PERSONALITY AND PSYCHOPATHOLOGY AS PREDICTORS OF OUTCOME FOLLOWING IMPLANTATION WITH A PAIN MANAGEMENT DEVICE

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Dedication

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CHAPTER ONE

Introduction

Most people have an understanding of the experience of pain; often described as a throbbing, stabbing, burning, or sharp sensation. Most frequently, tissue heals and the pain resolves. Unfortunately in some cases, pain persists beyond resolution of the acute injury and becomes chronic; leading to a pain of new form and meaning. Millions of people around the world suffer from chronic pain, an often-exasperating condition that drains its victims physically, emotionally, spiritually, financially, and mentally. The desperation of the chronic pain patient often leads to the search for anything that may bring relief, such as the newest drug on the market, or costly contraptions and machines. Patients may also transition from specialist to specialist in search of the cure to their pain. The toll of chronic pain can be overwhelming; affecting one's sense of self and well-being, their role in the family and social worlds, and the ability to work. More simply put, chronic pain affects, in one way or another, all aspects of the patient's life. On a personal and societal level, the cost of chronic pain is devastating. The financial burden, both personally and institutionally, is tremendous. This is an extremely pervasive medical problem in the United States and affects more than 50 million Americans. Considering health care expenses, lost income, and lost productivity, the estimated annual cost is $70 billion (Gatchel & Mayer, 2000).

Although a common experience, pain is a complex and dynamic process. According to the International Association for the Study of Pain (IASP), pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Merskey & Bogduk, 1994, p. 210). The experience of pain, according to this definition, is a combination of several factors: a sensory, emotional, and physical experience; collaboration of the mind and the body; with the incorporation the individual's thoughts and secondary behaviors (Turk, Meichenbaum, & Genest, 1983). Pain is also a subjective experience; one not easily measured. Given the diversity of factors associated with the pain experience, it is understandable that no diagnostic tool designed to obtain a purely objective measure of pain exists.

Despite the varying experiences and expressions of pain, one quantifiable component exists which allows for the differentiation of a subtype binary: acute and chronic, based on the duration of pain symptoms. Most people are familiar with the acute pain experience, which may vary from benign injuries, such as stubbing a toe, to more complex injuries, such as a bone fracture. In most of these cases, the injured tissue heals, the pain eventually subsides, and normal life is resumed. In some cases, with or without the restoration of damaged tissue, pain persists past what would be considered reasonable. In this case, pain is deemed chronic and often dramatically affects the treatment plan and the perceptions of the patient and those involved in their care.

The biopsychosocial model of pain; which incorporates physical, psychological, and social factors associated with pain, highlights the connection between the mind and body when interpreting the pain experience. This model is generally accepted by clinicians and researchers as the most accurate and comprehensive, and is therefore used to guide treatment plans and interventions with chronic pain patients. Throughout history; however, the medical community has vacillated between both ends of the mind-body connection spectrum. History has demonstrated acceptance of models depicting complete separation of mind and body and the opposite, which acknowledges the complete connectedness between the two. Collectively, the models and hypotheses of the past have contributed to the current understanding of the pain experience; which now includes a variety of psychological and social factors in addition to the physiologic signs and symptoms. Therefore, assessing and identifying these psychological and social factors is important to understanding how the patient interprets their experience of pain, reactions to pain, and responses to various treatment modalities. Furthermore, psychological and social factors can significantly influence the degree to which the patient reports pain relief, their satisfaction with their care providers, and interventions aimed at pain reduction.

In an attempt to battle chronic pain, patients will often try a variety of treatments, for example: oral pain medications, physical therapy, orthopedic surgery, osteopathic manipulation/chiropractic treatment, and naturopathic therapy. Patients vary significantly in their responses to treatments, some finding relief early on in the treatment process and others who find little relief, if any, from most of the treatments attempted. Often after several failed attempts, patients are referred to specialists trained in chronic pain management. In some cases even with a highly specialized pain treatment plan, patients find only minimal pain relief, experience unwanted/unpleasant side effects, and/or have difficulty tolerating treatments for a variety of reasons. Such dissatisfaction with more conservative and traditional front-line means of treatment may lead medical care providers to consider treatment with an implantable pain management device; a more invasive and complex treatment option. Two types of implantable devices that are used to treat chronic pain include: spinal cord stimulators (SCS) or intrathecal drug delivery systems (IDDS, "drug pump"). A SCS, once implanted generates mild electrical signals, which then travel to the spinal cord, and interrupt pain signals to the brain. The patient feels the tingling sensation of the electrical signal, which serves to mask or dull the pain. With an IDDS, the patient receives medication directly to the fluid around the spinal cord, which is referred to as the intrathecal space. The IDDS controls pain by releasing medication directly to the pain receptors in the spine. The goal of implanted pain management therapy is to improve the patient's quality of life by providing increased pain relief with the possibility of reduced morphine load, allowing for an increase in functional ability and decrease in perceived disability.

