)	15 (40%)			
• DARS	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)			
• Other	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (5%)			
Employment Status						25.63	.01	.33
• Unemployed	2 (18%)	13 (33%)	10 (18%)	19 (25%)	9 (23%)			
• Employed	6 (55%)	17 (43%)	25 (44%)	23 (31%)	7 (18%)			
• Disabled	2 (18%)	4 (10%)	13 (23%)	27 (36%)	20 (51%)			
• Retired	1 (9%)	6 (15%)	9 (16%)	6 (8%)	3 (8%)			

6.4.3 Occupational Differences between Severity Levels

As with the demographic variables, there were very few occupational variable differences between the FACS severity levels (shown in Table 6.18). It was found that CMPD patients in the mild severity level were more likely to have federal worker's compensation (z = 2.2), however, and that those in the extreme severity level were less likely to be working upon admission to the FRP (z = -2.2).

Table 6.18 Occupational variables by FACS severity level at FRP admission in CMPD patients

Variable	Subclinical 0-20 n = 13	Mild 21-40 n = 26	Moderate 41-60 n = 87	Severe 61-80 n = 175	Extreme 81-100 n = 119	F/χ^2 Value	p value	Effect Size
Job Type (n, %)						.91	.93	
• Blue collar	10 (77%)	5 (24%)	18 (23%)	32 (19%)	22 (19%)			
• White collar	3 (23%)	16 (76%)	61 (77%)	137 (81%)	96 (81%)			
Pre-injury Wage (Mean, SD)	820.0 (536.2)	969.2 (491.2)	851.2 (579.4)	790.9 (635.7)	791.9 (502.8)	.42	.79	
Case Type, n (%)						20.22	.02	.25
• State WC	7 (64%)	11 (65%)	56 (85%)	118 (90%)	83 (93%)			
• Federal WC	1 (9%)	2 (12%)	1 (2%)	3 (2%)	2 (2%)			
• Private Pay	3 (27%)	4 (24%)	9 (14%)	10 (8%)	4 (5%)			
Job Demand (n, %)						24.30	.08	
• Sedentary/Light	1 (17%)	0 (0%)	9 (18%)	17 (15%)	12 (15%)			
• Light/Medium	2 (33%)	2 (17%)	0 (0%)	19 (17%)	12 (15%)			
• Medium/Heavy	1 (17%)	7 (58%)	19 (39%)	28 (25%)	20 (25%)			
• Heavy/Very Heavy	1 (17%)	3 (25%)	17 (35%)	29 (26%)	26 (33%)			
Job Satisfaction Pre-Injury (n, %)						18.18	.30	
• Very satisfied	5 (63%)	8 (89%)	33 (72%)	61 (67%)	50 (74%)			
• Satisfied	1 (13%)	1 (11%)	7 (15%)	17 (19%)	6 (9%)			
• Neutral	0 (0%)	0 (0%)	5 (11%)	8 (9%)	8 (12%)			
• Dissatisfied	2 (25%)	0 (0%)	1 (2%)	3 (3%)	2 (3%)			
• Very Dissatisfied	0 (0%)	0 (0%)	0 (0%)	2 (2%)	2 (3%)			
Job Satisfaction Post-Injury (n, %)						15.37	.50	
• Very satisfied	2 (40%)	7 (78%)	18 (49%)	31 (43%)	31 (61%)			
• Satisfied	1 (20%)	1 (11%)	4 (11%)	9 (12%)	4 (8%)			
• Neutral	0 (0%)	0 (0%)	9 (24%)	18 (25%)	5 (10%)			
• Dissatisfied	1 (20%)	0 (0%)	2 (5%)	3 (4%)	2 (4%)			
• Very Dissatisfied	1 (20%)	1 (11%)	4 (11%)	12 (16%)	9 (18%)			
Case settled at admission (n, %)						.68	.95	
• No	6 (50%)	13 (57%)	43 (57%)	99 (60%)	70 (60%)			
• Yes	6 (50%)	10 (44%)	33 (43%)	67 (40%)	7 (40%)			
Work Status at admission (n, %)						12.52	.02	.18
• No	9 (69%)	18 (95%)	58 (76%)	132 (78%)	103 (90%)			
• Yes	4 (31%)	1 (5%)	18 (24%)	38 (22%)	11 (10%)			
Duty (mean months, SD)								
• Full time, Full Duty	N/A	2.7 (6.9)	2.9 (9.5)	3.0 (4.1)	4.1 (21.5)	.17	.95	
• Full time, Modified Duty	N/A	N/A	4.7 (21.8)	.4 (1.4)	1.2 (6.8)	1.52	.20	
• Part time, Light Duty	3.6 (6.3)	1.2 (2.0)	9.3 (29.6)	3.9 (10.7)	5.2 (25.7)	.81	.52	
Job Availability at pre-treatment (n, %)						3.32	.51	
• No	5 (39%)	7 (37%)	25 (36%)	63 (39%)	49 (44%)			
• Yes	8 (62%)	12 (63%)	38 (60%)	84 (57%)	46 (48%)			

Table 6.18 – Continued

Variable	Subclinical 0-20 n = 13	Mild 21-40 n = 26	Moderate 41-60 n = 87	Severe 61-80 n = 175	Extreme 81-100 n = 119	F/χ^2 Value	p value	Effect Size
Receiving SSI/SSDI (n, %)						3.49	.48	
• No	11 (85%)	15 (88%)	57 (93%)	120 (94%)	81 (88%)			
• Yes	2 (15%)	2 (12%)	4 (7%)	8 (6%)	11 (12%)			

6.4.4 Psychiatric Diagnosis Differences between Severity Levels

First, Axis II personality disorders were examined for differences between the FACS severity levels among the CMPD patients, as shown below in Table 6.19. Results showed that there was a significant difference in the frequency of Cluster A personality disorders, however, when the standardized residuals were examined, there was no cell greater than ± 2.0. This trend continued with the individual Cluster A disorders, as the overall Chi-Square value for paranoid personality disorder was significant, but the standardized residuals were not large enough. The remaining Cluster A personality disorders, schizoid and schizotypal, did not significantly differ among FACS severity levels.

There was also a significant difference in the frequency of Cluster B personality disorders, demonstrating that those in the subclinical and mild FACS severity levels were less likely to be diagnosed with any Cluster B personality disorder (z = -3.1 and -2.9, respectively), while those in the extreme FACS severity level were more likely (z = 4.3) to be diagnosed with Cluster B personality disorders. These Cluster B results may be driven in part by the individual diagnosis of borderline personality disorder. Those in the subclinical FACS severity level were less likely to be diagnosed (z = -2.7) with a Cluster B personality disorder than those in the extreme FACS severity level (z = 5.1). While narcissistic personality disorder also showed significant differences between FACS severity levels, when the standardized residuals were examined, there were no values greater than ± 2.0. Neither antisocial nor histrionic personality disorder significantly differed among FACS severity levels.

Similar results appeared for the Cluster C personality disorders, with those in the subclinical FACS severity level less likely to be diagnosed ($z = -2.8$) with a Cluster C personality disorder and those in the extreme FACS severity level more likely to be diagnosed with a Cluster C personality disorder ($z = 2.5$). These results may in part be generated by the significance of the obsessive-compulsive personality disorder Chi-Square; it was found that those in the subclinical and mild FACS severity levels were less likely to be diagnosed with obsessive-compulsive personality disorder ($z = -2.5$ and -2.2, respectively), while those in the extreme FACS severity level were more likely to be diagnosed with obsessive-compulsive personality disorder ($z = 2.4$). No significant differences were found in the avoidant or dependent personality disorders among the FACS severity levels.

Table 6.19 Axis II personality disorders by FACS severity level at admission to FRP

Variable	Subclinical 0-20 n = 13	Mild 21-40 n = 26	Moderate 41-60 n = 87	Severe 61-80 n = 175	Extreme 81-100 n = 119	X^2 Value	p value	Effect Size
Any Cluster A Disorder (n, %)						11.73	.02	.12
No	103 (100%)	106 (100%)	172 (99%)	257 (96%)	159 (96%)			
Yes	0 (0%)	0 (0%)	2 (1%)	11 (4%)	7 (4%)			
Cluster A Personality Disorders (n, % yes)							.	
Paranoid	0 (0%)	0 (0%)	1 (1%)	9 (3%)	6 (4%)	11.02	02	.16
Schizoid	0 (0%)	0 (0%)	1 (1%)	3 (1%)	1 (1%)	2.43	.71	
Schizotypal	0 (0%)	0 (0%)	0 (0%)	1 (0%)	0 (0%)	2.05	1.00	
Any Cluster B Disorder (n, %)						42.61	.00	.22
No	103 (100%)	105 (99%)	161 (93%)	237 (88%)	133 (80%)			
Yes	0 (0%)	1 (1%)	13 (8%)	31 (12%)	33 (20%)			
Cluster B Personality Disorders (n, % yes)								
Antisocial	0 (0%)	0 (0%)	4 (2%)	9 (3%)	4 (2%)	6.72	.14	
Borderline	0 (0%)	0 (0%)	9 (5%)	19 (7%)	29 (18%)	44.72	.00	.23
Histrionic	0 (0%)	1 (1%)	1 (1%)	1 (0%)	2 (1%)	2.04	.81	
Narcissistic	0 (0%)	0 (0%)	0 (0%)	6 (2%)	4 (2%)	8.96	.05	.11
Any Cluster C Disorder (n, %)						18.82	.00	.16
No	103 (100%)	103 (97%)	161 (93%)	245 (91%)	145 (87%)			
Yes	0 (0%)	3 (3%)	13 (8%)	23 (9%)	21 (13%)			
Cluster C Personality Disorders (n, % yes)								
Avoidant	0 (0%)	1 (1%)	0 (0%)	2 (1%)	2 (1%)	2.94	.60	
Dependent	0 (0%)	1 (1%)	1 (1%)	1 (0%)	2 (1%)	2.04	.73	
Obsessive-Compulsive	0 (0%)	1 (1%)	12 (7%)	20 (8%)	18 (11%)	18.76	.00	.16

The Axis I psychiatric disorders are presented in Table 6.20. Many significant differences were found among the FACS severity levels. Those in the mild and moderate severity levels were more likely not to have a diagnosis of Major Depressive Disorder (MDD; z = 3.5 and 2.2, respectively), while those in the extreme FACS severity level were less likely to have no diagnosis (z = -3.0). Those in the moderate FACS severity level were less likely to be diagnosed with MDD (z = -2.5) while those in the extreme FACS severity level were more likely (z = 2.2). Those in the extreme level were more likely to be diagnosed with any anxiety disorder (z = 2.2),

and were also more likely to be diagnosed with Generalized Anxiety Disorder (z = 2.1). Those in the subclinical FACS severity level were more likely not to have a diagnosis of pain disorder (z = 2.7). No significant differences existed in opioid dependence among the five FACS severity levels.

Table 6.20 Axis I psychiatric disorders by FACS severity level at admission to FRP

Variable	Subclinical 0-20 n = 13	Mild 21-40 n = 26	Moderate 41-60 n = 87	Severe 61-80 n = 175	Extreme 81-100 n = 119	F/χ^2 Value	p value	Effect Size
Major Depressive Disorder, n (%)						40.87	.00	.30
No	6 (46%)	19 (73%)	42 (47%)	55 (31%)	21 (18%)			
Yes	7 (54%)	7 (27%)	47 (53%)	122 (69%)	99 (83%)			
Generalized Anxiety Disorder, n (%)						9.26	.05	.16
No	11 (92%)	24 (92%)	77 (87%)	148 (84%)	89 (74%)			
Yes	1 (8%)	2 (8%)	12 (14%)	29 (16%)	31 (26%)			
Opiate Dependence, n (%)						2.96	.55	
No	12 (100%)	24 (92%)	81 (91%)	160 (91%)	114 (95%)			
Yes	0 (0%)	2 (8%)	8 (9%)	16 (9%)	6 (5%)			
Any Anxiety Disorder, n (%)						14.32	.01	.19
No	11 (85%)	19 (73%)	66 (74%)	115 (65%)	63 (53%)			
Yes	2 (15%)	7 (27%)	23 (26%)	62 (35%)	57 (48%)			
Pain Disorder, n (%)						11.22	.03	.17
No	3 (23%)	3 (12%)	4 (5%)	9 (5%)	4 (3%)			
Yes	10 (77%)	22 (88%)	85 (96%)	168 (95%)	116 (97%)			

6.4.5 Psychosocial PRO Differences between Severity Levels: Psychiatric Chronic Pain Patients

Significant differences in psychosocial PROs also existed in the psychiatric chronic pain patients, as depicted in Table 6.21. Pain intensity, rated at four time points (worst, least, current, and average), showed many significant differences. When patients' worst pain was examined, it was found that those in the subclinical FACS severity level had the lowest pain ($p \leq .05$)

compared to all other levels, and that those in the mild severity level had lower pain ratings at their worst time point than those in the severe FACS severity level (p = .001). When worst pain was examined categorically, it was found that those in the subclinical FACS severity level were more likely to score in the mild pain intensity category (z = 6.2).Those in the mild FACS severity level were more likely to score in the moderate pain intensity category (z = 3.5), and those in the moderate FACS severity level were more likely to score in the severe pain intensity category (z = 2.4), exhibiting a stair-step pattern of severity level correspondence. An examination of pain at the patients' least pain time point showed that those in the extreme FACS severity level had significantly higher pain ratings than those in the mild or moderate severity levels ($p \leq .01$), and that those in the severe level had significantly higher pain than those in the mild FACS severity level (p = .001). Categorical differences in least pain intensity were also found: those in the mild FACS severity level were more likely to score in the mild pain intensity category (z = 2.7), while those in the extreme FACS severity level were less likely to score in the mild pain intensity category (z = -2.2).

When patient reports of average pain intensity were examined, those in the severe and extreme FACS severity levels had significantly higher average pain ratings than all other levels ($p \leq .02$), with the exception of each other (p = 1.0). Categorically, however, results seemed to paint a slightly different picture: those in the subclinical and mild FACS severity levels were more likely to score in the mild pain intensity category (z = 2.5 and 2.8, respectively), while only those in the extreme FACS severity level were more likely to score in the severe pain intensity category (z = 2.0). Lastly, the variable of current pain showed that those in the mild FACS severity level had significantly lower scores than all other severity levels (p = .001), with the exception of those in the subclinical severity level (p = 1.0). From a categorical standpoint, it was found that those in the subclinical and mild FACS severity levels were more likely to score in the mild pain intensity category (z = 2.2 and 4.3, respectively).

Those patients in the subclinical and mild FACS severity levels had significantly lower PDQ scores than those patients in the severe and extreme severity levels ($p > .001$), and the

subclinical FACS severity level was also significantly lower than the moderate level (p = .01). When a categorical approach was examined, it was found that those in the subclinical and mild FACS severity levels were more likely to score within the mild/moderate PDQ category (z = 2.7 and 2.2, respectively).

When examining differences on the BDI, it was found that those in the mild FACS severity level had significantly lower scores than those in the extreme group (p = .001), although no other significant differences among severity levels existed. A categorical approach yielded similar results, with those in the mild FACS severity level significantly more likely to be categorized as “no depression” (z = 2.8) and those in the extreme FACS severity level more likely to be categorized as having severe depression (z = 2.8). No significant differences existed upon the ISI when the measured was examined continuously. When the ISI was examined categorically, however, it was found that those in the FACS subclinical severity level were more likely to score in the “no clinical insomnia” range on the ISI (z = 3.1).

The CSI also showed significant differences among FACS severity levels, with those in the subclinical severity level having significantly lower scores on the CSI than all other severity levels (p < .001), with the exception of the mild group (p = .60). The extreme FACS severity level scored significantly higher on the CSI than all other severity levels (p < .001), with the exception of the severe level (p = .40). In addition, the severe FACS level also had higher scores than the mild severity level (p < .001). When the CSI was analyzed categorically, it was found that those in the subclinical FACS severity level were more likely to score in the subclinical or mild CSI group (z = 2.4 and 2.8, respectively), and that these groups were less likely to score in the extreme CSI group (z = -2.0 and -2.1, respectively), while those in the extreme FACS severity level were more likely to score in the extreme CSI group (z = 3.6).

Table 6.21 Psychosocial variables by FACS severity level in psychiatric chronic pain patients

Variable	Subclinical 0-20 n = 18	Mild 21-40 n =46	Moderate 41-60 n = 73	Severe 61-80 n = 91	Extreme 81-100 n = 46	F/χ^2 Value	p value	Effect Size
Worst Pain Intensity, mean (SD)	6.9 (3.1)	8.1 (1.8)	8.6 (1.2)	9.1 (1.0)	8.9 (1.0)	10.48	.00	.14
Worst Pain Intensity severity levels, n (%)						73.98	.00	.48
• Mild	3 (23%)	1 (2%)	0 (0%)	0 (0%)	0 (0%)			
• Moderate	1 (8%)	4 (10%)	0 (0%)	0 (0%)	0 (0%)			
• Severe	0 (0%)	7 (17%)	17 (24%)	6 (7%)	4 (10%)			
• Extreme	9 (69%)	30 (71%)	54 (77%)	81 (93%)	38 (91%)			
Least Pain Intensity, mean (SD)	3.4 (2.0)	3.1 (2.0)	3.8 (1.9)	4.7 (2.5)	5.3 (2.3)	7.46	.00	.11
Least Pain Intensity severity levels, n (%)						35.50	.00	.35
• Mild	7 (54%)	30 (71%)	36 (51%)	29 (33%)	9 (21%)			
• Moderate	5 (39%)	6 (14%)	20 (28%)	28 (32%)	14 (33%)			
• Severe	0 (0%)	6 (14%)	13 (18%)	20 (23%)	13 (31%)			
• Extreme	1 (8%)	0 (0%)	2 (3%)	10 (12%)	6 (14%)			
Current Pain Intensity, mean (SD)	5.4 (3.1)	4.8 (2.8)	6.5 (1.9)	6.9 (2.3)	7.1 (2.1)	7.82	.00	.11
Current Pain Intensity severity levels, n (%)						48.30	.00	.41
• Mild	4 (33%)	14 (35%)	4 (6%)	5 (6%)	2 (5%)			
• Moderate	3 (25%)	11 (28%)	17 (24%)	11 (13%)	5 (12%)			
• Severe	2 (17%)	6 (15%)	28 (39%)	28 (33%)	16 (39%)			
• Extreme	3 (25%)	9 (23%)	22 (31%)	41 (48%)	18 (44%)			
Average Pain Intensity, mean (SD)	5.3 (2.7)	5.4 (1.9)	6.1 (1.6)	7.2 (1.7)	7.2 (1.7)	10.93	.00	.15
Average Pain Intensity severity levels, n (%)						39.45	.00	.37
• Mild	3 (25%)	7 (18%)	3 (4%)	1 (1%)	2 (5%)			
• Moderate	3 (25%)	12 (30%)	23 (33%)	13 (15%)	6 (15%)			
• Severe	3 (25%)	12 (30%)	30 (43%)	36 (42%)	12 (29%)			
• Extreme	3 (25%)	9 (23%)	14 (20%)	35 (41%)	21 (51%)			
PDQ Total, mean (SD)	27.0 (8.5)	58.8 (34.6)	80.8 (27.2)	101.7 (21.9)	103.5 (25.0)	11.56	.00	.40
PDQ severity levels, n (%)						25.89	.00	.51
• Mild/Moderate	3 (100%)	5 (63%)	4 (24%)	4 (13%)	2 (13%)			
• Severe	0 (0%)	2 (25%)	9 (52%)	8 (26%)	4 (27%)			
• Extreme	0 (0%)	1 (13%)	4 (24%)	19 (61%)	9 (60%)			

Table 6.21 – Continued

Variable	Subclinical 0-20 n = 18	Mild 21-40 n =46	Moderate 41-60 n = 73	Severe 61-80 n = 91	Extreme 81-100 n = 46	F/χ^2 Value	p value	Effect Size
BDI , mean (SD)	5.0 (7.1)	6.3 (6.2)	18.1 (12.2)	19.0 (10.7)	27.3 (10.9)	5.53	.00	.30
BDI severity levels, n (%)						36.40	.00	.63
• No depression	1 (50%)	6 (86%)	3 (25%)	4 (19%)	2 (14%)			
• Mild depression	1 (50%)	0 (0%)	2 (17%)	6 (29%)	0 (0%)			
• Moderate depression	0 (0%)	1 (14%)	4 (33%)	4 (19%)	0 (0%)			
• Severe depression	0 (0%)	0 (0%)	3 (26%)	7 (33%)	12 (85%)			
ISI, mean (SD)	7.7 (2.1)	12.7 (3.7)	15.3 (8.8)	19.0 (13.0)	21.4 (4.8)	1.89	.13	
ISI severity levels, n (%)						24.44	.02	.54
• No insomnia	2 (67%)	0 (0%)	2 (17%)	2 (8%)	0 (0%)			
• Sub-threshold insomnia	1 (33%)	4 (67%)	4 (33%)	7 (27%)	1 (8%)			
• Moderate insomnia	0 (0%)	2 (33%)	2 (17%)	9 (35%)	5 (39%)			
• Severe insomnia	0 (0%)	0 (0%)	4 (33%)	8 (31%)	7 (54%)			
CSI, mean (SD)	32.4 (10.4)	40.0 (14.2)	45.9 (13.2)	52.1 (14.0)	57.4 (16.3)	16.3	.00	.20
CSI severity levels, n (%)						63.02	.00	.44
• Subclinical	6 (35%)	11 (24%)	10 (15%)	6 (7%)	3 (7%)			
• Mild	7 (41%)	9 (20%)	10 (15%)	8 (9%)	5 (11%)			
• Moderate	3 (18%)	14 (30%)	22 (32%)	19 (22%)	6 (13%)			
• Severe	1 (6%)	8 (17%)	18 (26%)	27 (31%)	9 (20%)			
• Extreme	0 (0%)	4 (9%)	9 (13%)	27 (31%)	23 (50%)			

6.4.6 Correlations between Measures

Table 6.22 depicts the correlation between psychosocial measurements at program admission in CMPD patients. While all measures were significantly correlated with the FACS, some had much higher correlations than others, such as the correlations with the IEQ (r = .68-.72) and the PDQ (r = .68-.70). This helps demonstrate construct validity.

Table 6.22 Correlations between FACS total score and other psychosocial measures at FRP admission in CMPD patients

Psychosocial Measure	Correlation *r*	*p* value
Pain Intensity	.54	.00
PDQ Total	.70	.00
BDI	.61	.00
ODI	.58	.00
ISI	.62	.00
CSI	.60	.00
TSK Total	.62	.00
TSK Activity Avoidance Subscale	.59	.00
TSK Physical Function Subscale	.56	.00
PHQ Somatization	.49	.00
IEQ Total	.72	.00
IEQ Blame/Unfairness	.68	.00
IEQ Severity/Irreparability	.70	.00

At program discharge, most measures continued to significantly correlate with the FACS, as shown in Table 6.23. However, the PDQ Functional Subscale became non-significant (p = .57), as well as the ODI (p = .20). While the remaining measures all significantly correlated, as with the admission measures, some had higher correlations than others, including the IEQ (r = .57-.59) and the TSK (r =.34-.35).

Table 6.23 Correlations between FACS total score and other psychosocial measures at FRP discharge in CMPD patients

Psychosocial Measure	Correlation *r*	*p* value
Pain Intensity	.10	.02
PDQ Total	.26	.00
BDI	.15	.00
ODI	.06	.20
ISI	.26	.00
CSI	.23	.00
TSK Total	.35	.00
TSK Activity Avoidance Subscale	.34	.00
TSK Physical Function Subscale	.34	.00
PHQ Somatization	.13	.00
IEQ Total	.58	.00
IEQ Blame/Unfairness	.57	.00
IEQ Severity/Irreparability	.59	.00

Table 6.24 below shows the correlations between psychosocial measures in the psychiatric chronic pain sample. The FACS significantly correlated with all measures; however, the *p* value for the ISI was not as low ($p = .04$), perhaps indicating discriminant validity between insomnia and fear-avoidance as measured by the FACS.

Table 6.24 Correlations between FACS scores and other psychosocial measures in psychiatric chronic pain patients

Psychosocial Measure	Correlation *r*	*p* value
Worst pain intensity	.36	.00
Least pain intensity	.33	.00
Average pain intensity	.37	.00
Current pain intensity	.31	.00
PDQ total	.62	.00
BDI	.49	.00
ISI	.27	.04
CSI	.40	.00

6.5.6 Psychosocial Variable Admission, Discharge, and Response to Treatment Analyses

Response to treatment was analyzed using pattern mixture modeling. This model accounts for all demographic covariates (age, education, marital status, and attorney retention) as well as for non-completers who have not finished the FRP. Results are depicted with the variables in each model, their estimate, degrees of freedom, *t*-test value, and the significance of the *t*-test shown. Multilevel modeling was performed by restructuring the database from a multivariate format to a "stacked" format, in which a variable reflecting the timing of repeated assessments was created and included in the database. Consequently, the df for each predictor varied depending on the number of subjects that had repeated measurements for each piece of information. Please note that marital status had to be dummy coded into 6 variables, and was not reported in the tables unless one of the specific variables was significant.

6.5.6.1 FACS

The FACS analysis, done with pattern mixture modeling, is shown in Table 6.25. A main effect of time, F (1, 499.86) = 44.28, $p < .001$, and FACS severity level, F (1, 382.6) = 443.31, $p < .001$, were found. When the post-hocs for the main effect of time was examined, it was found that FACS scores significantly differed from admission to discharge ($p = .001$), with a mean decreased from admission to discharge of 12.4 points. When the post-hocs for the main effect of FACS severity level was examined, it was found that all FACS severity levels significantly differed from each other on the FACS total score ($p < .001$), with the exception of the subclinical and mild FACS severity levels ($p = .38$), with each severity level up from the mild level having a higher mean FACS score. There also was a significant main effect of the covariate attorney retention, F (1, 341.28) = 4.92, $p < .03$. However, when further ANOVA analysis was undertaken to find where the significant difference lay, the effect of attorney retention was no longer significant ($p = .09$).

Table 6.25 Pattern mixture modeling: FACS

Variables	Estimate	df	t-test	Sig.
FACS Total				
Time	-12.4	499.9	-6.6	.00
FRP Completion	-2.0	715.3	-.6	.55
FACS Severity Level	14.7	382.6	21.1	.00
Time x FRP completion	-11.6	591.8	-1.8	.07
Time x FACS Severity Level	-9.9	363.8	-7.3	.00
FRP completion x FACS Severity Level	1.4	604.9	.6	.53
Age	-.0	394.9	-.2	.86
Education Level in Years	-.1	371.6	-.7	.50
Marital Status				
Attorney Retention	2.9	341.3	2.2	.03

A significant interaction effect also existed between time and the FACS severity levels, F (1, 363.81) = 53.68, $p < .001$. Closer examination of the interaction showed that all FACS severity levels significantly decreased the FACS total score from admission to discharge ($p < .001$), except for those in the subclinical FACS severity level ($p = .32$). Admission and discharge scores are presented in Table 6.26. The mean change from admission to discharge was examined in the entire sample, for those who had elevated pain intensity and perceived disability scores ("screamers"), and for those who decreased their PILE score from admission to discharge by at least 30%, which was deemed the Minimally Clinically Important Difference (MCID) change value. The average change from admission to discharge for all patients was a 12 point decrease, and remained so when "screamers" were removed. A large jump in the number of points of FACS improvement did occur in those who had greater than a 30% change in their PILE scores; they decreased their FACS scores by nearly 24 points.

Table 6.26 FACS admission and discharge scores

Variable	Admission (Mean, SD)	Discharge (Mean, SD)	Mean Change Score	F value	p value	Effect Size
FACS	50.5 (36.5)	38.1 (27.9)	12.44	29.28	.00	.09
FACS (removal of "screamers")	47.2 (2.1)	34.4 (1.6)	12.80	32.55	.00	.10
FACS (MCID 30% change)						
• < 30% change	51.2 (1.8)	37.4 (1.4)	13.7	14.00	.00	.03
• > 30% change	60.2 (7.0)	36.3 (9.1)	23.9			

In addition, response to treatment was also examined by change in FACS severity level from admission to discharge. As seen in Table 6.27, at discharge, the percentage of patients in the Subclinical, mild, and moderate FACS severity levels increased, while the percentage of patients in the severe and extreme FACS severity levels decreased.

Table 6.27 Admission to discharge change on the FACS severity level in CMPD completers and QLs

FACS at Admission		FACS at Discharge		Percent change from admission to discharge
Category	**N (%)**	**Category**	**N (%)**	
Subclinical	12 (3%)	Subclinical	93 (24%)	32% increase
Mild	23 (7%)	Mild	84 (22%)	221% increase
Moderate	76 (22%)	Moderate	121 (31%)	40% increase
Severe	140 (31%)	Severe	59 (15%)	63% decrease
Extreme	91 (20%)	Extreme	33 (8%)	68% decrease

6.5.6.2 TSK

Next, the TSK total score was examined using pattern mixture modeling. Results are presented in Table 6.28. There were significant main effects for time, F (1, 508.37) = 93.36, p < .001, and the FACS severity levels, F (1, 348.26) = 114.98, p < .001). When the FACS severity level main effect was explored, all FACS severity levels had significantly different scores on the total TSK ($p \leq .04$), with the exception of the subclinical and mild severity levels (p = 1.0) and the

subclinical and moderate severity levels (p = .08), demonstrating a general trend that as the FACS levels became more severe, TSK scores increased. When covariates were examined, a main effect of marital status was found in regards to those who were cohabitating, F (1, 306.14) = 4.59, p = .03. Interactions were also found with cohabitation: there was an interaction effect with completion status, F (1, 517.68) = 9.58, p < .01, and with time, F (1, 294.65) = 6.39, p = .01. Since an interaction effect did not exist with the FACS severity levels, the primary variable under review in this document, these effects were not explored further.

Table 6.28 Pattern mixture modeling results: TSK

Variables	Estimate	df	t-test	Sig.
TSK Total				
Time	-6.7	508.4	-9.7	.00
FRP Completion	-1.7	687.7	-1.3	.20
FACS Severity Level	4.8	348.3	10.7	.00
Time x FRP completion	-3.3	484.5	-.8	.42
Time x FACS Severity Level	-1.1	290.8	-1.6	.11
FRP completion x FACS Severity Level	-1.5	290.8	-1.1	.29
Age	.0	360.8	.02	.99
Education Level in Years	-.2	356.3	-1.7	.09
Marital Status: Cohabitating	-8.2	306.1	-2.1	.03
Attorney Retention	1.5	295.4	1.7	.10

Table 6.28 – Continued

Variables	Estimate	df	t-test	Sig.
TSK Activity Avoidance Subscale				
Time	-4.4	512.3	-9.38	.00
FRP Completion	-.9	697.4	-1.0	.30
FACS Severity Level	2.7	348.2	9.17	.00
Time x FRP completion	-3.0	493.3	-1.1	.27
Time x FACS Severity Level	-.6	292.5	-1.3	.20
FRP completion x FACS Severity Level	-.6	553.5	-.7	.49
Age	-.0	360.7	-.62	.54
Education Level in Years	-.1	356.3	-1.7	.08
Marital Status: Cohabitating	-5.2	304.8	-2.1	.04
Attorney Retention	.8	294.3	1.4	.17
TSK Physical Functioning				
Time	-2.5	523.4	-7.1	.00
FRP Completion	-.9	704.1	-1.3	.18
FACS Severity Level	2.2	359.9	10.1	.00
Time x FRP completion	1.1	503.5	-1.4	.16
Time x FACS Severity Level	-.3	305.5	-.8	.42
FRP completion x FACS Severity Level	-.9	559.5	-1.4	.16
Age	.0	372.8	.4	.69
Education Level in Years	-.0	367.1	-.8	.44
Marital Status				
Attorney Retention	.7	304.6	1.8	.07

Although no significant interaction effects existed, the admission and discharge data was still explored; these data are presented in Table 6.29. At admission, it was found that total TSK scores significantly differed among the FACS severity levels, with those categorized in the severe and extreme severity levels showing significantly higher FACS scores than all other severity levels ($p < .001$), as well as the subclinical and moderate severity level significantly differing ($p = .02$). An examination of the total TSK scores broken into severity levels shows that those in the subclinical, mild, and moderate groups were significantly more likely to fall into the mild TSK

category (z = 4.9, 5.1, and 4.1, respectively), and that the severe and extreme FACS patients were less likely to score in the mild (z = =3.4 for both) or moderate (z - -2.7 and -2.6, respectively). In addition, those in the mild or moderate FACS severity level were less likely to score in the severe TSK category (z = -2.7 and -3.8 respectively) and those in the extreme FACS severity level were more likely to score in the severe TSK category (z = 6.3).

At discharge, those in the extreme FACS severity level had significantly higher TSK scores than all other FACS severity levels ($p < .001$), and that the severe FACS severity level patients had significantly higher TSK scores than all other levels ($p < .01$), with the exception of the moderate severity level ($p = .13$). In addition, those in the subclinical FACS severity level had significantly lower TSK scores at discharge than those in the mild or moderate severity levels ($p < .001$). When a categorical approach was examined, it was found that those in the subclinical FACS severity level were more likely to be categorized as having no kinesiophobia (z = 9.0), while those in the moderate, severe, and extreme FACS severity levels were less likely to be categorized as having no kinesiophobia on the TSK (z = -4.0, -3.4, and -2.9, respectively). Those in the subclinical and extreme FACS severity levels were less likely to be categorized as having mild kinesiophobia (z = -3.7 and -2.9, respectively), while those in the mild and moderate FACS severity levels were more likely (z = 2.6 for both). Those in the subclinical FACS severity level were also less likely to score in the moderate kinesiophobia category (z = -4.6), while those in the moderate, severe, and extreme FACS severity levels were more likely (z = 2.3, 3.0, and 2.4, respectively). In addition, those in the subclinical FACS severity level were less likely to score in the severe kinesiophobia category (z = -2.1), while those in the extreme FACS severity level were more likely (z = 7.4).Admission and discharge TSK data can be found in Table 6.29.

The TSK activity avoidance results are shown in Table 6.28. Main effects were found for time, F (1, 512.31) = 87.97, $p < .001$, and for FACS severity level, F (1, 348.23) = 84.15, $p < .001$. When the FACS main effect was further delved, it was found that all FACS severity levels significantly differed from all other FACS severity levels on TSK activity avoidance ($p \leq .02$), with the exception of the subclinical and mild FACS severity levels ($p = 1.0$) and the subclinical and

moderate FACS severity levels (p = .07), indicating that as the FACS severity levels increased from subclinical/mild/moderate to the other higher levels, TSK activity avoidance scores also rose. As with the total TSK, there was a significant main effect for the marital status variable dummy coded for cohabitation: F (1, 304.84) = 4.21, p = .04, but no other effects for the remaining covariates. When cohabitation marital status was explored further, significant interaction effects were found for completion status, F (1, 521.61) = 9.90, p < .01, and for time, F (1, 296.17) = 7.85, p = .01. Since neither of these interactions involved the FACS severity level, post-hocs were not pursued.

There were no significant interaction effects; however, admission and discharge TSK activity avoidance data is presented in Table 6.29 in order to help provide validation evidence. At admission, it was found that both the severe and extreme FACS severity level patients having significantly higher scores than all other severity levels (p < .001) on both subscales, and the subclinical and moderate FACS severity levels differing significantly from each other (p = .02). At discharge, those in the extreme FACS severity level had significantly higher activity avoidance scores than all other severity levels (p ≤ .02), and those in the subclinical FACS severity level having significantly lower activity avoidance scores than all other severity levels (p < .001). In addition, those in the mild FACS severity level had lower scores than those in the severe level (p < .001).

Next, the TSK physical functioning subscale was examined with pattern mixture modeling, as detailed in Table 6.28 below. Main effects were found for time, F (1, 523.42) = 50.88, p < .001, as well as for the FACS severity levels, F (1, 359.90) = 102.86, p < .001. When the FACS severity level information was further examined, it revealed that those in the severe and extreme FACS severity levels had significantly higher TSK physical functioning scores than those in all other severity levels (p < .001). No significant main effects existed for any covariates, either.

No significant interaction effects existed, although information is presented in Table 6.29 with more details about how the TSK physical functioning subscale relates to the FACS severity

levels at admission. Both the severe and extreme FACS severity level patients had significantly higher scores than all other severity levels ($p < .001$) on both subscales, and the subclinical and moderate FACS severity levels differing significantly from each other ($p = .02$). At discharge, the same pattern was found for physical functioning as was found for activity avoidance: those in the extreme FACS severity level having significantly higher physical functioning scores than all other severity levels ($p \leq .02$), and those in the subclinical FACS severity level having significantly lower physical functioning scores than all other severity levels ($p < .001$). In addition, those in the mild FACS severity level had lower scores than those in the severe level ($p < .001$).

Table 6.29 TSK admission and discharge scores by FACS severity level

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	F/χ^2 Value	p value	Effect Size
Admission TSK Total, mean (SD)	19.1 (8.5)	24.3 (5.2)	27.8 (8.9)	33.9 (9.1)	40.0 (9.5)	40.00	.00	.28
• Activity Avoidance	11.5 (5.3)	15.0 (3.5)	17.1 (6.0)	20.4 (6.3)	24.0 (6.5)	28.41	.00	.22
• Physical Function	7.5 (4.1)	9.3 (3.0)	10.5 (4.3)	13.3 (4.6)	16.0 (3.8)	32.82	.00	.24
Admission TSK severity levels, n (%)						193.60	.00	
• None	7 (58%)	10 (39%)	17 (20%)	4 (2%)	3 (3%)			
• Mild	4 (33%)	13 (50%)	43 (51%)	60 (36%)	7 (6%)			
• Moderate	1 (8%)	3 (12%)	23 (27%)	82 (49%)	53 (46%)			
• Severe	0 (0%)	0 (0%)	2 (2%)	22 (13%)	53 (46%)			
Discharge TSK Total, mean (SD)	18.5 (6.5)	25.5 (9.1)	28.6 (9.7)	32.4 (11.9)	40.1 (11.8)	40.11	.00	.30
• Activity Avoidance	11.4 (4.2)	14.8 (5.9)	17.1 (6.7)	19.0 (7.9)	23.3 (8.1)	27.89	.00	.29
• Physical Function	7.2 (2.9)	10.4 (4.6)	11.2 (5.0)	13.0 (6.3)	16.5 (5.8)	27.96	.00	.29
Discharge TSK severity levels, n (%)						264.25	.00	.65
• None	77 (85%)	24 (30%)	12 (11%)	3 (6%)	1 (3%)			
• Mild	12 (13%)	44 (54%)	59 (52%)	20 (37%)	2 (6%)			
• Moderate	0 (0%)	11 (14%)	38 (33%)	23 (43%)	14 (44%)			
• Severe	2 (2%)	2 (3%)	5 (4%)	8 (15%)	15 (47%)			

6.5.6.3 IEQ

The IEQ was also examined through pattern mixture modeling, with results presented in Table 6.30. There were main effects for time, F (1, 452.82) = 31.75, $p < .001$, as well as FACS severity level, F (1, 341.89) = 183.43, $p < .001$. When the later main effect was examined in

detail, it demonstrated that those in the severe and extreme FACS severity levels had significantly higher IEQ total scores than those in all other severity levels ($p < .001$). No interaction effects existed for time, completion status, or FACS severity levels. Main effects were found for the marital status covariates of single, F (1, 292.92) = 3.87, p = .05, married, F (1, 289.9) = 5.38, p = .02, divorced, F (1, 291.59) = 4.01, p = .05, and widowed, F (1, 300.24) = 3.94, p = .05, as well as for attorney retention, F (1, 274.51) = 9.90, $p < .01$. These findings were not followed up, as they did not significantly interact with the FACS, the primary target variable in this study.

Table 6.30 Pattern mixture modeling: IEQ

Variables	Estimate	df	t-test	Sig.
IEQ Total				
Time	-4.4	452.8	-5.6	.00
FRP Completion	-3.0	597.5	-1.7	.09
FACS Severity Level	7.4	341.9	13.5	.00
Time x FRP completion	-4.2	416.7	-.9	.39
Time x FACS Severity Level	-.5	276.6	-.6	.54
FRP completion x FACS Severity Level	-.6	502.7	-.4	.71
Age	-.0	350.6	-.3	.75
Education Level in Years	.2	342.2	1.6	.11
Marital Status: Single	-8.2	292.9	-2.0	.05
Marital Status: Married	-9.3	289.9	-2.3	.02
Marital Status: Divorced	-8.3	291.6	-2.0	.05
Marital Status: Widowed	-11.6	327.6	-2.0	.05
Attorney Retention	3.15	274.5	3.1	.00

Table 6.30 – Continued

Variables	Estimate	df	t-test	Sig.
IEQ Blame/Unfairness				
Time	-1.6	446.2	-3.6	.00
FRP Completion	-1.7	583.5	-1.7	.10
FACS Severity Level	4.1	335.7	12.5	.00
Time x FRP completion	-1.1	388.1	-.4	.68
Time x FACS Severity Level	-.4	265.3	-.8	.40
FRP completion x FACS Severity Level	-.5	481.8	-.5	.59
Age	-.0	343.4	-.1	.90
Education Level in Years	.08	334.3	1.1	.27
Marital Status: Married	-5.4	303.1	-2.2	.03
Marital Status: Divorced	-4.9	303.6	-1.9	.05
Attorney Retention	1.9	265.3	3.1	.00
IEQ Severity/Irreparability				
Time	-2.6	457.9	-5.1	.00
FRP Completion	-1.3	616.7	-1.3	.19
FACS Severity Level	3.4	344.5	11.7	.00
Time x FRP completion	-1.3	446.0	-.5	.65
Time x FACS Severity Level	.0	285.1	.1	.95
FRP completion x FACS Severity Level	-.3	532.4	-.4	.72
Age	-.0	353.3	-1.1	.26
Education Level in Years	.2	345.3	2.4	.02
Marital Status				
Attorney Retention	1.5	276.4	2.9	.01

Although there was not a significant interaction between time and the FACS severity levels, the admission and discharge information was still examined. For the total IEQ at admission, those in the severe and extreme FACS severity levels scored significantly higher on the IEQ than all other severity levels ($p < .001$), and those in the subclinical severity level scored lower on the IEQ than the moderate severity level ($p = .04$). At discharge, all FACS severity levels

significantly differed from each other ($p \leq .01$), with the exception of the severe and extreme FACS levels ($p \geq .96$). This information is depicted in Table 6.31.