Implantation with a SCS or IDDS is not universally successful. Poor outcome can be the result of surgical factors, the patient's physiology, and/or the constellation of psychological and social factors. These implantable devices are now considered the standard of care for those struggling with intractable pain. However, as with any medical device or procedure, the pain implants are costly and the procedure is invasive, carrying several risks. Given these factors, determining which patients are most likely to benefit from the procedure in the pre-surgical period has several significant benefits to all involved parties, especially the physician and the patient. Physicians are able to determine a patient's medical appropriateness for such procedures and often rely on psychologists to assess for psychological and social factors likely to impact outcome. Therefore, physicians and insurance companies often require pre-surgical psychological evaluations prior to implantation. As the psychological evaluation is an important component of the process, investing in refining and improving the process is therefore likely to have significant benefits for all stakeholders, in that this would allow for revisions of treatment plans and assist in finding the most effective and individualized treatment. These evaluations also assist in determining the most appropriate allocation of resources, with the goal of providing the best care possible to patients considering this form of treatment.

Pre-surgical psychological evaluations are commonly used in a variety of medical specialties, including: solid organ and bone marrow transplant, bariatric surgery, post-mastectomy breast reconstruction surgery, and neurosurgery. A significant body of research has demonstrated the usefulness of these evaluations in screening patients before these and other medical procedures. Unfortunately, the research on the use of pre-surgical psychological evaluations for patients considering implantation with a pain management device is limited. However, there has been a great deal of research investigating the psychology of spine surgery, and the findings produced in this research often guide the psychologist's clinical decision when making recommendations for pain device implant surgery. Although spine surgery research may be used as a guide, it cannot be considered completely generalizable to this form of surgery due to the differences in these procedures and nature of the treatments. Further investigation into the field of pain management devices is warranted, with a goal of improving the psychologist's clinical decision making process that will likely positively impacted the outcome and treatment choices made by patients and their providers. A pre-surgical psychological evaluation for implanted device candidates is generally aimed at assessing the patient's current emotional adjustment and adaptation to the chronic pain condition, expectations regarding treatment, and willingness to comply with multi-disciplinary pain treatment. The evaluation should also include an assessment of co-morbid psychological symptoms and emotional/psychosocial factors that could influence surgical treatment outcome and address medical compliance prognosis.

Given the lack of research in the area of pre-surgical psychological evaluations prior to implantation with pain management devices, the question remains regarding which specific psychological factors play the greatest role in determining successful outcome. The aim of this study is to determine which psychological factors, above and beyond others, are most influential in surgical outcome following implantation with one of these devices.

CHAPTER TWO

Review of the Literature

Historical Medical Models

Historically, the medical community has taken differing views regarding the conceptualization and explanation of the mind-body connection. Early theories focused on the role of religion and demonic possession in illness. With more advanced knowledge came additional hypotheses regarding disease models. Hippocrates, the ancient Greek physician and “father of Western Medicine” presented a disease model based on the balance of the four humors of the body. He removed disease from the religious context, presenting a model based on naturally occurring physiological processes. Hippocrates’ model suggested an imbalance of fluids in the body; blood, black bile, yellow bile, and phlegm, caused illness. He proposed fluids circulate throughout the body and are responsible for attributes of an individual’s personality and temperament, in addition to physical and mental illnesses (Gatchel, 1999). In this way, Hippocrates noted the interaction between the biological components and psychological/personality factors. It was believed that the mind and the body were of one system; each played an important role in disease.

During these very early stages of medicine, knowledge of physical anatomy was limited and human dissection was taboo, limiting the early physician’s ability to gain more knowledge and understanding of the human anatomy. The limited available information coupled with the lack of diagnostic tools and technology, lead to the creation of purely speculative disease models. Medical advancement through the 17th century allowed for a more accurate understanding of anatomy and improved understanding of disease processes. With increased knowledge came increased attention and evolving theories related to the mind-body connection (Gatchel, 1999).

In the next phase of theoretical models, a strong demarcation was established between the mind and the body in an attempt to move away from the superstitious views of the past. In this way, physicians were to treat the body and philosophers and theologians were to address issues of the mind. Diagnosis and treatment of illness was based solely on physical evidence (Taylor, 1999). Gatchel (1999) suggests this marks the beginning of the biomedical reduction tradition. According to this approach, physical functioning and behavior would no longer be connected to concepts of the mind or soul. Rene Descartes (1596-1650), a French philosopher, popularized this dualistic model. According to Descartes, the mind was considered parallel to the body; as such they were completely two separate entities incapable of affecting the other (Gatchel, 1999).

With his early work on hysteria, Freud brought awareness to the interplay between psychological and physical factors. According to his theory, unconscious psychological conflict manifests in physical symptoms without a physiological cause. Freud (1895) proposed that somatic/physiologic reactions were often the result of unconscious emotional conflict. Therefore, the unconscious emotional experience manifests in physical symptoms. This was a significant contribution both to the field of medicine and psychology.

Despite Freud's contribution, the continued growth and development of modern psychology and psychiatry, brought increased acceptance of the monistic approach (Gatchel, 1999). However, the development of cognitive-behavioral perspective in the 1970's brought more scientifically based support for the connection between mental and physical states of health and illness. These developments spurred the progression and interest in psychosomatic medicine; illnesses thought to be caused by emotional conflict, though more in the psychological than medical communities.

Evolution of the Biopsychosocial Model

The biomedical model was widely accepted and followed in the medical community at the time George Engel (1977) called for a reform. According to the biomedical model, disease was to be defined strictly by biomedical markers. In this way, the primary focus was on test results and imaging studies, which provided doctors with objective data regarding physiologic processes needed for diagnoses.

Engel, a psychiatrist, was disturbed by the reductionist biomedical model and encouraged those in the medical field to expand their understandings of the disease process. Engel (1977) saw the world of medicine in a “crisis,” as a result of “adherence to a model of disease no longer adequate for the scientific tasks and social responsibilities of either medicine or psychiatry” (p. 129). He believed that the biomedical model had become dogmatic; instead of abandoning the theory when it failed to account for data, as would be the standard in science, the data were forced to fit the model. Symptoms were to be considered a disease if and only if they fit the biomedical standard via objective, physiologic markers. Therefore, the body came to be viewed as a machine and diseases were to be understood as results of mechanical breakdown. The role of the doctor was to repair the machine (Engel, 1977). The narrow focus of the biomedical model, Engel notes, made it extremely successful and globally adaptable. But this success came with costs.

The biomedical model neglects the human experience of illness. In his argument, Engel (1977) notes that biomedical markers may suggest the presence of a disease; however, the patient may not feel sick nor be complaining of any symptoms. Engel (1977) argued then that biomedical markers are to be seen as “necessary but not sufficient condition for the occurrence of the human experience of the disease, the illness" (p. 131). A model with further "frames of reference" and "additional concepts" to fully understand illness was needed. He contested that without considering how the illness is expressed both psychologically and behaviorally, the biomedical indicators serve very little purpose. Basing decision-making solely on biomedical markers may lead to unnecessary treatment for those who complain of no symptoms, or dismissal from medical care when a patient presents to their physician complaining of symptoms typically associated with disease, but have no physiological markers suggesting disease. Objective test results and physiologic manifestations of the disease, that is, the biomedical defect, fail to consider other pertinent factors that may be associated with the patient's presentation.

Engel (1977) argues that how physiologic symptoms are experienced and reported are the function of many psychological, social, and cultural factors. By relying on objective tests alone, health care providers disregard the patient's verbal account of their illness experience. Even the language used by the patient and the way they go about reporting their symptoms is influenced by psychological and social factors, as well as their historical experiences within the medical system and communicating with others. Engel (1977) suggests that verbal expressions regarding physiologic symptoms are developed from bodily experiences during childhood. Thus, language becomes personalized and ambiguous, with individual meanings. "Hence the same words may serve to express primary psychological as well as bodily disturbances, both of which may coexist and overlap in complex ways" (p. 132). What Engel (1977) suggests here is that symptoms of apparent physical ailments reported by the patient could actually and very easily be accounted for by psychological factors. Engel (1977) further highlights the importance of "conditions of life and living" as significant variables in the disease process, he explains “psychophysiologic responses to life change may interact with existing somatic factors to alter susceptibility and thereby influence the time of onset, the severity, and the course of a disease” (p. 132).

Psychological and social factors also influence whether and at what point a person with a physiologic abnormality decides they are sick and are viewed by others as sick. Engel (1977) presented several ideas to support this hypothesis. He argued that biochemical markers alone do not determine when the patient will become sick and/or adapt the sick role. Another point of contention regarding the biomedical model, according to Engel’s argument, is the failure of the “rational treatment” approach in some instances [as quoted by Kety (1974) in Engel (1977)]. Sometimes treatments aimed solely at the repair and resolutions of biomedical abnormalities fail to restore the individual back to health, despite complete or nearly complete correction or alleviation of the abnormality. Engel (1977) suggests that solely targeting the somatic defects does not necessarily solve health problems, there may be psychological and social factors at play, which may actually maintain the sick role, even after the physical problem has resolved. He also noted that the relationship between the patient and the care provider often impacts the outcome of the illness.

Taking all of these issues together, Engel proposed a new framework for medicine. In support of a new, biopsychosocial model, Engel (1977) called for a new understanding of disease that would provide a backdrop to understanding the cause and perpetuation of disease and help guide the physician in treatment planning. He argues, “a medical model must also take into account the patient, the social context in which he lives, and the complementary system devised by society to deal with the disruptive effects of illness, that is, the physician role and the health care system” (p. 132). Historically, the role of the physician has been to determine when one is “sick” versus “well,” and is to then diagnose, understand, and treat the disease. This is not a clear-cut process, however, as the demarcation between being sick and being well is vague, clouded by various cultural, social, and psychological influences. It then becomes the physician’s responsibility to take these various influences into account when diagnosing and treating a patient. With the evaluation of these factors, the physician gains an understanding of how the patient is interpreting their symptoms, when and if they determine to adapt the sick role and enter the medical system. At the time of this publication, Engel (1977) was calling for change, challenging medical professionals to take a broader look at their patients and consider more than test scores and objective measures when assessing disease.