The blame/unfairness IEQ subscale was also examined; the results are shown in Table 6.30. There were significant main effects for time, F (1, 446.17) = 12.72, $p < .001$, and FACS severity level, F (1, 335.67) = 155.87, $p < .001$. When the latter was examined in more detail, it was found that those in the severe and extreme FACS severity levels had significantly higher IEQ blame/unfairness subscale scores than all other FACS severity levels ($p < .001$). There were significant covariate main effects concerning marital status: there was an effect for being married, F (1, 303.14) = 4.63, $p = .03$, and an effect for being divorced, F (1, 303.60) = 3.76, $p = .05$. In addition, there was a main effect of attorney retention, F (1, 265.26) = 9.92, $p < .01$. After determining that there were no significant interactions between the covariates and the FACS severity levels, these analyses were no longer pursued. There were no significant interaction effects for time, completion status, or FACS severity level; however, admission and discharge results are presented in Table 6.31. At admission, the blame/unfairness subscale of the IEQ results showed that the severe and extreme FACS severity levels had significantly higher scores on the blame/unfairness than all other severity levels ($p < .001$). At discharge, all FACS severity levels significantly differed from each other ($p \leq .01$), with the exception of the severe and extreme FACS levels ($p \geq .96$).

For the IEQ severity/irreparability subscale, results are shown in Table 6.30. Main effects of time, F (1, 457.87) = 29.23, $p < .001$, and FACS severity level, F (1, 344.51) = 137.25, $p < .001$) were found. When the FACS severity level main effect was explored, it was found that those in the severe and extreme FACS severity levels had significantly higher scores on the IEQ severity/irreparability subscale than all other severity levels ($p < .001$). There were main effects for some of the covariates, however: education level, F (1, 345.3) = 5.54, $p = .02$, and attorney retention, F(1, 276.37) = 8.14, $p = .01$. Since neither interacted with the FACS severity levels, further analysis of these covariates was not performed. There were no significant interactions between the variables of FACS severity level, completion status, or time, although the admission

and discharge information is presented in Table 6.31 anyway. At admission, it was found that the severe and extreme FACS severity levels had significantly higher scores on the severity/irreparability subscales than all other severity levels ($p < .001$), as well as the moderate FACS severity level having a higher severity/irreparability score than those in the subclinical FACS severity level ($p = .01$). At discharge, all FACS severity levels significantly differed from each other ($p \leq .01$), with the exception of the severe and extreme FACS levels ($p \geq .96$).

Table 6.31 IEQ admission and discharge scores by FACS severity level

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	F Value	p value	Effect Size
Admission Injustice Experience Questionnaire, mean (SD)	9.9 (11.5)	14.9 (12.0)	18.9 (9.6)	27.3 (10.9)	36.8 (8.5)	56.43	.00	.37
• Blame/Unfairness	3.4 (4.9)	4.4 (6.3)	6.6 (5.8)	11.3 (7.0)	17.2 (5.6)	48.64	.00	.36
• Severity /Irreparability	6.5 (7.5)	9.9 (8.1)	12.3 (5.1)	15.9 (5.6)	19.5 (3.7)	39.84	.00	.29
Discharge Injustice Experience Questionnaire, mean (SD)	7.1 (7.7)	15.8 (10.5)	22.3 (11.0)	33.7 (11.1)	37.2 (15.5)	78.86	.00	.47
• Blame/Unfairness	2.3 (4.2)	5.7 (6.4)	9.3 (6.5)	15.5 (7.1)	17.9 (8.8)	58.85	.00	.40
• Severity /Irreparability	4.6 (4.9)	9.6 (5.8)	12.8 (6.2)	17.8 (5.4)	18.7 (8.7)	58.64	.00	.40

6.5.6.4 PHQ Somatization

The next psychosocial measure to be examined through pattern mixture modeling was the PHQ somatization scale, depicted in Table 6.32. There were significant main effects for the variables time, F (1, 494.53) = 44.11, $p < .001$, completion status, F (1, 684.10) = 8.49, $p = .01$, and the FACS severity levels, F (1, 347.32) = 38.46, $p < .001$.Severity level post-hoc analysis showed that those in the extreme FACS severity level had higher PHQ somatization scores than those in the subclinical, mild, or moderate FACS severity levels ($p \leq .01$) and that those in the severe FACS severity level had higher PHQ somatization scores than those in the mild or moderate FACS severity levels ($p \leq .04$). Main effects also existed for some of the covariates: marital status as single, F (1, 301.21) = 4.16, $p = .04$, marital status as married, F (1, 298.38) = 5.14, $p = .02$, and marital status as divorced, F (1, 300.31) = 7.87, $p = .01$. There were no

interactions between the covariates and the FACS severity levels, though, and thus analysis of these main effects was not completed.

Table 6.32 Pattern mixture modeling: PHQ somatization subscale

Variables	Estimate	Df	t-test	Sig.
PHQ Somatization				
Time	-1.7	494.5	-6.6	.00
FRP Completion	-1.5	684.1	-2.9	.00
FACS Severity Level	1.3	347.3	6.2	.00
Time x FRP completion	-2.4	459.0	-1.3	.19
Time x FACS Severity Level	.1	282.5	.3	.75
FRP completion x FACS Severity Level	-.3	526.5	-.5	.63
Age	.0	357.0	.2	.85
Education Level in Years	.0	344.1	.1	.94
Marital Status: Single	3.4	301.2	2.0	.04
Marital Status: Married	3.6	298.4	2.3	.02
Marital Status: Divorced	4.6	300.3	2.8	.01
Attorney Retention	.4	289.6	1.1	.26

No significant interaction effects existed between time and the FACS severity levels. Admission and discharge data is presented in Table 6.33. At admission, those in the extreme FACS severity level had higher scores on the PHQ somatization subscale than all other severity levels ($p \leq .03$), with the exception of those in the severe FACS severity level ($p = .53$). In addition, those in the severe FACS level had higher PHQ somatization scores than those in the mild FACS severity level ($p = .05$). When the PHQ somatization subscale was examined categorically, it was found that those in the mild FACS severity level were more likely to score in the mild PHQ somatization category (z = 2.5), while those in the extreme FACS severity level were less likely (z = - 2.3). On the PHQ Somatization subscale at discharge, it was found that those in the extreme FACS severity level had significantly higher somatization scores than all other severity levels ($p < .01$), and that those in the severe FACS level had significantly higher

somatization scores than all other severity levels ($p < .01$) except the moderate FACS severity level ($p = .13$). In addition, those in the moderate and mild FACS severity level had significantly higher somatization scores than those in the subclinical level ($p < .001$). When examined categorically, those who were in the subclinical FACS severity level were more likely to be in the mild somatization group (z = 3.5), while those in the extreme FACS severity level were less likely to be classified as mild (z = -2.8). The reverse was true for the moderate and severe somatization groups: those in the subclinical FACS severity level were less likely to score in both categories (z = -3.3 and -2.2, respectively), while those in the extreme FACS severity level were more likely to score in both categories (z = 2.0 and 3.3, respectively). In addition, those in the mild FACS severity level were also less likely to score in the severe PHQ somatization group (z = -2.1).

Table 6.33 Somatization admission and discharge scores by FACS severity level

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	F/χ^2 Value	p value	Effect Size
Admission PHQ Somatization, mean (SD)	5.5 (4.2)	5.7 (4.0)	7.2 (4.2)	8.3 (4.7)	9.5 (4.5)	6.94	.00	.06
Admission PHQ Somatization severity levels, n (%)						28.63	.00	.26
• Mild	9 (69%)	18 (69%)	42 (47%)	64 (37%)	31 (26%)			
• Moderate	4 (31%)	8 (31%)	41 (46%)	93 (53%)	73 (61%)			
• Severe	0 (0%)	0 (0%)	6 (7%)	18 (10%)	16 (13%)			
Discharge PHQ Somatization, mean (SD)	18.5 (6.5)	25.5 (9.1)	28.6 (9.7)	32.4 (11.9)	40.1 (11.8)	40.11	.00	.30
Discharge PHQ Somatization severity levels, n (%)						64.89	.00	.39
• Mild	75 (81%)	48 (58%)	57 (48%)	21 (36%)	6 (18%)			
• Moderate	18 (19%)	35 (42%)	52 (44%)	32 (55%)	21 (64%)			
• Severe	0 (0%)	0 (0%)	9 (8%)	5 (9%)	6 (18%)			

6.5.6.5 Pain Intensity

The analysis of pain intensity was also undertaken using pattern mixture modeling, with results presented in Table 6.34. In this analysis, there was a significant main effect of time, F (1, 530.41) = 182.49, $p < .001$, as well as a main effect of completion status, F (1, 764.5) = 15.32, p

< .001, and a main effect of the FACS severity levels, F (1, 371.3) = 32.20, p < .001. When the FACS severity level main effect was further analyzed, it showed that that those in the extreme FACS severity level had significantly higher pain intensity scores than those in the subclinical, mild, and moderate FACS severity levels ($p \leq .01$), and that those in the severe FACS severity level had significantly higher scores than the mild FACS severity level ($p = .01$). There were no significant main effects for covariates.

Table 6.34 Pattern mixture modeling results: Pain intensity

Variables	Estimate	df	t-test	Sig.
Pain Intensity				
Time	-2.1	530.4	-13.5	.00
FRP Completion	-1.0	764.5	-3.9	.00
FACS Severity Level	.6	371.3	5.7	.00
Time x FRP completion	1.0	571.1	.9	.35
Time x FACS Severity Level	-.4	332.6	-2.0	.05
FRP completion x FACS Severity Level	.2	603.6	.7	.50
Age	-.0	379.2	-.8	.45
Education Level in Years	-.0	365.0	-.5	.62
Marital Status				
Attorney Retention	.1	320.2	.7	.49

Additionally, there was an interaction effect between time and the FACS severity levels, F (1, 332.55) = 4.06, p =. 05; further analysis demonstrated that all FACS severity levels significantly decreased their pain intensity levels from admission to discharge (p < .001), with the exception of those in the subclinical FACS severity level (p = .45). Admission and discharge differences in pain intensity were further analyzed, as seen in Table 6.35; it was found at admission that with those in the severe and extreme categories scored higher on the VAS than all other severity levels ($p \leq .03$), with the exception of the severe and mild severity levels (p = .23). In addition, the subclinical severity level scored lower than the moderate severity level (p = .01). Findings were similar when the pain VAS was examined categorically; it was found that those in

the subclinical FACS severity level were more likely to score in the mild (z = 5.0) or moderate (z = 2.1) pain intensity category, while those in the extreme severity level were less likely to score in the moderate pain intensity category (z = -2.9). Those in the moderate FACS severity level were also less likely to score in the extreme pain intensity category (z = -2.0), and those in the extreme FACS severity level were more likely (z = 2.6).

At discharge, all pain intensity levels significantly differed from all other levels ($p \leq .001$), with the exception of the moderate and severe ($p = .08$) and the severe and extreme FACS severity levels ($p = .27$). Aside from those, as severity level increased, so did pain intensity. Categorical analysis showed that those in the subclinical FACS severity level were more likely to score in the mild pain intensity category (z = 6.1), and those in the moderate, severe, and extreme FACS severity levels were less likely to be classified as having mild pain intensity (z = -3.0, -2.9, and -2.8, respectively). The extreme FACS severity level was also less likely to be classified as having moderate pain intensity (z = -2.2). Those in the subclinical FACS severity level were less likely to be classified as having severe pain intensity (z = -3.5), while those in the severe group were more likely (z = 2.2). Lastly, those in the subclinical FACS severity level were less likely to have pain scores categorized as extreme (z = -2.9), while those in the severe and extreme FACS severity levels were more likely (z = 2.3 and 4.9, respectively).

Table 6.35 Pain intensity admission and discharge scores by FACS severity level

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	F/χ^2 Value	p value	Effect Size
Admission Pain Intensity, mean (SD)	4.3 (2.3)	6.0 (1.9)	6.3 (2.0)	7.4 (6.2)	7.7 (2.3)	3.22	.01	.03
Admission Pain Intensity severity levels, n (%)						67.33	.00	.38
• Mild	4 (31%)	2 (7%)	5 (6%)	4 (2%)	1 (1%)			
• Moderate	5 (39%)	7 (27%)	20 (23%)	27 (15%)	6 (5%)			
• Severe	2 (15%)	11 (42%)	36 (40%)	62 (35%)	39 (33%)			
• Extreme	2 (15%)	6 (23%)	28 (32%)	83 (47%)	73 (61%)			
Discharge Pain Intensity, mean (SD)	3.1 (2.1)	4.4 (2.2)	5.6 (1.9)	6.4 (1.9)	7.4 (1.6)	43.87	.00	.31
Discharge Pain Intensity severity levels, n (%)						134.92	.00	.51
• Mild	58 (62%)	31 (37%)	17 (14%)	5 (9%)	1 (3%)			
• Moderate	22 (24%)	25 (30%)	40 (33%)	11 (19%)	2 (6%)			
• Severe	9 (10%)	21 (25%)	44 (36%)	26 (44%)	13 (39%)			
• Extreme	4 (4%)	7 (8%)	20 (17%)	17 (29%)	17 (52%)			

6.5.6.6 Perceived Disability: PDQ and ODI

As seen in Table 6.36, for the total PDQ, there was a main effect for time, F (1, 509.96) = 226.46, $p < .001$, completion status, F (1, 689.90) = 25.95, $p < .001$, and the FACS severity levels, F (1, 373.19) = 94.66, $p < .001$. There were no main effects for any of the covariates ($p \geq .19$). When interactions were examined, only a significant interaction between the FACS severity levels and time, F (1, 314.27) = 13.30, $p < .001$ existed, showing that in all FACS severity levels except for the subclinical level, the PDQ significantly decreased from admission to discharge ($p < .01$). No interactions existed between time and completion status or completion status and the FACS severity levels ($p \geq .39$).

Table 6.36 Pattern mixture modeling: Perceived disability

Variables	Estimate	df	t-test	Sig.
PDQ Total				
Time	.7	510	-15.1	.00
FRP Completion	-7.2	686.9	-5.1	.00
FACS Severity Level	5.2	373.2	9.7	.00
Time x FRP completion	-4.0	390.4	-8.6	.39
Time x FACS Severity Level	-2.9	314.3	-3.6	.00
FRP completion x FACS Severity Level	.67	551.8	.4	.69
Age	-.0	380.0	-.2	.81
Education Level in Years	-.0	365.6	.9	.37
Marital Status				
Attorney Retention	1.3	313.5	1.3	.19
PDQ Functional				
Time	-18.8	515.8	-17.7	.00
FRP Completion	-11.3	706.9	-5.6	.00
FACS Severity Level	7.2	377.2	9.4	.00
Time x FRP completion	-4.3	519.9	-.6	.53
Time x FACS Severity Level	-2.5	324.9	-2.1	.04
FRP completion x FACS Severity Level	.19	571.0	.08	.94
Age	.02	384.5	.36	.74
Education Level in Years	-.07	372.2	-.40	.69
Marital Status				
Attorney Retention	1.4	322.2	.99	.33

Table 6.36 – Continued

Variables	Estimate	df	t-test	Sig.
PDQ Psychological				
Time	-10.6	510.0	-15.0	.00
FRP Completion	-7.2	686.9	-5.1	.00
FACS Severity Level	5.2	373.2	9.73	.00
Time x FRP completion	-4.0	490.3	-.9	.39
Time x FACS Severity Level	-2.9	314.3	-3.6	.00
FRP completion x FACS Severity Level	.7	551.8	.41	.69
Age	-.0	380.0	-.2	.81
Education Level in Years	.1	365.6	.9	.37
Marital Status				
Attorney Retention	1.3	313.5	1.3	.19
ODI				
Time	-11.8	464.6	-13.0	.00
FRP Completion	-8.2	618.9	-4.0	.00
FACS Severity Level	4.9	350.6	5.8	.00
Time x FRP completion	.3	448.2	.0	.96
Time x FACS Severity Level	-2.7	276.9	-2.5	.02
FRP completion x FACS Severity Level	2.7	492.1	1.1	.27
Age	.0	352.4	.08	.94
Education Level in Years	.3	336.8	1.7	.10
Marital Status				
Attorney Retention	.8	279.7	.5	.60

Closer examination of the FACS severity level main effect showed that those in the severe and extreme FACS severity levels had higher PDQ scores at any time point than any other severity levels ($p < .01$), and that those in the moderate FACS severity level had higher PDQ scores than those in the subclinical FACS severity level ($p = .05$). When admission data was examined further, as shown in Table 6.37, those in the extreme and severe FACS severity level scored significantly higher on the total PDQ than all other severity levels ($p \leq .01$), with the exception of each other ($p = .06$), and the subclinical severity level scoring significantly lower than

the mild FACS severity level (p = .02). Significant categorical differences were also found for the PDQ; those in the subclinical, mild, and moderate FACS severity levels were more likely to score in the mild/moderate PDQ category (z = 6.1, 4.4, and 2.5, respectively) and those in the severe and extreme FACS severity levels were less likely to score in the mild/moderate category (z = -2.5 and – 3.1, respectively. Those in the moderate and severe FACS severity levels were also more likely to score in the severe PDQ category (z = 2.4 and 2.0, respectively), while those in the extreme FACS severity level were less likely to score in the severe PDQ category. Lastly, those in the mild and moderate FACS severity levels were less likely to score in the extreme PDQ category (z = -2.6 and -3.2, respectively), while those in the extreme FACS severity level were more likely to be included in the extreme PDQ category (z = 4.9).

At discharge, it was found that all FACS severity levels significantly differed from each other ($p \leq .03$), with the exception of the moderate and severe levels with each other (p = 1.0). As the FACS levels became more severe, it was found that perceived disability scores increased. Many results were found upon categorical analysis of these measures as well. For the PDQ, those in the subclinical and mild FACS severity levels were more likely to score in the mild/moderate disability level (z = 5.7 and 2.1, respectively), while those in the moderate, severe, and extreme FACS severity levels were less likely (z = -2.4, -4.2, and -3.3, respectively). Those in the subclinical FACS severity level were less likely to score in the severe disability level as well (z = -4.2), while those in the moderate FACS severity level were more likely (z = 4.1). Those in the subclinical and mild FACS severity levels were also less likely to score in the extreme disability category (z = -3.8 and -3.5, respectively), and those in the severe and extreme FACS severity levels were more likely to be rated as having extreme disability (z = 5.7 and 7.1).

Table 6.37 Perceived disability (PDQ & ODI) admission and discharge scores by FACS severity level

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	F/χ^2 Value	p value	Effect Size
Admission PDQ Total, mean (SD)	50.9 (37.4)	74.5 (26.9)	87.7 (21.6)	99.4 (21.0)	115.1 (17.7)	48.05	.00	.32
• Functional	30.2 (22.6)	44.6 (17.3)	53.5 (14.1)	58.2 (15.0)	68.3 (11.6)	35.11	.00	.25
• Psychological	20.7 (16.0)	29.9 (11.3)	34.2 (11.2)	41.1 (11.6)	46.8 (8.9)	33.81	.00	.24
Admission PDQ severity levels, n (%)						152.76	.00	.52
• Mild/Moderate	10 (77%)	12 (46%)	21 (24%)	12 (7%)	4 (3%)			
• Severe	1 (8%)	10 (39%)	42 (48%)	73 (42%)	13 (11%)			
• Extreme	2 (15%)	4 (15%)	25 (28%)	91 (52%)	102 (85%)			
Discharge PDQ Total, mean (SD)	36.4 (22.7)	57.2 (22.8)	76.3 (23.7)	102.3 (21.6)	109.7 (25.6)	109.38	.00	.54
• Functional	19.3 (14.3)	31.8 (16.1)	44.5 (15.2)	60.5 (13.7)	63.9 (16.0)	98.62	.00	.51
• Psychological	16.4 (9.3)	25.0 (9.9)	31.8 (11.1)	41.8 (10.3)	46.1 (11.3)	85.25	.00	.47
Discharge PDQ severity levels, n (%)						234.02	.00	.61
• Mild/Moderate	84 (91%)	58 (69%)	44 (37%)	5 (9%)	2 (6%)			
• Severe	6 (7%)	24 (29%)	58 (49%)	21 (36%)	4 (12%)			
• Extreme	2 (2%)	2 (2%)	17 (14%)	32 (55%)	27 (82%)			
Admission Oswestry, mean (SD)	18.3 (20.4)	28.9 (17.0)	32.6 (16.6)	38.8 (18.5)	44.9 (18.1)	11.37	.00	.10
Admission Oswestry severity levels, n (%)						40.59	.03	.31
• Mild disability	7 (64%)	9 (35%)	20 (24%)	31 (19%)	10 (9%)			
• Moderate disability	2 (18%)	8 (31%)	36 (43%)	55 (33%)	36 (33%)			
• Severe disability	2 (18%)	9 (35%)	24 (29%)	61 (36%)	43 (39%)			
• Crippled	0 (0%)	0 (0%)	4 (5%)	21 (13%)	19 (27%)			
• Bed-bound or exaggerating	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)			
Discharge Oswestry, mean (SD)	12.3 (13.0)	22.8 (14.8)	31.7 (16.3)	37.4 (19.8)	47.9 (20.4)	42.25	.00	.31
Discharge Oswestry severity levels, n (%)						134.54	.00	.52
• Mild disability	74 (80%)	47 (57%)	34 (29%)	11 (20%)	5 (15%)			
• Moderate disability	14 (15%)	23 (28%)	47 (40%)	19 (34%)	6 (18%)			
• Severe disability	5 (5%)	12 (15%)	32 (27%)	19 (34%)	13 (39%)			
• Crippled	0 (0%)	0 (0%)	5 (4%)	7 (13%)	8 (24%)			
• Bed-bound or exaggerating	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (3%)			

Next, the PDQ was examined by subscale. There was a main effect of time on the PDQ functional subscale, as seen in Table 6.36, F (1, 515.76) = 313.92, $p < .001$, as well as a main effect of completion status, F (1, 706.93) = 30.95, $p < .001$, and a main effect of the FACS

severity levels, F (1, 377.16) = 88.31, p < .001. When the main effect of the FACS severity levels was explored, it was found that all FACS severity levels significantly differed from all other FACS severity levels on the PDQ (p < .01), with the exception of the subclinical and mild FACS severity level (p = 1.0), the mild and moderate FACS severity level (p = .09), and the moderate and severe FACS severity level (p = 3.0), showing the general trend that those in the lower FACS severity levels had lower PDQ scores than those in the higher levels. There were no significant main effects for the covariates. Although there were no interactions for either time by completion status or for completion status by the FACS severity levels, an interaction effect was found for time and the FACS severity levels, F (1, 324.87) = 4.34, p = .04.