Psychological and Social Factors and Health

The progression from the reductionist biomedical model to the more complex and comprehensive biopsychosocial model has taken time for global adaptation. Understanding and accepting the role of psychological and social factors in health has been bolstered by a vast amount of clinical research. This ultimately led to a new way of thinking about health and illness. There was a move away from relying strictly on biomedical markers of disease accompanied by the push to consider the patient’s experience of their symptoms, all while exploring the psychological and social aspects impacting the presentation. Researchers and clinicians sought to investigate psychological and social factors which not only contribute to disease, but also those that keep people healthy. A great deal of research indicates the profoundly significant impact of psychosocial factors on health, a connection much stronger than would have been assumed at the early stages of this type of research (see for example, Dubos, 1959; Illich, 1976; Sagan, 1987; and Wilkinson, 1996). Research highlighting the impact of psychological and social factors on health and wellness, exercise, immune function, cardiovascular health, and disease onset fill literature reviews and health psychology and medical textbooks alike. All physiologic systems of the body are subject to influence by psychological and social factors, as they are interwoven within the complex dynamics of health and illness.

The psychological components associated with health and illness may include factors such as overall mental health, beliefs about health, stress, and coping strategies, whereas the social component may include culture, family, and social support factors. Not only do these factors serve as protective or deleterious components of health and impact the onset and duration of illness, they also play a significant role in how the patient responds once they are a part of the medical system. “Individuals differ significantly in how frequently they report physical symptoms, in their tendency to visit physicians when experiencing identical symptoms, and in their responses to the same treatments. Quite frequently, the nature of patient’s responses to treatment has little to do with their objective physical conditions” (Gatchel & Maddrey, 2004 p. 360-361). Research clearly suggests that these factors are at the root of one’s interpretation of health and illness, suggesting that a variety of factors can and do influence the way one understands, interprets, and reports their symptoms, while also impacting the outcome of any prescribed treatment.

Though many in the medical field acknowledge the importance of psychological and social factors in disease, their role is to first explore physiologic signs and symptoms. Clinical research in medicine is designed to assess the biomedical efficacy of treatments, which provides the rational for implementing a treatment plan (Sheridan & Radmacher, 2003). The laboratory setting, with closely monitored and controlled variables, provides an environment free from important psychological and social aspects of the individual’s experience in the real world. Therefore, treatment efficacy studies, which fail to take into consideration the importance of psychological and social factors, suffer limited generalizability. Financial, family, and cognitive factors, for example, all impact the way a patient understands, interprets, and carries out the doctor’s instructions. Treatments become much less effective when the patient does not understand the instructions or the treatment extends beyond the patient’s value system, or simply when treatments are not taken or followed as prescribed.

Several areas of personality and psychological functioning have been addressed in the research, which are thought to play a role in the onset of the disease process and the course of illness (Ricci Bitti, Gremigni, Bertolotti, & Zotti, 1995). One area of interest for health psychologists and those in the medical field has been the impact of personality on health. Gorfinkle and Tager (2003) explain, “personality factors interact in a nonlinear fashion with environmental and physiological processes in ways that may either predispose one to disease, or conversely act as a protective buffer against illness” (p. 40). In this way, personality factors can both work to the detriment and benefit of health. A closer look into the role of psychological factors on health has revealed that factors such as mechanisms for coping, depression, and personality play a role in health and disease processes (Kobasa, 1990; Friedman, 1990; Suls & Rittenhouse, 1990).

Health psychology research has noted the impact of stress on health. Martin and Brantley (2004) note the abundance of literature demonstrating the correlations between psychological distress and symptom presentation in both acute and chronic illness. Correlations have been consistently found for “infectious diseases, cancer, cardiovascular disease, and chronic conditions such as diabetes, asthma, and gastrointestinal disorders" (p. 239). There has been a significant amount of research suggesting the role of stress on specific areas of health, for example, stress and immune functioning, (Glaser et al., 1987; Kiecolt-Glaser & Glaser, 1988; Glaser, Kiecolt-Glaser, Speicher, & Holliday, 1985; Kiecolt-Glaser et al., 1984; Cobb & Steptoe, 1996), and stress and cancer (Linn, Linn, & Jensen, 1982; Shekelle et al., 1981; Bartrop, Luckhurst, Lazarus, Kiloh, & Penny, 1997; Pettingale, Hussein, Inayat, & Tee, 1994). Research has also demonstrated the connection between stress, Type A behavior pattern, and cardiovascular disease (Kop, 1997; Rozanski et al., 1988; Twisk, Snel, Kemper, & van Mechelen, 1999), and stress and weight gain (Gerace & George, 1996; Vitaliano, Russo, Scanlan, & Greeno, 1996; Seematter et al., 2000; Davis, Twamley, Hamilton, & Swan, 1999).

Not only has stress been implicated in several diseases, research has also suggested that stress decreases the amount of positive health behaviors, such as following a healthy diet and exercise regimen (Lindquist, Beilin, & Knuiman, 1997; Stetson, Rahn, Dubbert, Wilner, & Mercury, 1997) and increases maladaptive health behaviors including alcohol consumption, overeating, and tobacco use (Martin & Brantley, 2004). It is also significant to note that chronic illness, including chronic pain, is considered one of the major life stressors.

There has also been a great deal of interest in the relationship between coping mechanisms and health. Although "coping" is a difficult construct to define, it is generally defined according to areas of function: affective, physiological, behavioral, and cognitive; and includes the evaluation and management of stressful circumstances and situations (Martin & Brantley, 2004). In general, the research suggests that active and adaptive behavioral coping is associated with positive outcome in patients with a variety of health conditions. Maladaptive and avoidant coping strategies are more likely tied to negative outcomes (Mulder, Antoni, Duivenvoorden, Kauffmann, & Goodkin, 1995). Coping mechanisms and strategies become particularly important when health conditions become chronic.

Social support has also become a key issue in health psychology research. It has been noted that social support has a direct positive effect on health; improving the sense of well-being and self-worth (Cohen & Wills, 1985). Cohen and Wills (1985) proposed the Buffer Hypothesis, which suggests that social support protects the individual from negative effects of stress by serving as a “shield” or “buffer.” Social support may also decrease disease susceptibility via improved neuroendocrine function (Davis & Swan, 1999). Research also notes decreased suicide rates with increased social support (Durkeim, 1951), and beneficial health effects with marriage (although more for males than females, see: Martin and Brantley, 2004 for review). Researchers have also investigated the effect of social support on particular illnesses and suggested the positive effect on several conditions: coronary heart disease (King, 1997), diabetes (Gary-Seville et al., 1995), cancer (Helgeson & Cohen, 1996), HIV disease (Green & Kocsis, 1996), and obesity (Wing & Jeffrey, 1999).

With aspects of both coping mechanism characteristics and an avenue for social support, religion and spirituality have also been found to be associated with well-being (Ellison, 1991; Koenig, 1994; Pargament & Brant, 1998). Those with strong commitments to spirituality and faith are healthier than those who demonstrate a weaker commitment (Ellison & Fran, 2008; Patrick & Kinney, 2003; Levin & Chatters, 1998).

Early in the history of psychology, Breuer and Freud (1895) noted treatment cases in which distressing physical symptoms were experienced in the absence of physiologic pathology. Referred to as hysteric symptoms at the time, modern psychology now refers to this condition under the umbrella of somatoform disorders. As defined by the American Psychiatric Association (APA):

> The common feature of the Somatoform Disorders is the presence of physical symptoms that suggest a general medical condition (hence, the term *somatoform*) and are not fully explained by a general medical condition, by the direct effects of a substance, or by another mental disorder (e.g., Panic Disorder)...Somatoform Disorders differ from Psychology Factors Affecting Medical Condition in that there is no diagnosable general medical condition to fully account for the physical symptoms…These disorders are often encountered in the general medical setting (p. 485).

The research suggests that patients with somatic symptoms that cannot be medically explained are more likely to have an Axis I psychological disorder, especially depression and/or anxiety, than those without somatic symptoms (Reilly, Baker, Rhodes, & Salmon, 1999; Katon & Walker, 1998). Not only can psychological distress result in somatic symptoms from autonomic arousal (Katon & Walker, 1998), but somatoform disorders have also been associated with several personality traits (Russo, Katon, Sullivan, Clark, & Buchwald, 1994; Katon & Walker, 1998). Two examples include: neuroticism (Webb, 1983; Russo et al., 1994) and internalizing behaviors (Engel, 1959; Terre & Ghiselli, 1997; Campo, Jansen-McWilliams, Comer, & Kelleher, 1999). Somatoform disorders have also been associated with personality disorders (Kernberg, 1984).

In some cases, the medical condition itself is responsible for the onset of the mental disorder. The APA notes, “in some cases it is clear that the general medical condition is directly etiological to the development of worsening of mental symptoms and that the mechanism for this effect is physiological" (p. 29). When a diagnosis of Mental Disorders Due to a General Medical Condition is given, it implies the psychological symptoms are the direct result of the medical condition.

Early Theories of Pain

The evolution of theories designed to better understand the etiology and treatment of pain closely parallels the changes that occurred in general medicine (Gatchel & Maddrey, 2004). According Descartes' 1644 theory on pain, the pain system involved the sensory nervous system, with a direct path from the skin to the brain. Gatchel (1999) explains Descartes presented an analogy of pain like the ringing of a church bell; when the rope is pulled at the bottom of the tower, the bell rings up in the belfry. This was equated to applying flame to the bottom of the foot. It was proposed that doing so initiates activity in the particles of the foot, which then travel up the body to the head. Once the signal reaches the brain, an alarm system is engaged which triggers the person to feel the pain and respond to it.

A more formalized model of pain was proposed by von Frey in 1894, as reported by Melzack and Wall (1965), called the Specific Theory of Pain. According to this model, specific and individualized receptors on the skin were responsible for the transmission of sensations such as pain, pressure, and touch, for example. Therefore, suggesting the existence of a specific bodily system for pain. Similarly to other bodily sensations, pain was thought to have both central and peripheral mechanisms (Gatchel, 1999). There was a psychological component to this theory, with the implication that the pain receptor on the skin transmitted a signal to the area of the brain that experienced pain. Therefore, when these particular receptors were stimulated, pain and only pain would be experienced (Melzack & Wall, 1965).