When this interaction effect was explored, it was found that those in the all FACS severity levels improved from admission to discharge on the PDQ (p < .001), with the exception of the subclinical FACS severity level (p = .40). At admission, the PDQ functional subscale continued to be significantly higher among the extreme FACS severity levels as compared to all other severity levels, the severe group did not, as the moderate and severe FACS severity levels (p = .13) did not differ. In addition, the subclinical FACS severity level significantly differed from all other severity levels as well (p ≤ .03). At discharge, every FACS severity level significantly differed from each other (p < .001), with the exception of the extreme and severe FACS severity levels (p ≥ .64).

When the PDQ psychological subscale was examined, main effects were found for the variables time, F (1, 510.00) = 226.46, p < .001), completion status, F (1, 686.90) = 25.95, p < .001, and the FACS severity levels, F (1, 373.19) = 94.66, p < .001. When the main effect of the FACS was further explored, it was found that those in the severe and extreme FACS severity levels had significantly higher PDQ psychological subscale scores than all other groups (p < .01), and that those in the moderate FACS severity level also had significantly higher scores on the psychological PDQ subscale than those in the subclinical FACS severity level (p = .05).

The only significant interaction effect was the FACS severity levels by time, F (1, 314.27) = 13.30, p < .001. When this interaction was further explored, it was found that all FACS severity levels significantly improved from admission to discharge on the PDQ psychological subscale (p < .001), with the exception of the subclinical level (p = .81). At admission, both the severe and extreme FACS severity levels had significantly higher PDQ scores (p < .001), and the subclinical severity level had significantly lower PDQ scores than all other severity levels (p < .001), with the exception of the mild FACS severity level (p = .14). At discharge, as with the functional subscale, every FACS severity level significantly differed from each other (p < .001), with the exception of the extreme and severe FACS severity levels (p ≥ .64).

Upon examination of the ODI, located in Table 6.37, it was found that there was a main effect of time, F (1, 464.6) = 169.85, p < .001, completion status, F (1, 618.87) = 16.14, p < .001, and the FACS severity levels, F (1, 350.63) = 33.40, p < .001. When the post hoc analyses for the FACS severity levels was analyzed, results showed that those patients in the severe and extreme FACS severity levels had significantly higher perceived disability scores on the ODI than all other severity levels (p ≤ .02), with the exception of each other (p = .09). An interaction also existed between time and the FACS severity levels, F (1, 276.87) = 6.07, p = .02. Probing this interaction demonstrated that all FACS severity levels significantly decreased from admission to discharge (p ≤ .03), with the exception of the subclinical FACS severity level (p = .91).

Further analysis of this interaction showed that at admission, the FACS extreme severity level scored significantly higher on the ODI than all severity levels (p ≤ .01), with the exception of the severe level (p = .06), and when examined categorically, it demonstrated that those in the subclinical FACS severity level were more likely to score in the mild disability category (z = 3.3) on the ODI, and those in the extreme FACS severity level were less likely to score in that category (z = -2.4). These extreme FACS severity patients were also more likely to score in the “crippled” category on the ODI. At discharge on the ODI, it was found that all FACS severity levels significantly differed from each other (p ≤ .03), with the exception of the moderate and

severe levels with each other (p = 1.0). As the FACS levels became more severe, it was found that perceived disability scores increased.

When the ODI was examined categorically at discharge, those in the subclinical FACS severity level were more likely to score in the mild disability category (z = 5.6), while those in the moderate, severe, and extreme FACS severity levels were less likely to be rated as having mild disability (z = -3.2, -3.2, and -2.4, respectively). Those in the subclinical extreme FACS severity level were less likely to be rated as being moderately disabled (z = -2.5) and those in the moderate FACS severity level were more likely to be rated as having moderate disability (z = 2.5). Those in the subclinical FACS severity level were also less likely to be rated as having severe disability (z = -3.5), while those in the severe and extreme groups were more likely to be rated as having severe disability (z = 2.3 for both). Those in the subclinical and mild FACS severity levels were less likely to be rated as crippled (z = -2.2 and -2.0, respectively), while again those in the severe and extreme groups were more likely to be rated as crippled (z = 2.0 and 5.0, respectively). Lastly, those in the extreme FACS severity level were more likely to score in the bed bound or exaggerating ODI category (z = 3.1).

6.5.6.7 BDI

When the BDI was examined for significant differences using pattern mixture modeling (Table 6.38),there was a significant main effect of time, F (1, 482.3) = 187.72, p < .001, completion status, F (1, 624.2) = 11.89, p = .001, and FACS severity levels, F (1, 353.33) = 82.35, p < .001. When the severity level main effect was further explored, it was found that those in the severe and extreme FACS severity levels had significantly higher BDI scores than all other severity levels ($p \leq .02$). There were also significant interaction effects for both completion status and the FACS severity levels, F (1, 505.50) = 3.74, p = .05, and for time and the FACS severity levels, F (1, 286.90) = 6.53, p = .01.

Table 6.38 Pattern mixture modeling: BDI

Variables	Estimate	df	t-test	Sig.
BDI				
Time	-6.2	482.3	-13.7	.00
FRP Completion	-3.7	624.2	-3.4	.00
FACS Severity Level	3.9	353.3	9.1	.00
Time x FRP completion	.4	427.1	.1	.91
Time x FACS Severity Level	-1.4	286.9	-2.6	.01
FRP completion x FACS Severity Level	-2.4	505.5	-1.9	.05
Age	-.0	362.2	-.1	.89
Education Level in Years	.14	347.4	1.5	.12
Marital Status				
Attorney Retention	1.4	288.6	1.8	.08

However, when both interaction effects were examined in more detail, neither was significant any longer ($p \geq .13$). Nevertheless, these post-hocs were examined, with admission and discharge BDI information presented in Table 6.39. At admission, results showed that both the severe and extreme FACS severity levels had significantly higher BDI scores than all other severity levels ($p < .01$). When the BDI was examined categorically, it was found that those in the subclinical, mild, and moderate FACS severity levels were more likely to score in the "no depression" BDI category (z = 2.3, 2.8, and 3.8, respectively), while the extreme FACS group was less likely to score in the "no depression" category (z = -3.4). Those in the moderate FACS severity level were less likely to be placed in the "moderate depression" category (z = -2.9), as well as in the "severe depression" category (z = -2.4), while the extreme FACS severity level patients were more likely to score in the severe BDI category (z = 4.2).

At discharge, the BDI also showed significant differences between FACS severity levels, with all levels significantly differing from each other ($p \leq .01$), so that those in the subclinical FACS severity level had the lowest levels of patient-reported depressive symptoms and those in the extreme FACS severity level had the highest levels. Upon examination of the BDI

categorically, it was found that those in the subclinical FACS severity level were more likely to score in the "no depression" category on the BDI (z = 6.0), while those in the severe and extreme FACS severity levels were less likely to be rated as having no depression (z = -4.3 and -3.3, respectively). Those in the subclinical FACS severity level were also less likely to score in the mild depression category (z = -4.1), while those in the moderate FACS severity level were more likely (z = 2.2). Next, those in the subclinical and mild FACS severity levels were less likely to score in the moderate depression category (z = -3.7 and -2.9, respectively), while those in the severe and extreme FACS severity levels were more likely (z = 3.5 and 4.2, respectively). A similar pattern emerged for the severe depression category, with those in the subclinical and mild FACS severity levels less likely to be rated as having severe depression (z = -2.1 and -2.0, respectively) and those in the severe and extreme FACS severity levels more likely (z = 2.4 and 5.8, respectively).

Table 6.39 BDI admission and discharge scores by FACS severity level

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	F/χ^2 Value	p value	Effect Size
Admission BDI , mean (SD)	8.9 (8.2)	10.0 (6.2)	12.1 (8.5)	18.1 (9.1)	23.1 (10.2)	26.65	.00	.20
Admission BDI severity levels, n (%)						91.87	.00	.42
• No depression	7 (54%)	13 (50%)	38 (43%)	38 (43%)	31 (18%)			
• Mild depression	5 (39%)	10 (39%)	37 (42%)	37 (42%)	66 (37%)			
• Moderate depression	1 (8%)	3 (12%)	10 (11%)	10 (11%)	59 (33%)			
• Severe depression	0 (0%)	0 (0%)	4 (5%)	4 (5%)	21 (12%)			
Discharge BDI , mean (SD)	4.2 (4.7)	8.2 (6.3)	12.9 (8.3)	19.2 (8.6)	25.6 (10.7)	71.86	.00	.43
Discharge BDI severity levels, n (%)						201.32	.00	.58
• No depression	86 (93%)	51 (61%)	45 (37%)	6 (10%)	3 (9%)			
• Mild depression	6 (7%)	30 (36%)	49 (41%)	25 (42%)	5 (15%)			
• Moderate depression	0 (0%)	2 (2%)	22 (18%)	19 (32%)	14 (42%)			
• Severe depression	1 (1%)	1 (1%)	5 (4%)	9 (15%)	11 (33%)			

6.5.6.8 ISI

The ISI was examined first using pattern mixture modeling, as shown in Table 6.40. A main effect of time, F (1, 504.32) = 93.88, p < .001, completion status, F (1, 714.97) = 11.06, p = .001, and FACS severity levels were found, F (1, 350.69) = 58.01, p < .001. When the main effect for the FACS severity levels was examined in greater detail, it was found that those in the severe and extreme FACS severity levels had higher ISI scores than all other severity levels ($p \leq .03$). There was also a main effect of the covariate age, F (1, 359.71) = 3.96, p = .05. No significant interactions between age and the other variables existed, however.

Table 6.40 Pattern mixture modeling: ISI

Variables	Estimate	Df	t-test	Sig.
ISI				
Time	-4.7	504.3	-9.7	.00
FRP Completion	-3.1	715.0	-3.3	.00
FACS Severity Level	2.6	350.7	7.6	.00
Time x FRP completion	-.7	533.9	-.2	.83
Time x FACS Severity Level	-.7	305.0	-1.1	.26
FRP completion x FACS Severity Level	1.1	580.1	1.1	.29
Age	-.1	359.7	-2.0	.05
Education Level in Years	.0	347.5	.1	.95
Marital Status				
Attorney Retention	1.1	298.3	1.7	.09

While no significant interaction effects were found, the admission and discharge ISI information was still pursued (Table 6.41). At admission, the ISI also differed significantly among the FACS severity levels. Those in the extreme FACS severity level had significantly higher ISI scores than all other severity levels (p < .001), and those in the severe FACS severity level had significantly higher ISI scores than the subclinical severity level. When a categorical analysis was completed, it was found that those in the subclinical FACS severity level were more likely to score

in the “no clinical insomnia” category (z = 2.8), and those in the extreme FACS severity level were less likely to score in that category (z = -2.6). Extreme FACS patients were also less likely to score in the “moderate clinical insomnia” category (z= -2.1). Lastly, those patients in the mild and moderate FACS severity levels were less likely to score in the “severe clinical insomnia” category (z = -2.5 and -2.2, respectively), and those in the extreme FACS severity level were more likely to score in the “severe clinical insomnia” category (z = 5.1).

At discharge, The ISI also showed significant differences between the FACS severity levels. Those in the subclinical FACS severity level had significantly lower ISI scores than all other severity levels ($p \leq .04$), and those in the mild FACS severity level had significantly lower ISI scores than all other severity levels ($p \leq .04$), with the exception of the moderate severity level ($p = .07$). Similarly, those in the severe and extreme FACS levels had significantly higher ISI scores than all other severity levels ($p \leq .001$), with the exception of each other ($p = .32$). Results were also significant when examined by ISI categories. Those in the subclinical FACS severity level were more likely to score in the “no insomnia” group (z = 4.9), while those in the severe and extreme FACS severity levels were less likely to score in that group (z = -3.1 and -2.3, respectively). Those in the mild FACS severity level were more likely to score in the Subclinical clinical insomnia group (z = 2.4), while those in the extreme FACS severity level were less likely to score in that ISI category (z - =2.7). Those in the subclinical FACS severity level were less likely to score in the moderate clinical insomnia group (z = -2.9), and those in the severe FACS severity level were more likely (z = 3.0). Lastly, those in the subclinical and mild FACS severity levels were less likely to score in the severe clinical insomnia group (z = -2.6 and -2.0, respectively), while those in the extreme FACS severity level were more likely to be categorized as having severe insomnia (z = 6.0).

Table 6.41 ISI: admission and discharge scores by FACS severity level

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	F/χ^2 Value	p value	Effect Size
Admission ISI, mean (SD)	8.8 (10.l)	13.1 (6.8)	14.2 (6.9)	16.5 (7.6)	20.3 (7.2)	14.78	.00	.13
Admission ISI severity levels, n (%)						72.85	.00	.39
• No insomnia	5 (39%)	6 (23%)	14 (16%)	20 (12%)	4 (3%)			
• Sub-threshold insomnia	4 (31%)	8 (31%)	26 (30%)	38 (22%)	19 (16%)			
• Moderate insomnia	3 (23%)	11 (42%)	31 (36%)	72 (41%)	27 (23%)			
• Severe insomnia	1 (8%)	1 (4%)	15 (17%)	44 (25%)	66 (57%)			
Discharge ISI, mean (SD)	7.1 (6.1)	10.2 (6.3)	12.9 (8.1)	17.3 (6.0)	20.6 (8.0)	34.25	.00	.26
Discharge ISI severity levels, n (%)						146.21	.00	.52
• No insomnia	55 (59%)	28 (33%)	29 (24%)	4 (7%)	2 (6%)			
• Sub-threshold insomnia	25 (27%)	39 (46%)	37 (31%)	13 (22%)	2 (6%)			
• Moderate insomnia	10 (11%)	13 (16%)	42 (35%)	29 (49%)	11 (33%)			
• Severe insomnia	3 (3%)	4 (5%)	13 (11%)	13 (22%)	18 (55%)			

6.5.6.9 CSI

The last variable to be examined through pattern mixture modeling was the CSI, with information depicted in Table 6.42. A main effect of time, F (1, 483.71) = 152.63, p < .001, completion status, F (1, 657.47) = 16.80, p < .001, and FACS severity levels, F (1, 359.66) = 50.16, p < .001, existed. When the main effect of the FACS severity levels was further explored, it was found that those in the severe and extreme FACS severity levels had higher CSI scores than all other severity levels ($p \leq .05$), with the exception of the severe and subclinical FACS severity level (p = .06). No main effects for any of the covariates were found.

Table 6.42 Pattern mixture modeling: CSI

Variables	Estimate	Df	t-test	Sig.
CSI				
Time	-10.0	483.7	-12.4	.00
FRP Completion	-7.6	657.5	-4.1	.00
FACS Severity Level	5.2	359.7	7.1	.00
Time x FRP completion	-8.8	429.5	-1.4	.15
Time x FACS Severity Level	-2.4	288.2	-2.6	.01
FRP completion x FACS Severity Level	.2	505.0	.1	.94
Age	.0	366.1	.6	.58
Education Level in Years	.2	353.3	1.4	.17
Marital Status				
Attorney Retention	2.5	294.1	1.8	.07

While the interactions between time and completion status and the FACS severity levels and completion status were not significant, a significant interaction was present for time by FACS severity level, F (1, 288.17) = 6.79, p = .01. When this interaction was further examined, it was no longer significant, p = .46. In addition, details of admission and discharge analyses are presented in Table 6.43. At admission, the CSI also significantly differed among FACS groups, with those in the severe and extreme FACS severity levels having significantly higher scores than all other severity levels (p < .01), with the exception of the severe and mild severity levels (p = .08). When the CSI was examined categorically, it was found that those in the subclinical and moderate FACS severity levels were more likely to fall in the subclinical CSI category (z = 3.4 and 2.0, respectively) and that those in the extreme FACS severity level were less likely to score in the subclinical CSI category (z = -2.8). It was also found that those in the mild FACS severity level were more likely to score in the mild CSI category (z = 2.5). Lastly, those in the moderate severity level were less likely to score in the extreme CSI category (z = -2.3) and those in the extreme FACS severity level were more likely to score in the extreme CSI category (z = 3.9).

At discharge, all FACS severity level scores significantly differed from each other on the CSI ($p \leq .04$), with the exception of the extreme and severe FACS severity levels ($p = .08$), with a stair-step pattern emerging, showing that those who were categorized lower on the FACS also scored lower on the CSI. When the CSI was examined categorically, it was found that those in the subclinical severity level were more likely to score in the subclinical CSI group (z = 4.9), while those in the severe and extreme FACS severity levels were less likely to score in the subclinical CSI group (z = -3.1 and -2.8, respectively). Those in the extreme FACS severity level were also less likely to score in the mild CSI group (z = -2.2). It was also found that those in the subclinical FACS severity level were less likely to score in the moderate CSI group (z = -3.1), while those in the moderate FACS severity level were more likely (z = 3.4). The subclinical (z = -2.9 and -2.1, respectively) and mild FACS severity levels (z = -2.0 and -2.3, respectively) were also less likely to score in the severe and extreme CSI categories, and those in the severe (z = 2.9 and z = 2.2, respectively) and extreme (z = 2.2 and 5.5, respectively) FACS severity levels were more likely to score in the severe and extreme CSI groups.

Table 6.43 CSI admission and discharge scores by FACS severity levels

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	F/χ^2 Value	p value	Effect Size
Admission CSI, mean (SD)	27.5 (18.2)	34.9 (15.8)	37.4 (14.2)	43.5 (15.0)	50.8 (15.9)	16.23	.00	.13
Admission CSI severity levels, n (%)						68.30	.00	.38
• Subclinical	8 (62%)	7 (27%)	26 (29%)	33 (19%)	10 (8%)			
• Mild	2 (15%)	11 (42%)	22 (25%)	36 (20%)	16 (13%)			
• Moderate	0 (0%)	3 (12%)	25 (28%)	46 (26%)	33 (28%)			
• Severe	3 (23%)	3 (12%)	3 (12%)	39 (22%)	26 (22%)			
• Extreme	0 (0%)	2 (8%)	2 (8%)	23 (13%)	35 (29%)			
Discharge CSI, mean (SD)	19.3 (13.2)	28.1 (12.9)	36.7 (15.6)	43.4 (15.5)	51.9 (16.5)	46.31	.00	.33
Discharge CSI severity levels, n (%)						157.55	.00	.54
• Subclinical	72 (77%)	46 (55%)	39 (32%)	10 (17%)	4 (12%)			
• Mild	15 (16%)	22 (26%)	26 (22%)	15 (25%)	1 (3%)			
• Moderate	3 (3%)	11 (13%)	35 (29%)	10 (17%)	5 (15%)			
• Severe	1 (1%)	4 (5%)	13 (11%)	14 (24%)	11 (33%)			
• Extreme	2 (2%)	1 (1%)	8 (7%)	10 (17%)	12 (36%)			

6.5.6.10 MPI

Since the MPI is solely a categorical psychosocial measure, it was not appropriate to use a pattern mixture modeling analysis. However, scores were examined by Chi-Square at admission and discharge, as presented in Table 6.44. At admission, those in the subclinical and extreme FACS severity levels were less likely to be categorized as adaptive copers (z = -2.0 and -2.5, respectively), while those in the moderate FACS severity level were more likely to be categorized as adaptive copers (z = 3.4). Those in the subclinical severity level were also less likely to be categorized as interpersonally distressed (z = -2.2) or dysfunctional (z = -3.8). Patients in the mild and moderate FACS severity levels were also less likely to be classified as dysfunctional (z - -3.6 and -2.3, respectively), and those in the severe and extreme FACS severity levels were more likely to be classified as dysfunctional copers (z = 2.4 and 4.8, respectively). While no significant differences existed in either the anomalous or unanalyzable coper category, it was found that those in the severe FACS severity level were more likely to be classified as a hybrid coper (z – 2.5).