Around the same time the Specific Theory of Pain was developed, an alternative model was proposed by Goldschneider (1894), referred to as the Pattern Theory of Pain, as pointed out by Melzack and Wall (1965). The pattern theory suggested that in order for one to experience pain, a system needs a pattern of activation of neuronal activity. Goldschneider's (1894) conceptualization stated that with stimulation, nerve impulses were "patterned" at the site of peripheral stimulation and were then discharged. He proposed the variations in the manifestations of the nerve impulses at the site influenced how the sensation is experienced. For example, the light brush of fingers across the skin will feel like a soft touch, whereas a sharp poke to the arm will be experienced as pain. The differences in experiences were hypothesized to be the result of the amount of discharge, which was then thus processed or "coded" by the central nervous system. Where the Specific Theory of Pain proposed a direct connection between the pain receptor and the pain site, the Pattern Theory of Pain suggested the peripheral stimulation was processed and labeled by the central nervous system in order for the sensation to be experienced (Gatchel, 1999).

Both of these theories provided new information for a more comprehensive understanding of the pain experience. However, they were both flawed in some ways, failing to completely explain the pain process. The insufficient explanations spurred questions regarding the affect of psychological factors on the pain experience (Gatchel, 1999). Therefore, in an attempt to expand on the Specific Theory and Pattern Theory of Pain, Melzack and Wall (1965) proposed the Gate Control Theory of Pain. According to their theory, there were many different factors associated with how pain is experienced. Sensory information is processed and modulated by a gate control system prior to setting off the perception and response to pain. Once the skin is stimulated, nerve impulses are transmitted to three spinal cord systems. These systems are described as "the cells of the substantia gelatinosa in the dorsal horn, the dorsal-column fibers that project toward the brain, and the first central transmission cells in the dorsal horn" (Melzack & Wall, 1965, p. 974). The interaction between these three systems determines how pain is experienced. They proposed that large and small diameter fibers are transmitted from the skin to the substantia gelatinosa in the spinal cord, which then acts as the gate control system by modulating the synaptic transmission of the nerve impulses from the peripheral fibers to the central cells. The substantia gelatinosa contains cells that determine the excitatory effect of the arriving impulses. There are several components involved in the opening and closing of the gate and the firing of transmission cells to the brain. Once a critical level is reached or exceeded, based on the output of transmission cells, the action system responsible for the experience of pain and response to pain is set into action (Melzack & Wall, 1965). Once triggered, a sequence of responses by the action system is initiated; such as a startle response, autonomic responses, and orientation of head and eyes to examine injured area of the body. The purpose of these actions is to reduce the sensory and affective mechanisms associated with the pain experience. Therefore, people may rub the injured area or avoid or pull back from a stimulus. This has been referred to as a "pain response" and "pain sensation." Melzack and Wall (1965) argue this response to pain perception involves a variety of systems throughout the brain, rather than a singular "pain center." When considering pain perception and action system, prior experiences and conditioning become influential.

Melzack and Wall were motivated to develop a more comprehensive model to explain the pain experience; to explain components and experiences that were not accounted for in other theories. The Specific Theory of Pain suggests the communication between the skin and the brain is a direct line. In argument of this theory, Melzack and Wall (1965) propose several arguments against the idea of direct-line communication, based on several pain conditions, that is, causalgia, phantom limb pain, and the peripheral neuralgias. First, these pain conditions are not resolved with surgical interventions at the peripheral and/or central nervous system. Second, they argue gentle sensations and vibrations can elicit agonizing pain, which negates the idea of pathologically hypersensitive pain receptors. In the third argument, they relate that pain sensations can move to different areas of the body, often to areas without pathology. Finally, it was reported that in areas where skin has become hyperalgesic (increased sensitivity to pain), pain will often be experienced after a long delay following exposure to a stimulus and may persist after removal of the stimulus. Another flaw of the specificity theory, according to Melzack and Wall (1965), is that a "one-to-one relationship between pain perception and intensity of the stimulus" (p. 972) was not supported. Rather, they suggested that the perception of pain is significantly influenced by a variety of psychological variables.

They conclude that their theory has improved on others in that it can "account for the hyperalgesia, spontaneous pain, and long delays after stimulation characteristic of pathological pain syndromes" (Melzack & Wall, 1965, p. 977). The theory further accounts for pain experienced in some conditions elicited by non-damaging or un-painful stimuli and spontaneous pain. They also propose it accounts for referred pain, spread of pain, and pain located at a distance from the original injury site, based on summation mechanisms. They relate, "the model suggests that psychological factors such as past experience, attention, and emotion influence pain response and perception by acting on the gate control system" (Melzack & Wall, 1965, p. 978).

Biopsychosocial Model and Pain

The biopsychosocial model has become the widely used framework to aid in understanding the pain experience. The concept of pain itself is rather complex and multifaceted, and is best understood in terms of this model that highlights the complex interaction between biological, psychological, and social components. Pain, from the biological perspective, is defined in terms of the physiologic pathology, which could include nerve damage, broken bones, and/or other various bodily injuries. The psychological components of the pain experience are vast, including the potentially predisposing components, secondary mood disturbances, and/or psychological variables maintaining the sick role for the patient. Thirdly, various social aspects also play a key role in the individual's experience of pain. Family and culture aspects must be taken into consideration, for example. It is these components taken together which influence how pain is developed, and the course, exacerbation, and perpetuation of pain.

There are several components worth exploring when considering the application of the biopsychosocial model and pain. It has been suggested throughout the literature that individual's have very unique experiences of pain. An individual meaning associated with the word "pain" can be learned very early on in life, formed during experiences of injury and pain. It is further molded by variations in intensity and sensation (Merskey & Bogduk, 1994), how others respond to the individual in pain, and the other various social and psychological ramifications of pain. This "pain template" is developed, adapted, and applied throughout the lifetime. This intertwined and coevolved theory of the pain experience does not allow for the sensation of pain to be broken down to the individual components; which include physiological, psychological, and social factors. This multifaceted understanding becomes all the more important when pain is persistent, as the complex relationships and ebbs and flows associated with these factors interact and modulate the patient's experience and their life (Gatchel & Maddrey, 2004).

Biological, Psychological, and Social Aspects of Pain

Biological.

The physiology of pain: The pain impulse enters the spinal cord and is synapsed primarily on the dorsal horn and substantia gelatinosa. Beyond this point, the "nociceptive information ascends to the thalamus in the contralateral spinothalamic tract (STT) and to the medulla and brainstem via a spinoreticular (spinoparabrachial) and spinomesencephalic tracts" (Tracey & Mantyh, 2007, p. 378). It is suggested that the brainstem plays a role in mediating changes in pain perception. Tracey and Mantyh (2007) note researchers are still questioning the exact role of the thalamus in human pain processing; however, the connection between the thalamus and pain experience is made clear in past research.

Pain researchers describe the "pain matrix" when explaining the multifactorial experience; simplistically it can be thought of as having lateral (sensory-discriminatory) and medial (affective-cognitive evaluative) neuroanatomical components (Albe-Fessard, Berkley, Kruger, Ralston, & Willis, 1985). A variety of brain regions are therefore involved, especially given the variety of factors which tend to influence pain perception, such as mood, injury, and cognitive functioning (Tracey & Mantyh, 2007).

Considering the neuroanatomical components involved in the perception of pain, researchers have questioned how it is that the brain influences pain perception. The descending pathways are described to modulate the pain experience, either inhibiting or facilitating pain (Fields & Basbaum, 2005). The descending pathways facilitate pain transmission, and it is suggested that continuous activation of these pathways that may play a role in chronic pain (as noted in Tracey & Mantyh, 2007; see Gebhart, 2004; Porreca, Ossipov, & Gebhart, 2002; Suzuki, Rygh, & Dickerson, 2004).

Understanding the underlying physiologic components of pain allows for a more thorough conceptualization of the patient's experience. There are several key terms to define related to the biological components. *Nociceptors*, or pain receptors, are defined by the ISAP as "a receptor preferentially sensitive to tissue trauma or to a stimulus that would damage tissue if prolonged" (Merskey & Bogduk, 1994). Nociceptors are a key component in understanding the mechanisms and subsequently, the treatment of pain. They are located on the skin, in the joints, and on muscle tissue and viscera (Gold & Gebhart, 2010). Accordingly, pain receptors respond to *noxious stimuli*, which are defined as "a stimulus that is capable of activating receptors for tissue damage" (Merskey & Bogduk, 1994). *Nociception* is then the "activation of sensory transduction in nerves by thermal, mechanical, or chemical energy impinging on socialized nerve endings. The nerve(s) involved convey information about tissue damage to the central nervous system" (Turk & Okifuji, 2010, p. 16). Nociceptors vary in their threshold and some are more easily activated than others. For example, the skin has a lower threshold than other areas of nociceptors. Once the threshold is met, the signal travels along to spinal cord and to the brain. This can result in a variety of automatic responses and/or behaviors, that is, jerking a hand away from a hot stove.

Fields (1987) has identified four specific physiological processes involved in the pain experience: *transduction, transmission, modulation,* and *perception*. Transduction includes the nerve endings that respond to noxious stimuli and the conversion of sensory information into a language interpretable by the brain. The process of sending this information to the areas of the central nervous system responsible for sensing pain is referred to as transmission. This involves the activation of spinal neurons, which then send the message to the brain regarding the noxious stimulus. Various responses and reflexes are then elicited; the fitting example is again the jerk of the hand away from the hot stove. Modulation involves the control of the nociceptive transmission pathway via neural activity. Finally, perception refers to the subjective experience of pain produced by nociceptive transmission neurons (Fields, 1987). These physiological processes break down the pain experience and highlight the different responses of the body to pain. However, it is also important to keep in mind the psychological components are that also involved in this experience. Turk and Flor (1999) explain that "the severity of reported pain may range from minimal to unbearable in different individuals with apparently similar injuries, and it is obvious that the subjectively experienced intensity of pain depends not only on the stimulus intensity but also to a very large extent on psychological factors" (p. 27).