At discharge, it was found that those in the mild FACS severity level were more likely to be categorized as adaptive copers on the MPI (z = 3.2), while those in the extreme FACS severity level were less likely (z = -2.2). Those in the moderate FACS severity level were more likely to be categorized as interpersonally distressed (z = 2.0). Those in the subclinical and mild FACS severity levels were less likely to be classified as being dysfunctional copers on the MPI (z = -3.1 and -2.9, respectively), while those in the severe and extreme FACS severity levels were more likely (z = 2.0 and 5.7, respectively). Those in the subclinical FACS severity level were also more likely to be classified as an anomalous coper (z = 5.5), while those in the moderate and extreme FACS severity levels were less likely (z = -2.0 and -2.2, respectively). No significant differences existed in the hybrid coping category; however, those in the extreme FACS severity level were more likely to be classified as unanalyzable via the MPI.

Table 6.44 MPI admission and discharge scores by FACS severity level

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	χ^2 Value	p value	Effect Size
Admission MPI, n (%)						149.99	.00	.40
• Adaptive Coper	4 (5%)	15 (15%)	36 (21%)	31 (11%)	9 (5%)			
• Interpersonally Distressed	1 (1%)	3 (3%)	12 (7%)	26 (10%)	18 (11%)			
• Dysfunctional Coper	1 (1%)	3 (3%)	19 (11%)	26 (10%)	58 (34%)			
• Anomalous	5 (6%)	2 (2%)	2 (1%)	7 (3%)	9 (5%)			
• Hybrid	0 (0%)	0 (0%)	0 (0%)	8 (3%)	1 (1%)			
• Unanalyzable	0 (0%)	0 (0%)	3 (2%)	4 (2%)	4 (2%)			
Discharge MPI, n (%)						147.42	.00	.52
• Adaptive Coper	37 (40%)	45 (54%)	34 (28%)	12 (20%)	2 (6%)			
• Interpersonally Distressed	9 (10%)	8 (10%)	28 (23%)	12 (20%)	5 (15%)			
• Dysfunctional Coper	2 (2%)	2 (2%)	20 (17%)	14 (24%)	17 (52%)			
• Anomalous	33 (36%)	9 (11%)	9 (7%)	14 (24%)	0 (0%)			
• Hybrid	2 (2%)	6 (7%)	7 (6%)	1 (2%)	3 (9%)			
• Unanalyzable	1 (1%)	0 (0%)	4 (3%)	4 (7%)	3 (9%)			

6.5.7 Physical Variable Admission, Discharge, and Response to Treatment Analyses

6.5.7.1 PILE

The results of the pattern mixture modeling for the PILE are located in Table 6.45. Analysis of the FW PILE demonstrated main effects for time, F (1, 447.38) = 1427.71, p < .001, completion status, F (1, 581.4) = 47.89, p < .001, and FACS severity level, F (1, 325.35) = 29.06, p < .001. When the FACS severity level effects were further explored, it was found that those in the extreme FACS severity level had significantly lower FW PILE scores than all other severity levels ($p \leq .01$), with the exception of the subclinical FACS severity level (p = 1.0). There were also three significant interaction effects: between time and completion status, F (1, 430.08) = 13.90, p < .001, between completion status and the FACS quintiles, F (1, 473.99) = 3.77, p = .05), and between time and the FACS severity levels, F (1, 286.12) = 4.37, p = .04. When these interaction effects were explored, it was found that the time by FACS quintiles interaction was no longer significant (p = .35), and neither was the interaction between completion status and the FACS quintiles (p = .34). In addition, there was a main effect for the covariate of age, F (1, 322.4) = 5.32, p = .02. No additional interactions with age were found, so this variable was not analyzed further.

Table 6.45 Pattern mixture modeling: PILE

Variables	Estimate	df	t-test	Sig.
PILE FW				
Time	55.3	447.4	37.8	.00
FRP Completion	23.4	581.4	6.9	.00
FACS Severity Level	-6.7	325.3	-5.4	.00
Time x FRP completion	33.0	430.1	3.73	.00
Time x FACS Severity Level	3.9	286.1	2.1	.04
FRP completion x FACS Severity Level	-7.4	474.0	-1.9	.05
Age	-.3	322.4	-2.3	.02
Education Level in Years	-.3	332.7	-1.0	.30
Marital Status				
Attorney Retention	-2.4	255.7	-1.0	.32
PILE WS				
Time	50.1	398.4	37.4	.00
FRP Completion	28.9	518.8	7.5	.00
FACS Severity Level	-6.5	287.4	-5.2	.00
Time x FRP completion	27.2	415.2	3.0	.00
Time x FACS Severity Level	3.9	264.1	2.2	.03
FRP completion x FACS Severity Level	-4.8	425.8	-1.1	.27
Age	-.3	280.1	-2.7	.01
Education Level in Years	-.3	292.8	-1.3	.19
Marital Status				
Attorney Retention	-2.1	229.1	-.8	.41

The interaction between time and the FACS severity levels was not significant. Admission and discharge PILE data are presented in Table 6.46. At admission, it was found that those in the extreme FACS severity level had significantly lower scores on the PILE than all other severity levels ($p \leq .01$), except for the subclinical FACS severity level ($p = 1.0$). Those in the severe FACS level also had significantly lower PILE FW scores than those in the mild FACS severity level ($p \leq .03$). When the PILE FW was examined categorically for those scoring zero, meaning that they did not even attempt the lift task, it was found that those in the subclinical and mild

FACS severity levels were less likely to score a zero on the PILE (z = -3.1 and -2.7, respectively), while those in the extreme FACS severity level were more likely to score a zero on the PILE (z = 5.5). At discharge, those in the extreme and severe FACS severity levels had significantly lower scores than the subclinical and mild FACS severity levels ($p < .001$), and the moderate FACS severity level had significantly lower scores than the subclinical FACS level ($p = .001$). When discharged scores were examined categorically to determine the number of participants scoring zero, it was found that those in the severe FACS level were more likely to score a zero on the PILE tasks (z = 3.1).

Table 6.46 PILE admission and discharge scores by FACS severity level

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	F/χ^2 Value	p value	Effect Size
Admission Floor to Waist PILE (M, SD)	19.1 (15.7)	34.4 (37.5)	23.3 (29.6)	14.9 (21.1)	4.3 (10.4)	12.94	.00	.13
Admission Waist to Shoulder PILE (M, SD)	30.2 (21.9)	44.6 (34.4)	31.8 (27.0)	25.4 (24.3)	11.1 (16.4)	12.55	.00	.14
Admission PILE, n (% zero)	2 (17%)	8 (31%)	34 (39%)	81 (46%)	81 (68%)	88.25	.00	.32
Discharge Floor to Waist PILE (M, SD)	86.2 (24.1)	80.2 (26.7)	76.2 (24.8)	65.5 (27.7)	58.4 (22.8)	10.34	.00	.10
Discharge Waist to Shoulder PILE (M, SD)	86.7 (29.7)	80.8 (30.4)	70.2 (29.9)	58.9 (28.0)	55.1 (26.6)	21.62	.00	.12
Discharge PILE, n (% zero)	0 (0%)	0 (0%)	0 (0%)	2 (3%)	0 (0%)	11.28	.03	.17

The results of the WS PILE pattern mixture modeling is presented in Table 6.45. A main effect of time, F (1, 398.38) = 19395.42, $p < .001$, completion status, F (1, 518.84) = 56.97, $p < .001$, and FACS severity levels were found, F (1, 287.44) = 27.15, $p < .001$. When the FACS severity levels main effect was examined in more detail, it was found that those in the extreme FACS severity level had significantly lower scores on the PILE WS lift task than all other severity levels ($p < .001$), with the exception of the subclinical FACS severity level ($p = .64$). There were also main effects for the covariate age, F (1, 280.13) = 7.12, $p = .01$, and age did interact with the FACS severity levels, F (1, 285.70) = 3.69, $p = .05$. However, when this interaction was explored,

it was no longer significant, $p = .95$. Significant interaction effects were also found for time by completion status, F (1, 415.20) = 9.24, $p < .01$, and for time and the FACS severity levels, F (1, 264.07) = 4.98, $p = .03$.

When the interaction between time and the FACS severity level was examined in more detail, it was no longer found to be significant ($p = .42$). Admission and discharge WS PILE information is presented in Table 6.46. At admission, those in the extreme FACS severity level had significantly lower scores on the Isokinetic lifts than all other severity levels ($p \leq .01$), except for the subclinical FACS severity level ($p = 1.0$). Those in the severe FACS level also had significantly lower scores than those in the mild FACS severity level ($p \leq .03$). At discharge, those in the extreme FACS severity level had significantly lower scores than all other groups ($p \leq .01$), with the exception of the severe level ($p = 1.0$). In addition, the severe FACS level had lower WS PILE scores than those in the subclinical or mild FACS severity levels ($p \leq .01$).

6.5.7.2 Isokinetic Lift

Pattern mixture modeling results for the Isokinetic lift tasks are presented in Table 6.47. Main effects significant for the FW Isokinetic were: 1) Lift: time, F (1, 427.6) = 867.92, $p < .001$; 2) completion status, F (1, 652.3) = 15.48, $p < .001$; and 3) FACS severity level, F (1, 378.6) = 12.00, $p = .001$. When the main effect for the FACS severity levels was analyzed, it was found that those in the extreme FACS severity level had lower scores on the FW Isokinetic lift compared to all other severity levels ($p \leq .02$), with the exception of the subclinical FACS severity level ($p = 1.0$). A significant interaction effect existed for time and completion status only, F (1, 457.3) = 19.18, $p < .001$. There was also a significant main effect of age, F (1, 393.93) = 5.92, $p = .02$, and main effects of marital status: 1) single, F (1, 340.06) = 4.39, $p = .04$; and 2) married, F (1, 335.78) = 4.65, $p = .03$. When these main effects were further examined, an interaction was also found between time and being married, F (1, 325.67) = 5.78, $p = .02$. Since none of these main effects involved the FACS severity levels, further analysis was discontinued.

Table 6.47 Pattern mixture modeling: Isokinetic lift

Variables	Estimate	df	t-test	Sig.
Isokinetic Lift FW				
Time	53.3	427.6	29.5	.00
FRP Completion	12.4	652.3	3.9	.00
FACS Severity Level	-4.7	378.6	-3.5	.00
Time x FRP completion	32.3	457.3	4.4	.00
Time x FACS Severity Level	1.2	332.1	.6	.57
FRP completion x FACS Severity Level	-2.1	529.3	-.5	.59
Age	-.3	393.9	-2.4	.02
Education Level in Years	.1	361.4	.3	.75
Marital Status: Single	-22.6	340.1	-2.1	.04
Marital Status: Married	-22.4	335.9	-2.2	.03
Attorney Retention	-2.4	312.8	-1.0	.33
Isokinetic Lift WS				
Time	72.8	536.4	31.3	.00
FRP Completion	17.8	657.3	3.9	.00
FACS Severity Level	-6.7	381.5	-3.5	.00
Time x FRP completion	46.4	466.2	4.3	.00
Time x FACS Severity Level	2.0	337.8	.7	.51
FRP completion x FACS Severity Level	-3.0	535.1	-.5	.60
Age	-.4	380.5	-2.0	.05
Education Level in Years	.4	366.4	.92	.36
Marital Status				
Attorney Retention	-3.0	316.0	-.8	.40

No interaction between time and FACS severity levels were found. The admission and discharge scores for the Isokinetic lift are presented in Table 6.48 below. At admission, it was found that those in the extreme FACS severity level had significantly lower scores on the Isokinetic lifts than all other severity levels ($p \leq .01$), except for the subclinical FACS severity level ($p = 1.0$). Those in the severe FACS level also had significantly lower scores than those in the mild FACS severity level ($p \leq .03$). When the data was also examined categorically, to examine the number of participants scoring zero in each FACS severity level on the Isokinetic lift tasks, it

was found that those in the subclinical and mild FACS severity levels were less likely to score a zero on the Isokinetic lift (z = -4.4 and -3.8, respectively), while those in the extreme FACS severity level were more likely to score a zero on the Isokinetic lift (z = 5.3).

At discharge, those in the extreme FACS severity level had significantly lower scores than all other severity levels ($p < .001$), with the exception of the severe level ($p \geq .24$). Those in the subclinical FACS severity level had significantly higher discharge Isokinetic lift scores than those in the moderate or severe levels ($p \leq .01$), and those in the severe level had significantly lower lift scores than those in the mild FACS severity level ($p = .001$). When the percentage of participants soring zero were examined for the discharge physical measures, it was found that those in the subclinical FACS severity level were less likely to score a zero (z = -2.5), while those in the severe and extreme FACS severity levels were more likely to score a zero (z = 2.1 and 4.2, respectively), indicating an inability to succeed at the task.

Table 6.48 Isokinetic lift admission and discharge scores by FACS severity level

Variable	Subclinical 0-20	Mild 21-40	Moderate 41-60	Severe 61-80	Extreme 81-100	F/χ^2 Value	p value	Effect Size
Admission Floor to Waist Isokinetic Lift Task (M, SD)	11.7 (16.7)	28.5 (31.5)	16.9 (26.4)	14.1 (24.7)	4.4 (13.0)	8.06	.00	.07
Admission Waist to Shoulder Isokinetic Lift Task (M, SD)	16.3 (22.4)	41.7 (45.0)	24.3 (39.0)	20.0 (34.9)	6.1 (17.5)	8.55	.00	.08
Admission Isokinetic Lift Task, n (% zero)	7 (54%)	12 (46%)	50 (58%)	108 (62%)	98 (82%)	23.63	.00	.23
Discharge Floor to Waist Isokinetic Lift Task (M, SD)	82.2 (32.6)	76.5 (41.1)	64.6 (33.9)	52.7 (36.5)	36.7 (35.6)	13.77	.00	.13
Discharge Waist to Shoulder Isokinetic Lift Task (M, SD)	117.2 (49.2)	110. 1 (599)	93.6 (47.4)	74.7 (52.6)	49.1 (48.9)	14.77	.00	.13
Discharge Isokinetic Lift Task, n (% zero)	1 (1%)	8 (10%)	5 (4%)	10 (17%)	10 (30%)	34.44	.00	.29

Next, the Isokinetic lift from WS was examined. There were main effects of time, F (1, 536.4) = 981.09, $p < .001$, completion status, F (1, 657.3) = 15.32, $p < .001$, and FACS severity

level, F (1, 381.51) = 11.95, p = .001. When the FACS severity level main effect was examined further, results showed that those in the extreme FACS severity level had lower Isokinetic FW scores than all other severity levels ($p \leq .02$), with the exception of the subclinical FACS severity level (p = 1.0). Lastly, there were main effects for the covariate age, F (1, 380.5) = 3.94, p = .05. As it did not interact with the FACS severity level, further analysis was not undertaken. There was an interaction effect for time by completion status only, F (1, 466.19) = 18.87, $p < .001$.

There was no interaction effect for time by FACS severity level. Admission and discharge scores are presented in Table 6.48. At admission, it was found that those in the extreme FACS severity level had significantly lower scores on the Isokinetic lifts than all other severity levels ($p \leq .01$), except for the subclinical FACS severity level (p = 1.0). Those in the severe FACS level also had significantly lower scores than those in the mild FACS severity level ($p \leq .03$). At discharge, those in the extreme FACS severity level had significantly lower scores than all other severity levels ($p < .001$), with the exception of the severe level ($p \geq .24$). In addition, those in the subclinical FACS severity level had significantly higher discharge Isokinetic lift scores than those in the moderate or severe levels ($p \leq .01$), and those in the severe level had significantly lower lift scores than those in the mild FACS severity level (p = .001).

6.5.8 One-year Socioeconomic Outcome Differences between Severity Levels

The one-year socioeconomic variable comparison results for those completing FRP are depicted in Table 6.49. Significant differences between the FACS severity levels were found for the variables of work return and work retention only. When standardized residuals were examined for work return, no cell revealed a value above ± 2.0; it is clear, however, that significance was driven by the severe and extreme FACS severity levels being less likely to return to work (z = 1.8 and 1.9, respectively). For work retention, it was found that those in the extreme FACS severity level were less likely to retain work once they had returned to it (z = 2.2).

Table 6.49 One-year socioeconomic outcome variables by FACS severity level, CMPD completers only

Variable	Subclinical 0-20 n = 93	Mild 21-40 n = 84	Moderate 41-60 n = 121	Severe 61-80 n = 59	Extreme 81-100 n = 33	χ^2 Value	*p* value	Effect Size
Return-to-Work, n (%)						12.20	.02	.30
No	1 (3%)	2 (7%)	5 (14%)	5 (29%)	4 (33%)			
Yes	34 (97%)	26 (93%)	30 (86%)	12 (71%)	8 (67%)			
Work Retention, n (%)						10.79	.03	.28
No	4 (12%)	4 (14%)	7 (20%)	6 (35%)	6 (50%)			
Yes	31 (89%)	24 (86%)	28 (80%)	11 (65%)	6 (50%)			
Surgery on Original Injury, n (%)						6.90	.14	
No	29 (94%)	24 (100%)	37 (100%)	13 (87%)	9 (90%)			
Yes	2 (6%)	0 (0%)	0 (0%)	2 (13%)	1 (10%)			
New Injury, n (%)						31.12	.49	
No	25 (30%)	22 (31%)	36 (36%)	17 (41%)	9 (41%)			
Yes	1 (1%)	3 (4%)	3 (3%)	0 (0%)	1 (5%)			
Visits to New Provider, n (%)						7.90	.09	
No	33 (94%)	23 (89%)	40 (100%)	14 (82%)	10 (83%)			
Yes	2 (6%)	3 (12%)	0 (0%)	3 (18%)	2 (17%)			

6.6 One-year Outcome Prediction in CMPD Patients

The last analysis conducted was sequential binary logistic regression analysis for prediction of the two significant one-year outcomes documented in Section 6.5.8 (work return and work retention). Results for work return are presented in Table 6.50. When the known predictors of work return were entered into the model, there was a significant increase in model prediction from the null model (prediction due to chance), χ^2 (6, N = 101) = 12.92 p = .04, with the factors accounting for 22% of the variance (Nagelkerke's R^2 = .23). In this first step, the significant predictors of work return included only length of disability (p = .03). When the FACS severity levels were added on the second step of the model, the model significantly increased in predictive value, χ^2 (6, N = 101) = 24.67, p = .001, and accounted for 40% of the variance (Nagelkerke's R^2 = .40), demonstrating that the FACS is a significant predictor of work return over and above

previously recognized predictors. While LOD remained a significant predictor (p = .04), total temporary disability became a significant predictor as well (p = .02), as did discharge FACS scores (p < .01).A patient was 1.04 times less likely to return to work for every point increase on the FACS.

Table 6.50 Sequential logical regression analysis for prediction of work return – all variables at the final block

Variable	B	SE	Wald	*p*	Exp B
Length of Disability	.24	.12	4.34	.04	1.27
Working at Admission	-.17	.95	.03	.86	.85
Pre-admission Surgery	.79	.77	1.06	.30	2.21
Admission Job availability	.00	.00	.03	.88	1.00
Admission Total Temporary Disability	-.07	.03	5.15	.02	.93
Receiving Social Security Income	30.75	13038.6	.00	1.00	2.24E13
Discharge FACS Score	-.05	.02	8.55	.00	.95
Constant	5.94	1.45	16.72	.00	.00

Next, the binary logistic analysis for prediction of work retention was undertaken, as shown in Table 6.51. The first step of the model, which included addition of known predictors of work retention such as length of disability, working at admission, pre-admission surgery, job availability at admission, total temporary disability at admission, and social security income status at admission, did not significantly improve classification from the null model, χ^2 (6, N = 101) = 12.14, p = .06, and only accounted for 18% of the variance (Nagelkerke's R^2 = .18). However, when discharge FACS scores were added as a predictor in step two of the model, the classification significantly increased both from the null model (χ^2 (1, N = 101) = 9.75, p = .002) and from the model presented in step one (χ^2 (6, N = 101) = 21.89, p = .003), accounting for 30% of the variance (Nagelkerke's R^2 = .30). Significant predictors of work retention in step two of the model included pre-admission surgery (p = .05), total temporary disability at admission (p = .05), and discharge FACS scores (p < .001). The chances of retaining work decreased by 1.03 times for every point increase on the FACS at discharge.

Table 6.51 Sequential logical regression analysis for prediction of work retention – all variables at the final block

Variable	B	SE	Wald	*p*	Exp B
Length of Disability	.24	.12	4.34	.04	1.27
Working at Admission	-.17	.95	.03	.86	.85
Pre-admission Surgery	.79	.77	1.06	.30	2.21
Admission Job availability	.00	.00	.03	.88	1.00
Admission Total Temporary Disability	-.07	.03	5.15	.02	.93
Receiving Social Security Income	30.75	13038.6	.00	1.00	2.24E13
Discharge FACS Score	-.05	.02	8.55	.00	.95
Constant	5.94	1.45	16.72	.00	.00

6.7 Comparison between the FACS, TSK, & IEQ

The last component to help validate the FACS is to directly compare it to prior measures of FA. Therefore, regression analyses were run to determine whether FACS scores at admission could predict psychosocial and lifting performance scores at discharge over and above the TSK or the IEQ.

6.7.1 Prediction of Psychosocial Scores at Discharge

The B values, standard error, t-tests, and the significance of individual predictors for each psychosocial variable are presented below in Table 6.52. When discharge somatization symptoms were predicted, the model fit did not significantly increase after adding the FACS (Adjusted R^2 = .01), and the final model only accounted for 4% of the total variance, $F\Delta$ (1, 374) = 1.89, p = .17. Admission FACS scores were also not a significant predictor of discharge somatization, (p = .17), although the IEQ and the TSK were ($p \leq .04$). Upon examination of discharge perceived disability using the ODI, it was found that admission FACS scores were a better predictor than the TSK or IEQ, $F\Delta$ = (1, 370) = 5.25, p = .02, adding an additional 1% of variance to the total 3% variance accounted for in discharge ODI scores (Adjusted R^2 = .03). While the FACS and the TSK were significant predictors (p = .02), the IEQ was not (p = .08). However, when using the PDQ to examine perceived disability, admission FACS scores were not

a significant predictor, $F\Delta$ = (1, 372) = 2.47, p = .12, adding less than 1% of the variance to the final model, which accounted for 4% of the variance (Adjusted R^2 = .04). Only the TSK was a significant predictor (p = .01) of discharge PDQ scores.

Upon examination of discharge pain intensity, it was found that admission FACS scores were not a significant predictor, $F\Delta$ = (1, 374) = .61, p = .44, and that it added less than 1% of the variance to the final predictive model, which predicted 10% of the variance. However, when the individual predictors were examined, it was found that neither the TSK, IEQ, nor FACS significantly helped predict discharge pain intensity. When discharge depressive symptoms were predicted, it was found that the model fit significantly increased after adding the FACS by 2% (Adjusted R^2 = .08), successfully accounting for 8% of the total variance in depressive symptoms at discharge, $F\Delta$ = (1, 375) = 6.42, p < .01, with admission IEQ, TSK, and FACS scores all significant predictors of discharge BDI scores ($p \leq$ ..01). Admission FACS scores did not help predict ISI scores at discharge, $F\Delta$ = (1, 375) = .81, p = .37, and added less than 1% of the variance to the final model, which overall was 11% (Adjusted R^2 = .11). However, the IEQ and the TSK were significant predictors (p < .01). Admission FACS scores did not significantly increase the model fit when predicting CSI scores at discharge, $F\Delta$ = (1, 373) = 2.84, p = .09, with the model fit increasing by only 1% and the final model accounting for only 9% of the variance (Adjusted R^2 = .09). Nor was it a significant predictor of the CSI at discharge (p = 09), although the IEQ and the TSK were (p < .01).

Table 6.52 Prediction of discharge psychosocial outcomes, final model

Variables	B	SE	t-test	Sig.
Discharge PHQ Somatization				
• IEQ	.05	.02	2.38	.02
• TSK	.05	.02	2.07	.04
• FACS	-.01	.01	-1.38	.17
Discharge Pain Intensity				
• IEQ	.02	.01	1.52	.13
• TSK	.02	.02	1.17	.24
• FACS	-.00	.01	0.78	.44
Discharge PDQ				
• IEQ	.27	.15	1.82	.07
• TSK	.45	.17	2.67	.01
• FACS	-.10	.06	-1.57	.12
Discharge ODI				
• IEQ	.15	.08	1.77	.08
• TSK	.23	.10	2.37	.02
• FACS	-.08	.04	-2.29	.02
Discharge BDI				
• IEQ	.14	.04	3.35	.00
• TSK	.14	.05	3.00	.00
• FACS	-.04	.02	-2.53	.01
Discharge ISI				
• IEQ	.10	.04	2.79	.01
• TSK	.17	.04	4.17	.00
• FACS	-.01	.02	-.90	.37
Discharge CSI				
• IEQ	.27	.07	3.70	.00
• TSK	.24	.08	2.30	.01
• FACS	-.05	.03	-1.68	.09

6.7.2 Prediction of Lifting Capacity Scores at Discharge

Similar analyses were undertaken for the physical lifting capacity measures, as detailed in Table 6.53 below. Admission FACS scores did not significantly add to the predictive model for

FW PILE scores, $F\Delta$ = (1, 353) = .40, p = .53, accounting for less than 1% of the variance in the total model. However, neither the TSK nor the IEQ were significant predictors either. Similarly, admission FACS scores did not predict WS PILE scores, $F\Delta$ = (1, 351) = .49, p = .48, the FACS accounted for less than 1% of the variance, and neither TSK nor IEQ were significant predictors either.

It was found that admission FACS scores were a significantly better predictor of WS Isokinetic lifting capacity than the TSK or the IEQ, $F\Delta$ = (1, 384) = 4.01, p = .05, accounting for an additional 1% of variance. In fact, the FACS was the only significant predictor of WS Isokinetic Lift scores, p = .05. However, the FACS was not a significant predictor of the FW Isokinetic Lift scores, $F\Delta$ = (1, 373) = 3.16, p = .08, adding less than 1% of the variance to the final model. Neither the TSK nor the IEQ were significant either.

Table 6.53 Prediction of discharge lifting performance outcomes, final model

Variables	B	SE	t-test	Sig.
Discharge FW PILE				
• IEQ	-.10	.13	-.73	.47
• TSK	.03	.16	.16	.88
• FACS	-.04	.06	-.64	.53
Discharge WS PILE				
• IEQ	-.11	.12	-.95	.34
• TSK	-.01	.13	-.10	.92
• FACS	-.03	.05	-.70	.48
Discharge FW Isokinetic Lift				
• IEQ	.17	.17	1.04	.30
• TSK	-.16	.19	-.86	.39
• FACS	-.12	.07	-1.78	.08
Discharge WS Isokinetic Lift				
• IEQ	.37	.23	1.58	.11
• TSK	-.32	.27	-1.21	.23
• FACS	-.19	.10	-2.00	.05

Chapter 7

Discussion

Previous measures of fear-avoidance suffered from mediocre psychometric properties, were constructed before the development of two new theoretical models of FA that have changed the field, and were not well suited to a CMPD population. Therefore, the purpose of this study was to develop and validate a new measure of fear-avoidance, entitled the Fear-Avoidance Components Scale (FACS), which addressed addresses these problems. The FACS was developed by an interdisciplinary team, was based on and included all components of the FAM, and included reworked items from many well-known scales, such as the TSK, FABQ, PASS, and the PCS. Discussion on the FACS' psychometric properties and validation in the CMPD and psychiatric chronic pain populations are presented below, including the study's strengths, limitations, future directions, and conclusions.

7.1 Initial Reliability and Validity Analyses

The FACS showed high test-retest reliability in both the CMPD patients and the non-patient comparison sample, both for the total score and for each item. Test-retest reliability for the FACS was similar or slightly better than the TSK (de Souza et al., 2008; Haugen et al., 2008; Ostelo et al., 2007), the FABQ (de Souza et al., 2008; Pfingsten et al., 2000; Swinkels-Meewisse et al., 2003; Waddell et al., 1993), and the PASS (Cho, Lee, McCracken, Moon, & Heiby, 2010; Coons, Hadjistavropoulos, & Asmundson, 2004). Corrected item totals, which determined how the item fits into the whole scale, were high for CMPD patients. In addition, internal consistency was also found to be quite high, both for the total FACS and for each of its subscales. Although the victimization subscale demonstrated the lowest levels of internal consistency, this may be an artifact of including only three items in that subscale, as Cronbach's alpha is based on the number of items. The victimization subscale may also have the lowest internal consistency because victimization is not as integral to the FAM. Although it is clear how pain-related anxiety and activity avoidance relate to FA, the relationship of FA to victimization is probably more subtle. With the exception of the victimization subscale, the FACS still had better internal consistency

than the TSK (Kole-Snijders et al., 1993; Roelofs, Goubert, Peters, Vlaeyen, & Crombez, 2004; J. W. Vlaeyen et al., 1995; Woby et al., 2005), had similar or better internal consistency than the FABQ (Askary-Ashtiani et al., 2014; Cleland et al., 2008; K. Lee et al., 2006) and had better internal consistency than the PASS (L. M. McCracken et al., 1992; L. M. McCracken et al., 1993; Osman et al., 1994).

CMPD patient feedback was sought on the FACS in order to better understand its utility. Patients felt that the FACS was easy to understand, was an appropriate length, and had relevant subject matter. A few written comments, however, revealed that the FACS may be too long, confusing, not personalized or detailed enough, or that its administration should be conducted in a private area. Unfortunately, it is not possible to please everyone, as demonstrated by the somewhat conflicting comments from different patients in which the FACS was deemed too long, but also not detailed enough. Further, a comment about the FACS being administered in a crowded waiting room rather than in a private area does not actually criticize the questions on the FACS; only the locale. This criticism may be dealt with through the amendment of the FRP intake procedures, not through any psychometric changes.

It was important to not only gather patient ratings, but clinician ratings as well to ensure as much face validity with the FACS as possible. Two occupational therapists rated patients for overall presence of fear-avoidance as well as the subtype of fear-avoidance the patient exhibited (learned, misinformed avoider, or affective avoider). While the therapists agreed on whether the patients had any fear-avoidance, as well as what type, the ratings did not initially correspond to the FACS. However, when correlations between the specific item and its subtype were examined, strong relationships were found, indicating excellent content validity for items #1, 5, and 11. They are indeed measuring the fear-avoidance subtypes the developers hoped they would measure. Another research group using a similar technique of clinical ratings of FA found similar results, with therapist ratings correlating to the TSK and the FABQ only mildly, although ratings did correspond well to disability and catastrophizing measures (Calley et al., 2010). Similar validation

was also found in a population of workers with upper extremity disorders (Inrig, Amey, Borthwick, & Beaton, 2012).

7.2 Factor Analyses

Several iterations of factor analyses were run, with different types and different rotations, so that the best-fitting structure could emerge. Two models seemed to have similar fits, depending on the factor analysis variations: 1) a model including all the items on the FACS; or 2) a model removing 8 items. For the model that included all FACS items, the *a priori* FACS subscales of activity avoidance, pain-related anxiety, and victimization were supported. However, the second model, which excluded eight items from the analysis, may have formed different subscales. While activity avoidance remained, the second factor was comprised of catastrophizing, blame, and injustice questions, which had considerable overlap to the *a priori* subscale determination of pain-related anxiety, but also included the items from the IEQ on injustice and blame. Next, these two factor structures were tested in a separate CMPD sample, as well as the psychiatric chronic pain sample and the non-patient comparison sample. For the CMPD and non-patient populations, in general, it was found that neither model was an extremely great fit, although the 12 item factor structure appeared a slightly better fit. However, in the psychiatric chronic pain patients, it was found that either model would be an acceptable fit for the data, with the 12 item factor structure slightly better. One last alternative, a unidimensional factor structure, was tested in all three populations, to little success, as it was a poor model fit. Some lesser-known questionnaires measuring elements of the FAM have also had issues with factor analyses (Roelofs et al., 2005); perhaps something about the FA concept does not lend itself well to the separation of theoretical elements. In addition, factor analysis is more of an art than a science, and results can be somewhat difficult to interpret in many cases (Ford, MacCallum, & Tait, 1986; Henson & Roberts, 2006). Lastly, there may be factor invariance due to other uncontrollable factors, such as the economy, which has shown to influence the course of chronic pain patients (Hartzell, Mayer, Neblett, Marquardt, & Gatchel, 2014).

7.3 Analysis of Item Response and Sensitivity/Specificity Analyses

Previous measures of fear-avoidance, such as the TSK, PASS, and FABQ, do not have severity levels that will aid in interpretability of results in a clinical setting, though several have a variety of cut-off points (Barke, Baudewig, Schmidt-Samoa, Dechent, & Kröner-Herwig, 2012; Bränström & Fahlström, 2008; Brede et al., 2011; Bunketorp et al., 2005; Fritz & George, 2002; S. Z. George et al., 2008; Helmhout et al., 2010; Klaber Moffett et al., 2004; Lundberg et al., 2006; J. S. Thomas & France, 2007; J. S. Thomas et al., 2008; J. W. Vlaeyen et al., 1995; J. W. Vlaeyen et al., 1999; J. W. S. Vlaeyen & Linton, 2012; Wertli et al., 2013). Therefore, the overall goal of this section of the manuscript was to create clinically meaningful severity levels by determining how the FACS related to other psychosocial benchmarks, examining item means and response trends, and determining appropriate cut-offs for the different sample populations. Although item means and response trends did not provide information on the total scores for the FACS, they did allow a descriptive comparison between the non-patients and the CMPD and psychiatric chronic pain samples. For the non-patients, item means did not rise above 2.9, while for the CMPD patients, item means did not fall below 2.5, revealing a dichotomy. The psychiatric chronic pain patients appeared to have scores somewhat in the middle of the two other samples, and had a much wider range of means and distribution of scores, showing how diverse the psychiatric chronic pain patients were.

The non-patient average FACS score hovered just above the 20 point mark (M = 21.7), while the psychiatric chronic pain patients, regardless of their employment status, fell in the 60-70 point range. The psychiatric chronic pain patients with mild PDQ scores scored lower (M = 45.2), and the majority of CMPD patients fell in the 60-70 point range, unless they had either mild PDQ scores or mild or moderate TSK scores, in which case, their scores were much lower, falling around the 20 point mark. ROC analyses were conducted for: 1) discriminating between populations and 2) differentiating between different characteristics in the psychiatric chronic pain and CMPD populations. These demonstrated that a cut-off of 41 optimally discriminated between the CMPD patients and the non-patient comparison sample, a cut-off of 33 optimally

discriminated between the psychiatric chronic pain patients and the non-comparison sample, a cut-off of 65 optimally discriminated between the CMPD and the psychiatric chronic pain patients and a cut-off of 73 discriminated between those who were “screamers,” or patients who had extremely elevated pain intensity and perceived disability.

Using the benchmarks and the ROC analyses as a guideline for determining severity levels, and by examining frequency distributions, the research team determined that quintile severity levels at 20, 40, 60, and 80 would be most appropriate, although many severity levels were considered and later rejected. These points were labeled as subclinical, mild, moderate, severe, and extreme, respectively. Quintile severity levels enabled the data to fit best into the three different populations, while allowing the range of scores between each severity level to remain the same. Clinical input from physicians, psychiatrists, psychologists, and physical and occupational therapists also supported the quintile severity levels; many reported they found these points to be natural breaks in how many symptoms patients had and how severe the reported symptoms were. Ninety-one percent of non-patients scored below a 40 on the FACS, while only 9% of CMPD patients and 23% of psychiatric chronic pain patients scored below 40 on the FACS.

7.4 Validation of Severity Levels

7.4.1 Demographic Differences

Few demographic differences existed when examining the FACS severity levels in the CMPD patients. Those in the subclinical FACS severity level were significantly younger, however. It has been hypothesized that one becomes more likely to experience chronic pain and its related psychosocial symptoms as the number of trauma experiences increase (Moseley & Vlaeyen, 2015). Perhaps younger patients were more likely to fall into the subclinical FACS severity level because their chronic pain disorder is not as severe; some evidence to back this theory up has been found in dental pain patients (Maísa Soares & Rizzatti-Barbosa, 2015). FA is related to chronicity as well (Heymans et al., 2010; Karels et al., 2007). It is also likely that there may be a reporting bias; younger patients may be less likely to report their own fear and weaknesses,

especially with high parent protectiveness (Wilson, Lewandowski, & Palermo, 2011). These hypotheses, however, are not supported by past research. Several studies have found no relationship between age and FA (Gremeaux, Coudeyre, Viviez, Bousquet, & Dupeyron, 2014; Hart et al., 2009), while others found that those who are older have the lowest levels of FA (Cook, Brawer, & Vowles, 2006; Vernon et al., 2011), with younger adults having more negative FA and injury beliefs (Bränström & Fahlström, 2008; B. Tan et al., 2014).

Significant differences also existed in the CMPD patients on marital status, with those separated from their spouse more likely to be classified as subclinical, those widowed more likely to be classified as mild, and those who were cohabitating more likely to have extreme FA scores on the FACS. One prior study on the TSK found that those who were married had higher levels of FA (Misterska et al., 2015); this may be why those who are widowed or separated have lower FA levels. In contrast, however, another study found that those who were single had higher levels of anxiety before a colposcopy (Kola & Walsh, 2012), though this may not translate as well, since results were not from a chronic pain population. Although it is difficult to explain the findings for those separated or widowed, it makes some sense that those cohabitating had more extreme FA. Literature suggests that couples who cohabitate without marriage suffer from a lack of commitment (Noller, 2006), and thus have poor marriage quality and stability if they do eventually tie the knot (Jose, Daniel O'Leary, & Moyer, 2010).

This may influence social support, which is a large component of chronic pain recovery, and a component of fear-avoidance because social support can influence whether a patient goes on to confront the pain and disability of the injury or whether negative coping methods such as fear-avoidance develop. It has been found that those with high FA in chronic pain samples (Feleus et al., 2007), as well as those who have high fear of childbirth (Fisher, Hauck, & Fenwick, 2006), often have low social support, and that a threatening social context can increase pain-related fear in laboratory settings (Karos, Meulders, & Vlaeyen, 2014). FA, and the extended absence from work that may result, can also be reduced by increasing social support in the workplace (Symonds, Burton, Tillotson, & Main, 1995). However, one study found no relationship

between pain acceptance and social support (Ojala, Piirainen, Sipilä, Suutama, & Häkkinen, 2013). Findings about pain acceptance may or may not apply; theoretically, pain acceptance should be the opposite of the fear-avoidance cycle, but in reality, these concepts may be quite different. It may also be that those cohabitating don't have their lives "as together" and thus are more stressed and may be more sensitive to the physical and emotional changes that are associated with chronic pain.

In the psychiatric chronic pain population, a different set of demographic factors significantly differed among the FACS severity levels. It was found that those in the extreme severity level were more likely to have only some high school education, and those in the mild severity level were more likely to have a Bachelor's degree. Previous studies of dental pain fear found that those with a lower level of education were more likely to have a moderate dental anxiety (Goettems, Schuch, Demarco, Ardenghi, & Torriani, 2014; Tellez & Kaur, 2013), and socioeconomic status, which includes education, was significantly correlated with the FABQ (Valencia, Robinson, & George, 2011). Those with low education levels had higher FABQ physical functioning (Poiraudeau et al., 2006) and total scores (Oyeflaten, Hysing, & Eriksen, 2008). However, in a study of osteoarthritis patients, there were no differences between education levels using the Brief Fear of Movement Scale (Shelby et al., 2012).

Those in the mild severity level were also more likely to be enrolled in DARS, a vocational retraining program. Patients undergoing DARS may have been selected as likely successful candidates from that program in part because of their low fear-avoidance attitudes towards their pain, or there may be another factor, such as age, that is also playing a role; it stands to reason that those who are younger may welcome job retraining and additional experience, whereas someone who is older and has more job experience already may not voluntarily seek out additional job retraining from a program such as DARS. Although DARS is unique to Texas, and encompasses a variety of programs, such as the Technology Resource Center, the Independent Living Services and Centers, the one that is most relevant is the vocational rehabilitation program, which helps those who are disabled prepare for, find, and keep

employment. The vocational rehabilitation program provides a wide range of services encompassing medical treatment (if appropriate), job placement, or job retraining (Texas Department of Assistive and Rehabilitative Services, ND). It is possible that those in DARS are more likely to be in the mild severity level because they feel secure, and their needs are already being taken care of through the program. Other vocational rehabilitation programs have effectively reduced FA (de Vries, Reneman, Groothoff, Geertzen, & Brouwer, 2012; Oyeflaten et al., 2008).

Those in the mild FACS severity level were also youngest; this may in part be an effect of DARS, which has a branch devoted to just helping students with disabilities. In addition, those in the mild FACS severity level were less likely to be classified as disabled, while those in the extreme level were more likely to be disabled. These disability effects have been found in previous studies as well (Beneciuk et al., 2013; Burns et al., 2000; Crombez et al., 1998; Crombez et al., 1999; Goubert et al., 2003; Keen et al., 1999; Peters et al., 2002; Pfingsten et al., 2001; Samwel et al., 2006; van den Hout et al., 2001; Waddell et al., 1993). It is assumed that the more fear of movement one possesses, the less one will actually move and the higher disability level one will have.

7.4.2 Occupational Differences

Few occupational differences existed in CMPD patients as well, although those in the mild FACS severity level were more likely to have federal worker's compensation. Previous literature has found that having any type of worker's compensation claim may increase the likelihood of having high FA physical activity scores on the FABQ (Fujii, Matsudaira, & Oka, 2013), and the FABQ seems to have the best predictive validity in worker's compensation patients (Cleland, Fritz, & Brennan, 2008). Another research study found an association between FA and payor status, with higher scores found in workers' compensation claims as compared to auto insurance or other insurance claims (S. Z. George, Fritz, & Erhard, 2001). Those in the extreme severity level were less likely to work upon FRP admission; this most likely has to do with an increase in disability status due to fear of movement and increased activity avoidance.

These findings are supported by previous literature, which found that FA is associated with work status upon entry into a rehabilitation program (Hiebert et al., 2012). While other programs have not assessed FA at admission, they have found significant associations between FA and return to work at program discharge or in the months/years following discharge (Fritz & George, 2002; Hart et al., 2011; Holden, Davidson, & Tam, 2010; Meijer, Sluiter, Heyma, Sadiraj, & Frings-Dresen, 2006; Turner et al., 2006).

No significant differences existed on any of the other occupational variables, such as job satisfaction, job type, job demand, or the duty a patient fulfilled. This may indicate that fear-avoidance can happen to anyone, in any job, and is not specifically related to one specific occupational characteristic. However, some studies have found that lower income is associated with high FA (de, de Góes Salvetti, Damiani, & de, 2014). In addition, FA has been shown to decrease work ability in factory workers (Sell, Lund, Holtermann, & Søgaard, 2014), which is similar to PDL, another variable that did not significantly differ among FACS severity levels. Lastly, FA is related to stress and social support at work (Stenberg, Lundquist, Fjellman-Wiklund, & Ahlgren, 2014), which is assumed to relate to job satisfaction.

7.4.3 Psychiatric Diagnosis Differences

CMPD patients in the extreme FACS severity level were more likely to be diagnosed with any Cluster B personality disorder (including antisocial, borderline, histrionic, and narcisstic personality disorders) or Cluster C personality disorder (including avoidant, dependent, and obsessive-compulsive personality disorders), while those in the subclinical and mild FACS severity levels were less likely to be diagnosed with a Cluster B or C personality disorder. It is assumed that significance for the Cluster B analysis was driven by Borderline Personality as those in the subclinical level were less likely to be diagnosed and those in the extreme level more likely to be diagnosed with any Cluster B personality disorder. Though very little literature has examined how FA and the presence of personality disorders is related, one group posited that there is a common link between borderline personality and some of the other more violent personality disorders to FA through the dysregulation of the amygdala (D. T. George, Phillips,

Doty, Umhau, & Rawlings, 2006). Those diagnosed with Borderline Personality Disorder are more likely to be seeking attention; as such, they may have higher FA scores due to their need to receive more attention in treatment regarding their chronic pain.

The Cluster C analysis was most likely driven by the obsessive compulsive personality disorder diagnoses. In a study of fibromyalgia patients, the "big five" personality traits of conscientiousness and neuroticism significantly impacted the FAM. These traits are certainly strong in those who have obsessive-compulsive personality disorder (Martínez, Sánchez, Miró, Medina, & Lami, 2011). These findings may be population specific, as a study on chronic tinnitus patients did not find a relationship between any of the personality traits and FA (Kleinstäuber et al., 2013), and neuroticism was only marginally related to FA in an experimental setting (J. E. Lee, Watson, & Law, 2010). Vassend et al. identified a relationship between personality traits and higher dental anxiety (2011). Lastly, FA was significantly related to obsessive-compulsive disorder in Sickle Cell patients (Pells et al., 2007). Although the Axis I disorder of obsessive-compulsive and the Axis II personality disorder are not the same, many of their traits do overlap.

Axis I psychiatric disorders also showed significant differences between the FACS severity levels, with those in the extreme FACS severity level more likely to be diagnosed with any anxiety disorder, Major Depressive Disorder (MDD), or Generalized Anxiety Disorder (GAD). The anxiety disorders particularly related to fear-avoidance, as many researchers consider fear and anxiety very similar, with the terms pain-related fear and anxiety often used interchangeably, although there are fine theoretical distinctions between them, including time orientation and level of physiological arousal (Blanchard & Blanchard, 1990; Carleton & Asmundson, 2009). Since anxiety disorders have a very high comorbidity, with over half having two or more secondary psychiatric diagnoses (Durand & Barlow, 2010), it follows that those who are already diagnosed with at least one anxiety disorder would be more predisposed to have elevated levels of fear-avoidance. It has been shown that all anxiety disorders show approximately equal patterns of anxiety sensitivity and pain-related anxiety, with the exception of panic disorder, which have higher levels of anxiety sensitivity and pain-related anxiety than any other anxiety disorder

(Carleton, Abrams, Asmundson, Antony, & McCabe, 2009). This may be because panic attacks provide a concrete incident to actively avoid, and can lead to agoraphobia as well. In addition, GAD symptoms include having near-constant moderate levels of anxiety at all times, and can include muscle tension and other physiological symptoms. These GAD symptoms could exacerbate the patient's chronic pain condition and further increase the intensity of the fear-avoidance cycle, with muscle tension being a particularly important link in chronic pain (Lucchetti, Oliveira, Mercante, & Peres, 2012). The same drugs that treat GAD (benzodiazepines) also reduce FA in animals (Glaudin et al., 1994). A link between FA and post-traumatic stress disorder has also been established, through the link of catastrophizing (López-Martínez, Ramírez-Maestre, & Esteve, 2014). Obsessive-compulsive disorder, general anxiety symptoms, and phobias are linked to FA in Sickle Cell patients (Pells et al., 2007). A relationship between panic attacks and dental anxiety has also been identified (R. Moore, Brødsgaard, & Rosenberg, 2004).

7.4.4 Psychosocial Differences

7.4.4.1 Correlations between Psychosocial Measures

The FACS significantly correlated with all other psychosocial measures used during CMPD admission. However, some psychosocial measures had higher *r* values than others. For instance, the PHQ Somatization subscale and pain intensity correlated less than the IEQ and its subscales or the PDQ, providing construct validity. At discharge, correlations between psychosocial measures had generally decreased. This may indicate that at FRP admission, elevated questionnaires scores were more susceptible to general psychosocial distress, and so patients tended to answer high on most questionnaires similarly. The ODI no longer correlated with the FACS at discharge, although the PDQ, another measure of perceived disability, did. This may be because the PDQ has a wider array of questions that assess both psychological and functional disability, as opposed to the ODI, which only measures perceived functional disability. It would make sense that fear-avoidance would relate more closely to a psychological perceived disability construct. Correlations with the TSK and IEQ continued to remain relatively high at discharge, which was expected, since 8 FACS questions were derived from these questionnaires.

Having significant correlations between these measures at discharge provides additional construct validity.

Correlations between psychosocial measures in the psychiatric pain patients were high, with the PDQ and BDI highest correlated and pain intensity, the ISI, and the CSI correlating the least. The lower correlations between the FACS and the ISI and CSI may provide some divergent validity evidence; while some influence of insomnia and central sensitization might be expected on the construct of fear-avoidance, it is not assumed that those concepts are highly related. Insomnia may be somewhat related to fear-avoidance, however, by means of a general chronic pain pathway (Asih, Hulla, Bradford, Hartzell, & Gatchel, 2014), in which those with chronic pain often have elevated pain, insomnia, and depression (Asih et al., 2014; Asih, Neblett, Mayer, & Gatchel, 2014). One prior study also found a connection between the ISI and fear-avoidance in osteoarthritis patients (Vitiello et al., 2014), and another found a link between fear of pain and insomnia in acute inpatients cases (Vico-Romero, Cabré-Roure, Monteis-Cahis, Palomera-Faneges, & Serra-Prat, 2014).

Central sensitization and the hypersensitivity of the central nervous system may relate somewhat to fear-avoidance through the component of hypervigilance (de Tommaso et al., 2003; Rollman, Abdel-Shaheed, Gillespie, & Jones, 2004); since hypervigilance is about paying extra attention to anything that may cause pain, it makes sense that attention would be focused both on external and internal cues. Paying close attention to internal cues, such as dizziness or nausea, leads to heightened somatization, and thus an increased likelihood that a patient may perhaps have a CSS (Barsky & Klerman, 1983). One recent study has found evidence that hypervigilance links to the neural mechanism of central sensitization in osteoarthritis patients (Herbert et al., 2014).

7.4.4.2 Psychiatric Chronic Pain Patients

In the psychiatric chronic pain population, it was found that, in general, those in the subclinical FACS severity level rated their pain the lowest even when they were feeling their worst pain, that those in the extreme FACS severity level rated their pain highest even at their least

pain time point, that the severe and extreme FACS severity level patients had the highest ratings of average pain intensity, and that those in the mild FACS severity level had the least current pain. Although these results were all significant, the *F* values were not very high, nor were the effect sizes, until these variables were examined categorically. It appears that although pain intensity is related to fear-avoidance as measured by the FACS, it may not be the major factor influencing fear-avoidance; perhaps instead acting only at the tail end of the FAM cycle, where disuse and disability are increasing.

Previous results using pain intensity have been mixed, with some finding a relationship to FA (Guclu, Guclu, Ozaner, Senormanci, & Konkan, 2012; Heinrich et al., 2011; Rostami et al., 2014) or to pain acceptance (the other side of the FAM, which leads to confrontation of pain and recovery from injury) (Ramírez-Maestre, Esteve, & López-Martínez, 2014), and others indicating that the two are not related (al Absi & Rokke, 1991; L. M. McCracken et al., 1996; Weisenberg et al., 1984). However, this lack of correlation may be somewhat explained by Ramirez-Maestere et al.'s findings, which showed that pain intensity and FA were related only in men (Ramírez-Maestre & Esteve, 2014), or perhaps because the relationship between catastrophizing and pain intensity is not solid (E. Thomas et al., 2010). The mixed results of pain intensity may also be partially explained by the time-frame that the negative finding studies came from. As they were all older studies, perhaps a generational cohort effect was present, as no recent studies corroborate their results.

Those in the subclinical and mild FACS severity levels in the psychiatric chronic pain population also had lower PDQ scores. As previous researchers have found that perceived disability is related to fear-avoidance, this finding was expected (Beneciuk et al., 2013; Burns et al., 2000; Crombez et al., 1998; Crombez et al., 1999; Goubert et al., 2003; Keen et al., 1999; Peters et al., 2002; Pfingsten et al., 2001; Samwel et al., 2006; van den Hout et al., 2001; Waddell et al., 1993). Psychiatric chronic pain patients in the mild FACS severity level also had significantly lower BDI scores than those in the extreme group. However, no other significant differences existed. In addition, no differences were found between the FACS severity levels on

insomnia. In part, these findings may point to divergent validity, as depressive symptoms and insomnia do not intuitively relate well to fear-avoidance.

Lastly, the CSI was examined in the psychiatric chronic pain population. Patients in the subclinical FACS severity level scored lower on the CSI and those in the extreme level scored higher on the CSI, in general. While central sensitization is not inherently a component in the FAM, it does relate to one of the elements, hypervigilance, and thus it can be expected that patients with elevated FACS scores may also have some degree of elevation on the CSI.

7.4.4.3 CMPD Patients

In the CMPD population, psychosocial variables were examined at both admission and discharge, which allowed analysis to take place at both time points, as well as to examine the variables' responsiveness to the FRP. The FACS was the first variable analyzed, and showed that FACS scores significantly decreased from FRP admission to discharge. As previously created measures of FA have found interdisciplinary treatment to be effective for decreasing fear-avoidance (Monticone et al., 2013; Monticone et al., 2014; Wertli et al., 2014; Wideman & Sullivan, 2011), it is encouraging that the FACS shows similar results, and provides validity to that effect. Additionally, elements of treatment that go into the FRP have also been effective treatment for FA, such as education ((Burton et al., 1999; Coudeyre et al., 2007; Godges et al., 2008; J. W. S. Vlaeyen et al., 2004) and CBT (Malone et al., 1988; Nicholas et al., 2013; Stahl, Rimes, & Chalder, 2014). As the FRP encompasses some of these treatments, it can be expected that combining them and adding additional treatment aspects can only help reduce fear-avoidance. In addition, a time by FACS severity level interaction showed that the only group to not decrease their FACS score was the subclinical FACS severity level. Perhaps their scores were already so low that they did not show high responsiveness (floor effect).

Response to treatment for the FACS was also determined by examining the change in FACS severity levels from admission to discharge. At discharge, the percentage of patients in the subclinical, mild, and moderate FACS severity levels increased while the percentage of patients in the severe and extreme FACS severity levels decreased. These findings show the positive

effect of the FRP on fear-avoidance perhaps even more than examining FACS scores continuously.

The TSK and its subscales of activity avoidance and physical functioning decreased significantly from admission to discharge in CMPD patients, providing validation evidence for the FACS. Additionally, nearly all FACS severity levels had significantly different total TSK scores, with a general trend indicating that those in the subclinical FACS severity level had the lowest TSK scores and those in the extreme severity level had the highest TSK scores. This was expected, since the construct overlap between the FACS and TSK is large. This trend also appeared for the TSK subscales of activity avoidance and physical functioning, with those in the severe and extreme FACS severity levels having significantly higher scores on both subscales than other severity levels at admission and discharge, and the subclinical FACS severity level having the lowest scores. Given that the FACS is meant to better understand patients' activity avoidance due to fear of pain or re-injury, it is unsurprising that the TSK subscales and the FACS severity levels relate well.

The IEQ and its subscales of blame/unfairness and severity/irreparability also decreased significantly from FRP admission to discharge. In general, those in the severe and extreme FACS severity levels scored significantly higher on the IEQ than other severity levels at admission, and at discharge, almost all severity levels significantly differed from each other, forming a stair-step pattern with the lower severity levels having less injustice than the higher severity levels. It is posited that fear-avoidance is highly related to injustice, especially through the catastrophizing pathway (Rodero et al., 2012). In addition, injustice remains high in whiplash patients (Ferrari, 2014; Scott, Trost, Milioto, & Sullivan, 2013), which may indicate that injustice plays a role in the hypervigilance as well, as numerous studies have found links between CSS-related disorders and FA (Barsky & Klerman, 1983; de Tommaso et al., 2003; Herbert et al., 2014). However, one study found only low correlations between FA and blame, which is part of the injustice concept (Monticone, Ferrante et al., 2014). Illness perceptions relate to FA (Albert, Coutu, & Durand, 2013), which has some overlap with the questions on the IEQ and provide additional explanation

for why FA and injustice are so related. It was expected that IEQ levels would decrease from program admission to program discharge, as similar results have been found in other work-related musculoskeletal populations (Kennedy & Dunstan, 2014).

The PHQ somatization subscale was chosen as a psychosocial variable to examine in relation to the FACS severity levels because of its close ties to hypervigilance. As with the other PROs, somatization decreased from admission to discharge, and it was found that those in the extreme FACS severity level had higher somatization scores than almost all severity levels at admission and at discharge, and that the mild and moderate FACS severity levels had higher somatization scores than the subclinical FACS severity level at discharge. It is expected that those in the extreme FACS severity level have higher somatization, as recent research has found that FA modulates the relationship between somatization and anxiety sensitivity (Cappucci & Simons, 2015), and that having higher levels of somatization will increase scores on the TSK (Feleus et al., 2007). FA and somatization were also linked in Sickle Cell patients (Pells et al., 2007).

The next variable examined in the CMPD population was pain intensity, which decreased from admission to discharge with FRP treatment in all FACS severity levels except for the subclinical level. As with the similar pattern of results shown for the FACS, it could be that subclinical FACS severity level patients aren't showing as much response to FRP treatment because their FACS scores were already quite low and they were demonstrating a floor effect. At admission, in general, those in the severe and extreme FACS severity levels had higher pain intensity scores, but at discharge, differences were more pronounced with almost all FACS severity levels significantly differing from each other, creating a stair-step pattern with the subclinical level having the least pain intensity and the extreme severity level having the most. These results are not surprising, as FA was a predictor of having long-duration pain (Nilsson, Sjödén, Dahl, & Denison, 2005).

Perceived disability was assessed in CMPD patients using two different PROs: the PDQ and the ODI. As with the other psychosocial measures discussed thus far, the ODI and PDQ total

scores, and the PDQ's functional and psychological subscale decreased in score from FRP admission to discharge, with the exception of the subclinical FACS severity level. At admission, those in the severe and extreme FACS severity levels had the highest perceived disability scores, and at discharge, these differences became more pronounced, with almost all FACS severity levels differing from each other, showing a stair-step pattern with those in the lowest levels having the least perceived disability. While the PDQ and the ODI are technically measuring the same concept, perceived disability, previous research examining the two has often shown slightly different results, with the PDQ more "in tune" with changes in CMPD patients (Asih et al., 2014; Choi et al., 2013; Gatchel, Mayer, Choi, & Chou, 2013; Hartzell et al., 2013; Hartzell et al., 2013; Hartzell et al., 2014). However, that was not the case with the pattern mixture modeling analyses, although the correlations did show a slightly different story. Perhaps the nuanced differences between the PDQ and the ODI were washed out in the pattern mixture modeling analyses because they partly look at responsiveness to treatment. It is expected that both the PDQ and the ODI would have high response to treatment, regardless of whether one focuses slightly more on psychosocial issues. In a sample of chronic low back pain patients, it was found that the best predictor of disability was FA levels (Paul, 2008). Both the FABQ and the TSK were found to relate to disability in a sample of chronic shoulder pain patients (Mintken, Cleland, Whitman, & George, 2010). Those with higher PDQ scores also had higher PASS scores (Brede et al., 2011).

CMPD patient BDI scores also significantly decreased from admission to discharge, although a time by FACS severity level interaction did not exist. At admission, it was found that the severe and extreme FACS severity levels had more depressive symptoms than all other severity levels, and at discharge, it was found that all FACS severity levels significantly differed from each other, again demonstrating the pattern that as the FACS severity levels increased, so did the amount of psychosocial distress, demonstrated for this analysis as depressive symptoms. Those with high levels of depression are more likely to have higher FA levels as well (Antunes et al., 2013), and other studies have found correlations between FA and depressive symptoms (Askary-Ashtiani et al., 2014; Gómez-Pérez, López-Martínez, & Ruiz-Párraga, 2011) although

other studies have found much lower correlations (Monticone et al., 2010) or no correlation (Morlion, Kempke, Luyten, Coppens, & Van Wambeke, 2011; Morsø, Kent, Albert, & Manniche, 2013), though depression did relate to catastrophizing (Morlion et al., 2011). It is posited that depressive symptoms may be a mediator between chronic pain maintenance and FA (Seekatz, Meng, & Faller, 2013).

ISI scores significantly decreased from admission to discharge as well, although the amount of change did not differ among the FACS severity levels. At admission, in general, those in the extreme FACS severity level had the highest clinical insomnia symptoms. At discharge, however, it was found that those in the subclinical and mild FACS severity levels had significantly lower clinical insomnia symptoms, and that those in the severe and extreme levels had significantly higher ISI scores, showing better differentiation between groups. As chronic pain and insomnia are often quite intertwined, it makes sense that with FRP treatment, insomnia would decrease in the patients who show overall decreases in the majority of their psychosocial PROs. This has been found in previous research in similar populations as well (Asih et al., 2014).

The last psychosocial measure examined with pattern mixture modeling was the CSI, which was created to better screen patients for potential central sensitivity syndromes. While this measure may not initially appear related to the FACS on the surface, further examination reveals that the constructs may overlap somewhat through the concept of hypervigilance, as well as through general psychosocial distress. Indeed, the CSI has shown responsiveness to the FRP like the other psychosocial measures, and at admission, the severe and extreme FACS severity levels demonstrated higher CSI scores than almost all other levels. At discharge, almost all FACS severity levels significantly differed from each other, demonstrating the familiar stair-step pattern, with those in the extreme FACS severity level having the highest CSI scores.

While the MPI could not be analyzed with pattern mixture modeling, it was still examined categorically with Chi-Square analyses. In general, it was found that at admission more severe FACS levels showed worse coping strategies than those in the less severe FACS levels. At discharge, a similar pattern emerged. Coping style relates well to FA, as improper coping, such

as avoiding activities that have the potential to cause pain and/or re-injury, can exacerbate the fear-avoidance cycle. In addition, social support is related to coping style, especially when measured by the MPI, since participants are answering the questions in relation to their most significant source of support, whether it be a best friend, spouse, parent, etc.. Positive social support may help patients confront their injury and fears related to it, eventually leading to successful recovery, rather than perpetuating the negative FA cycle. Lack of proper social support, such as support that encourages contemplation, may also decrease effective coping and increase the negative perceptions of illness and disability. Low levels of social support are linked to higher FA (Feleus et al., 2007; Fisher et al., 2006; Karos et al., 2014).

Prior research in this CMPD population has shown that the MPI relates well to many psychosocial factors, including pain severity, depressive symptoms, perceived disability, and PHQ diagnoses of MDD, GAD, and panic disorder (Choi et al., 2013), as well as one-year socioeconomic outcomes, including work retention, healthcare utilization, treatment dropout, and the number of new surgeries (Asih, Mayer, Williams, Choi, & Gatchel, 2015). Research has already demonstrated a link between depressive symptoms, perceived disability, psychiatric diagnoses, and work outcomes; it may be that coping style will modulate that relationship in some way. Interestingly, no significant differences existed among the anomalous or unanalyzable coper categories, and at discharge, there were no differences in the hybrid coper category. While most researchers tend to ignore these MPI categories, and believe they are “throw away” categories, in keeping with their names, some recent research has explored the differences between them, and found that the anomalous group may actually perform better than the adaptive copers (Rudy, 1989; Turk & Rudy, 1987). This was not found in current research, however.

Other literature that has compared the MPI specifically or coping styles in general (Schütze, Rees, Preece, & Schütze, 2010), have found a relationship with FA. One study found that FA helped classify approximately 75% of patients on the MPI (G. J. G. Asmundson, Norton, & Allerdings, 1997) and another found relations between the TSK and the MPI scales of interference, pain severity, life control, affective distress, and solicitous response (Lundberg et al.,

2006). Lastly, in a similar cohort of CMPD patients, the MPI was found to relate to the total PASS as well as all four subscales of avoidance/escape, fear of pain, cognitive anxiety, and somatic anxiety (Choi et al., 2013). While other FA measures have found little or no relationship with coping style (Crowley & Kendall, 1999; Hursey & Jacks, 1992); current findings are in direct opposition to previous results. These measures (Fear of Pain Questionnaire and the Fear Avoidance of Pain Scale), however, did not fully measure the entire FAM; perhaps examining it in its entirety allows for the bigger picture to be examined and thus coping style to become more of a factor.

7.4.5 Physical Differences

The four physical measure lifting tasks were also analyzed using pattern mixture modeling, and all showed an increase in physical capacity via lifting from admission to discharge. At admission, those in the extreme FACS severity levels had significantly lower lifting scores on all lifting measures (WS and FW PILE and Isokinetic lifts) than almost all other levels, and at discharge, this remained true. In addition, at discharge, those in the severe FACS severity level also had significantly lower lifting scores than almost all other levels on the PILE and WS Isokinetic lift. On the FW Isokinetic lift, those in the subclinical FACS severity level had better performance than the moderate or severe FACS severity levels.

Lifting tasks were also examined categorically by analyzing the frequency of zero scores. A zero score indicates that the patient had physical inhibition (either inability or pain-related unwillingness) to perform the lift test at all. Inability to exert any lifting force was interpreted as a proxy for extreme kinesiophobia, as patients begin the lift test by lifting at a very low weight level (2 pounds or less), and it is assumed that all patients have the ability, but not the desire (perhaps due to fear of movement, the pain associated with the movement, or reinjury), to lift this small amount of weight. Those in the subclinical and mild FACS severity levels were less likely to score a zero on the PILE and Isokinetic lift tasks at admission, while those in the extreme FACS severity level were more likely. At discharge, those in the severe FACS severity level remained

more likely to score a zero on the PILE and Isokinetic tasks, as well as those in the extreme severity level on the Isokinetic tasks.

It is assumed that physical tasks provided objective benchmarks for FA. If patients have high levels of fear of movement, they will most likely not perform well on any physical tasks, either due to severe physical deconditioning because of high avoidance of activities, or due to self-imposed inhibition of movement. One study using the PILE did find that those with high TSK scores had worse WS and FW lifting performance (Geisser et al., 2000). Previous research on FA has shown that many other physical measures are related to known fear-avoidance PROs, such as lower physical functioning in general (Crombez et al., 1999; Geisser et al., 2004; L. M. McCracken et al., 1993), strength (Al-Obaidi, Nelson, Al-Awadhi, & Al-Shuwaie, 2000; Trost, France, & Thomas, 2011) and lifting capacity (Swinkels-Meewisse, Roelofs, Oostendorp, Verbeek, & Vlaeyen, 2006), heel-rise in patients with Achilles Tendinopathy (Silbernagel, Brorsson, & Lundberg, 2011), range of motion (Crombez et al., 1994; Vaisy et al., 2014), walking ability after knee surgery (Doury-Panchout, Metivier, & Fouquet, 2014), gait speed (Camacho-Soto et al., 2012), number of falls in the elderly (Sions & Hicks, 2011), return to sports (Lentz et al., 2014), stair climbing in chronic fatigue syndrome patients (Nijs et al., 2012), and VO^2 max (R. J. E. M. Smeets et al., 2009). In addition, FA level was a significant predictor of FCE scores (Oesch et al., 2012), and those with mild or moderate FA were more likely to participate in leisure-time physical activity (Koho et al., 2011).There have been some conflicting results demonstrating no relationship between FA and any physical measures (Helmus, Schiphorst Preuper, Hof, Geertzen, & Reneman, 2012; Reneman, Schiphorts Preuper, Kleen, Geertzen, & Dijkstra, 2007), however. In general, though, the high associations with the FACS severity levels and these four lifting tasks provide perhaps the highest construct validity for this new measurement of FA.

7.5 One-year Socioeconomic Outcomes Prediction

The FACS severity levels showed significant differences for the variables of work return and work retention, demonstrating that those in the severe FACS severity level were less likely to

return to work and those in the extreme FACS severity level were less likely to both return to work and retain that work. It was also found that the FACS is a significant predictor of both work return and work retention, with patients being approximately one time less likely to return or retain work for every point increase on the FACS. In a recent study, Holden et al. found that the FABQ was able to predict work status in work-related musculoskeletal disorders as well (Holden et al., 2010), and another group found that FA was a significant predictor of work return in workers' compensation patients (Turner et al., 2006). The FABQ was also a significant predictor of work return in acute (Fritz & George, 2002) and subacute LBP (Storheim, Brox, Holm, & Bø, 2005). Return to work self-efficacy (Brouwer et al., 2011) and readiness to return to work (Franche, Corbière, Lee, Breslin, & Hepburn, 2007) are also significantly related to FA. Another study indicated that those who had both FA and somatization were five times less likely to return to work (Hart et al., 2011). In a study of multidisciplinary treatment of upper extremity disorder patients, it was found that FA was a significant predictor of work return (Meijer et al., 2006).

In addition, those with high FA were more likely to have a greater amount of sickness absence (Dawson, Schluter, Hodges, Stewart, & Turner, 2011; J. N. Jensen, Karpatschof, Labriola, & Albertsen, 2010; Nilsson et al., 2005). A high level of FA is a predictor of absenteeism (Truchon et al., 2012). No differences appeared among patients for rates of reinjury, although one study found that high FA was a significant predictor of occupational back reinjury (Keeney et al., 2013). It is surprising that no association between healthcare utilization and the FACS severity levels was found in this study. Several other studies have found associations (P. Keeley et al., 2008), although one was in children and adolescents (Simons, Sieberg, Carpino, Logan, & Berde, 2011), which means that results may not generalize well to the current population under study, which has a mean age of approximately 40. In addition, one article posited that increased healthcare utilization, such as unnecessary imaging, may increase FA and catastrophizing (Flynn, Smith, & Chou, 2011). On the other hand, patients may have increased fear and avoidance of medical procedures they may be prescribed when visiting the doctor, such as colonoscopy (A. R. Green et al., 2008; Ramos et al., 2011), mammography (Kaplan, Eisenberg, Erickson, Crane, &

Duffey, 2005; Leong, Heng, & Emmanuel, 2007), or insulin therapy (Wong et al., 2011), and this may explain why we did not see any differences in healthcare utilization.

7.6 Comparison between the FACS, TSK, & IEQ

Unfortunately, admission FACS scores did not significantly add variance to the overall predictive model of discharge psychosocial and physical lifting data in the majority of cases; only for the variables of ODI, BDI, and WS Isokinetic lift was the FACS a better predictor than the TSK or IEQ. However, it should be noted that for the remainder of the physical lifting variables, the overall models were not significant and the TSK and IEQ did not predict lifting capacity either, and that for the psychosocial measures, no overall model using the TSK and IEQ together accounted for more than 12% of the total variance. There are three possible explanations for this. First, the results may be an artifact of low sample size; particularly high samples are needed for multiple regression. Second, there are many other factors that help predict the decrease in psychosocial scores, including completion status and demographic and occupational factors. Third, previous in-house studies on lifting capacity have demonstrated that these measures do not relate as well to other psychosocial measures (such as the FACS, IEQ, or TSK), and so therefore it is not unexpected that the FACS would not be a significant predictor of lifting capacity.

7.7 Strengths and Limitations of the Present Study

7.7.1 Strengths

This study provides a strong prospectively collected but retrospectively analyzed comparison cohort analysis of the FACS. For the majority of analyses, all sample size requirements were met, and a many psychometric analyses were conducted to help provide reliability and validity evidence for the FACS. Inadequate validation of prior FA measures has been a well-voiced criticism in the field (G. J. Asmundson et al., 1999; S. Z. George et al., 2009; Lundberg et al., 2011; Pincus et al., 2010; Turk, 1992). It was imperative that thorough psychometric analysis be provided. In addition, this study was unique because it examined associations with many variables that have not been looked at before in conjunction with FA, such as psychiatric diagnoses, especially the Axis II personality disorders, and occupational

variables at admission, including job satisfaction, job demand, length of disability, and others. This study also provides severity levels for the FACS, which helps address additional criticism about the lack of clearly defined cut-offs or severity levels for the majority of prior FA measures (G. J. Asmundson et al., 1999; S. Z. George et al., 2009; Lundberg et al., 2011; Pincus et al., 2010; Turk, 1992). The design of the FACS itself also presents as strength; it was created to address the most recent fear-avoidance literature and theories, in order to be a comprehensive clinical measurement tool.

7.7.2 Limitations

Although there were numerous strengths to this study, limitations were present as well. Perhaps the largest limiting factor was that the Ns were quite small for some of the groupings, especially in the psychiatric chronic pain population when examining the psychosocial variables. However, this was offset as much as possible by utilizing bootstrapping techniques. Nevertheless, small Ns could result in overlooking some results that may actually have statistical significance, or other false conclusions. In particular, it should be noted that the Chi-Square assumption that all cells have at least 5 data points was not met, and therefore, those analyses should be interpreted with caution. Another statistical limitation was the high number of pairwise comparisons, which may have inflated Type I error, increasing the presence of statistical findings when truly none existed. This was also combatted, however, utilizing the Holm Stepdown procedure to adjust for multiple comparisons.

In addition to statistical concerns, another limitation existed in the form of generalizability. The FACS was tested in only two different populations, the CMPD cohort and the psychiatric chronic pain cohort, and thus it is difficult to say how generalizable results may be. CMPD patients in particular are known for the severity of their injury, with a number of exacerbating factors such as a long length of disability and many prior surgeries, as well as the population being primarily worker's compensation patients. In particular, research has found that those with worker's compensation claims have worse outcomes, take longer to recover, are less likely to return to work, and have higher costs than those who do not have worker's compensation claims

(Atlas et al., 2010; Carreon, Glassman, Kantamneni, Mugavin, & Djurasovic, 2010; DeBerard, Masters, Colledge, Schleusener, & Schlegel, 2001; Nguyen, Randolph, Talmage, Succop, & Travis, 2011). These differences make it vital that additional subject samples be utilized. The non-patient sample may also not have provided a good comparison match group. Very little information was known about those patients, except for whether they had current pain and if it interfered with their daily lives. No information was collected about other medical conditions or any treatment they may have been undergoing for acute or chronic pain. This provides an information gap in the present study that cannot be controlled for, and it is feasible that those undergoing treatment may show a different fear-avoidance presentation than those who are not, as they are more likely to be male (Marcus, 2003; Watkins, Wollan, Melton, & Yawn, 2006), younger (Watkins et al., 2006), and may be more likely to either feel defeated by their pain (Tang, Goodchild, Hester, & Salkovskis, 2010; Tang, Shum, Leung, Chen, & Salkovskis, 2013) or have adapted or accepted their pain (Au, Wong, McMillan, Bridges, & McGrath, 2014).

7.8 Future Directions

There are many follow-up studies to be conducted on the FACS. First is to examine the psychometric properties and response to treatment in a variety of populations, including neuropathic, cancer, burn pain patients, and arthritis patients, as well as populations with sports injuries. These populations have been studied using older FA questionnaires (Heuts et al., 2004; Kvist, Ek, Sporrstedt, & Good, 2005; Monticone et al., 2014; Nijs et al., 2012; Pells et al., 2007; Roelofs et al., 2004; Russek et al., 2014; Velthuis, Van et al., 2012; Velthuis, Peeters et al., 2012; Willebrand, Andersson, Kildal, Gerdin, & Ekselius, 2006). It is imperative to reach the typical FA audiences as soon as possible. Second, the topic of subscales for the FACS was not thoroughly addressed in this study; it would be useful to the clinical research community if the subscales of pain-related fear, activity avoidance, and victimization were further researched, first in the CMPD population, and then in the other medical populations listed above. These subscales need to be validated in their own right, to determine what patient characteristics may be associated with each fear-avoidance hallmark and to determine their predictive validity. It may even be useful to

determine cut-off scores for each subscale, to determine if a patient exhibits the principal symptoms of each scale.

Third, some of the factor analysis evidence pointed towards an abbreviated FACS scale, with only twelve items. As clinicians are always looking for ways to shorten their test battery for busy patients, it would be wonderful if creation and validation of a FACS-12 (or an even shorter version) was undertaken, with similar analyses to those mentioned here, but in a separate cohort of CMPD patients. Fourth, the association of many different variables with the FACS has yet to be analyzed. For instance, medication data on opioid, antidepressant, neuromodulators, and other drugs are available through the FRP, but have not been analyzed for relationships. Similarly, a large amount of occupational data at admission, discharge, and one-year after discharge is available, but has not been analyzed here. Although surface analyses showed that the FACS is only moderately related to occupational variables, perhaps examination of moderators and interactions would prove more insightful, especially considering that the majority of CMPD patients were injured at work. This suggests that work variables would play a large role in any aspect of their recovery process, including fear-avoidance.

Fifth, should a large body of literature on the FACS arise to support its validation, with other research labs adopting it, the FACS could be added to open-source test batteries Patient Reported Outcomes Measurement Information System (PROMIS) would be ideal as the PROMIS does not currently include any FA measure at all. Other batteries, to which the FACS (or a small selection of questions from the FACS) might be added include the Orebo Questionnaire (Hill et al., 2008) and the STarT Back Questionnaire (Hill, Vohora, Dunn, Main, & Hay, 2010; Hill et al., 2011). Not only does inclusion in these batteries give the FACS more “press time,” but it also allows continual validation evidence to be generated, from which the FACS can evolve and grow into a better measure of fear-avoidance, as other measures, such as the Oswestry and the BDI (Beck, Steer, Ball, & Ranieri, 1996; J. C. T. Fairbank, 2014; Steer, Ball, Ranieri, & Beck, 1999), have done.

Lastly, now that fear-avoidance has been identified through the FACS and TSK as being a component in the injury maintenance and/or recovery phase in CMPD patients, it is hoped that the FRP treatment can be modified slightly to incorporate modalities specific to FA, especially for those patients who fall into the severe or extreme FACS severity levels. Perhaps a few graded exposure tasks, done either with physical/occupational therapists or with counselors, might help decrease fear-avoidance even more from FRP admission to discharge. With the mean decrease being only twelve points on the FACS, this shows that perhaps further adaptation of the FRP may better assist patients in returning to work, although the mean change on the FACS is in line with the amount of mean change that has been termed effective for other FA questionnaires, such as the TSK and the FABQ (Ostelo et al., 2007).

7.9 Conclusions

Previous FA measures did not include the most updated theories of FA, were not well suited to the CMPD population, and often had lower-than-desired psychometric properties. It was necessary to develop and validate the FACS as a new measure of FA. The FACS has been thoroughly examined in this study to determine its reliability, validity, and utility as a new measure of fear-avoidance. Results showed that it has strong test-retest reliability and internal consistency among two different patient populations as well as a non-patient comparison sample, and that there is high construct validity of the FACS with other PROs measuring kinesiophobia, injustice, somatization, pain intensity, perceived disability, depressive symptoms, and coping style. In addition, the FACS was validated against objective lifting performance tasks, the Isokinetic lift and the PILE, in order to ensure it is measuring fear-avoidance of pain and re-injury. The FACS also had high treatment responsiveness to the FRP, and at one-year after discharge, related well to work return and work retention. All of these findings demonstrate that the FACS is a strong new measure of fear-avoidance.

Appendix A

The Fear-Avoidance Components Scale

FACS

Name:_____ ID #:_____ Date: ____/____/_____

Instructions: People respond to pain in different ways. We want to find out how you think and feel about your painful medical condition and how it has affected your activity level. Please think about how you have been over the past week, and circle one number between "0" and "5" from the scale below to answer each question.

5 = Completely Agree

4 = Mostly Agree

3 = Slightly Agree

2 = Slightly Disagree

1 = Mostly Disagree

0 = Completely Disagree

Over the past week, how much do you agree with these statements about your painful medical condition?	*Completely Agree*	*Mostly Agree*	*Slightly Agree*	*Slightly Disagree*	*Mostly Disagree*	*Completely Disagree*
1) I try to avoid activities and movements that make my pain worse……	5	4	3	2	1	0
2) I worry about my painful medical condition……	5	4	3	2	1	0
3) I believe that my pain will keep getting worse until I won't be able to function at all……	5	4	3	2	1	0
4) I am overwhelmed by fear when I think about my painful medical condition……	5	4	3	2	1	0
5) I don't attempt certain activities because I am fearful that I will injure (or re-injure) myself……	5	4	3	2	1	0
6) When my pain is really bad, I also have other symptoms such as nausea, difficulty breathing, heart pounding, trembling, and /or dizziness……	5	4	3	2	1	0
7) It is unfair that I have to live with my painful medical condition……	5	4	3	2	1	0
8) My painful medical condition puts me at risk for future injuries (or re-injuries) for the rest of my life……	5	4	3	2	1	0

Version 8, 4-9-2013

Continue…..

Over the past week, how much do you agree with these statements about your painful medical condition?

	Completely Agree	Mostly Agree	Slightly Agree	Slightly Disagree	Mostly Disagree	Completely Disagree
9) Because of my painful medical condition, my life will never be the same……	5	4	3	2	1	0
10) I have no control over my pain……	5	4	3	2	1	0
11) I don't attempt certain activities and movements because I am fearful that my pain will increase……	5	4	3	2	1	0
12) It is someone else's fault that I have this painful medical condition……	5	4	3	2	1	0
13) The pain from my medical condition is a warning signal that something is dangerously wrong with me……	5	4	3	2	1	0
14) No one understands how severe my painful medical condition is……	5	4	3	2	1	0

Start each of the following items with this statement: Over the past week, due to my painful medical condition I have avoided the following…

	Completely Agree	Mostly Agree	Slightly Agree	Slightly Disagree	Mostly Disagree	Completely Disagree
15) …strenuous activities (like doing heavy yard work or moving heavy furniture)……	5	4	3	2	1	0
16) …moderate activities (like cooking dinner or cleaning the house)……	5	4	3	2	1	0
17) …light activities (like going to the movies or going out to lunch)……	5	4	3	2	1	0
18) …my full duties and chores at home and/or at work……	5	4	3	2	1	0
19) …recreation and/or exercise (things that I do for fun and good health)……	5	4	3	2	1	0
20) …activities where I have to use my painful body part(s)…	5	4	3	2	1	0

Total Score: _____

Version 8, 4-9-2013

Appendix B

Historical Timeline for FACS Development and Personal Contribution

Appendix B is an outline of the historical timeline for the FACS development and my personal contribution to prior work on the FACS. For a brief overview, please see Table A1. In Fall 2011, upon examining initial data collected at PRIDE on the TSK, and after undertaking a brief literature search, the PRIDE research team determined that a new, more comprehensive measure of FA was required. I was a part of the interdisciplinary team that helped develop the FACS (I am listed as a health psychologist), and contributed regularly to the concepts the FACS should cover and helped develop item wording and order. By Spring 2012, our research group had settled on a version of the FACS they liked and agreed upon, and distribution of the FACS to both the CMPD and the non-patient comparison sample was undertaken. I helped determine the protocol for data collection. Although I was not on the initial IRB protocol for the non-patient sample, I was added approximately six months later.

In Fall 2012, a new team member began a limited analysis of FACS data, which consisted only of test-retest reliability. When this member unexpectedly left the program in 2013,, it was discovered that those analyses were inaccurate. At that point, I acquired the FACS project along with a junior team member. The junior team member conducted the test-retest reliability, Cronbach's alpha, corrected item totals, and exploratory factor analyses under my supervision. Once the FACS became my dissertation project, I assumed responsibility for all subsequent analyses, including rerunning initial analyses with larger Ns. In Spring 2014 the PRIDE research lab began developing a manuscript on the validation of the FACS that included only reliability, validity, and factor analysis information.

I co-authored that manuscript, which was entitled "the Fear-Avoidance Components Scale (FACS): Development and Psychometric Evaluation of a New Measure of Pain-Related Fear-Avoidance," and contributed all data analyses as well as substantial writing in the methods, results, and discussion section. This manuscript, submitted to PAIN, was rejected in Summer 2014. It was determined that in order to publish the FACS, we would need to make substantial changes, including collecting a larger non-patient comparison sample as well as the psychiatric chronic pain sample. I directed data collection of the psychiatric chronic pain sample, working 8

hours per week on the task myself as well as including 6 other undergraduate assistants to ensure timely delivery. I also initiated data collection for the non-patients.

In Fall 2014, analyses for an entirely new FACS manuscript began. A series of factor analyses were conducted, in order to determine whether items should be removed to make the FACS psychometrically sound. Then initial examination of severity levels began, by comparing the different sample population FACS means. As seen in this document, a consensus was reached on which severity levels to use, and this manuscript was submitted for publication once more in February 2015. I am a co-author on the publication and completed all analyses and much of the literature review sections in the introduction and discussion sections.

Table A.0.1 Historical timeline for FACS development and personal contribution

Date	What was Done	My Contribution
Fall 2011	Created the FACS	• Part of the interdisciplinary creation team. • Helped with item content, wording, and order.
Spring 2012	FACS distributed to CMPD patients and non-patient controls.	• Helped determine protocol. • Was later added to the IRB protocol.
Fall 2012	Limited examination of FACS data	• Determined analyses were inaccurate.
Spring & Fall 2013	Initial Psychometric Analyses	• Supervised juior student initially. • Redid all analyses upon undertaking dissertation.
Spring 2014	Manuscript Preparation	• Contributed writing and data analyses
Summer 2014	• Manuscript Rejection • Renewal of data collection	• Orchestrated new data collection and participated
Fall 2014	• New Manuscript Analyses • Dissertation Proposal	• Factor analysis already completed • All other analyses listed in proposal have not yet been conducted.
Spring 2015	• New Manuscript Submitted • Dissertation Defended	• All analyses • Literature review • The entirety of this document

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