Gatchel and Maddrey (2004) make the distinction between pain and nociception. As described: nociception is the biological process of stimulating nerve cells that then send information regarding tissue damage to the brain. This process is objective, one that can be observed via action potentials and thresholds. Conversely, pain is a subjective perception that involves the "transduction, transmission, and modulation of sensory input. This input may be filtered through individuals' genetic composition, earlier learning histories, current physiological status, and sociocultural influences. "Pain, therefore, cannot be comprehensively assessed without a full understanding of the person who is exposed to the nociception" (Gatchel & Maddrey, 2004, p. 361).

A similar distinction can be made between illness and disease, such that disease is generally accepted to define "'an objective biological event' that involves the disruption of specific body structures or organ systems caused by anatomical, pathological, or physiological changes" (Gatchel & Maddrey, 2004, p. 361). This may involve anatomical, pathological, and/or physiological events that impact a bodily structure or organ system. On the other hand, illness is defined as a "'subjective experience or self-attribution' that a disease is present. An illness will yield physical discomfort, behavioral limitations, and psychosocial distress. Thus, illness references how sick individuals and members of their families live with, and respond to, symptoms and disability" (Gatchel & Maddrey, 2004, p. 361).

Pain can be divided into two categories, based on the duration of pain: acute and chronic. Historically, the demarcation is based on the duration of symptoms, where pain lasting more than six months is considered chronic, and pain lasting less than six months is acute. Most often when an injury occurs, if attended to and/or treated properly, the tissue will heal and the pain will subside. A framework of "normal healing" is then developed and the injured expect to recover. Therefore, an additional variable used to define chronic versus acute pain is healing time. When pain continues past the time one would have expected to heal, it is then viewed as chronic (Bonica, 1990). Turk and Okifuji (2010) have suggested a conceptualization of acute and chronic pain based on both time and physical pathology dimensions. According to their definitions, acute pain is:

> Pain elicited by the injury of body tissues and activation of nociceptive transducers at the site of local tissue damage. The local injury alters the response characteristics of

> the nociceptors and perhaps their central connections and the autonomic nervous system in the region. In general, the state of acute pain lasts for a relatively limited time and remits when the underlying pathology resolves (p. 14).

Whereas chronic pain:

> May be elicited by an injury or disease but is likely to be perpetuated by factors that are both pathogenetically and physically remote from the originating cause. Chronic pain extends for a long period of time and/or represents low levels of underlying pathology that does not explain the presence and extent of the pain (p. 14).

In their review, Turk and Okifuji (2010) note that past life experiences and/or genetic factors may lead to a predisposition to chronic pain.

Although unpleasant, pain, in the acute sense, has a rather important function. Pain serves as a warning signal of danger or injury and can therefore provide an opportunity to react to the situation and reduce the amount of harm incurred. Once the painful stimulus has been removed and the body has been given time to heal, the pain typically resolves. However, in some cases, it does not. In the case of chronic pain, the pain sensation no longer serves as a warning signal of harm to the body. Chronic pain is the result of ongoing injury to tissue as well as continued activation of pain receptors. This persistent activation can lead to anatomical, pharmacological, and physiological changes in the core of the pain information processing center; the central nervous system (Winterowd, Beck, & Gruener, 2003).

Pain, especially once categorized as chronic, is elusive and biologically multifaceted. Pain has troubled both those who experience it and those who try and treat it. For the medical providers, understanding the underlying physiologic components gives insight into potential treatments to address the patient's very individualized pain experience. In order to create a more universal and functional language for the pain experience, several classification systems in addition to duration (acute versus chronic), have been proposed. These categories are not designed to be mutually exclusive, but rather to describe pain as objectively as possible. There are several different forms and occurrences of pain in the body. Portenoy (1989) noted three primary categories of pain: nociceptive, neuropathic, and psychogenic. Nociceptive pain includes pain resulting from tissue damage, such as sprains, bumps, bruises, burns and bone fractures. Neuropathic pain results from injury or problem in the central or peripheral nervous system and may include neuralgia, phantom limb pain, reflex sympathetic dystrophy, and neuropathy. Both nociceptive and neuropathic pain would be considered somatogenic pain; pain which result from physiological process. Psychogenic pain, on the other hand, is pain associated with psychological processes, in that psychological factors can cause, exacerbate, and/or extend the experience of pain (Turk & Okifuji, 2010).

Friction (1982) proposed a classification system according to body system: myofacial (chronic muscle pain), rheumatic (inflammatory condition of the musculoskeletal system), causalgic (pain from nerve damage), neurologic (pain associated with neurologic system), and vascular (pain resulting from disrupted blood flow to an organ, tissue, or nerves). Turk & Okifuji (2010) note demarcations can also be made based on the level of functioning. The International Classification of Functioning Disability and Health have developed a model for labeling health outcomes. The main outcomes include: impairment, activity limitations, and participation restrictions (World Health Organization, 2001).

All of the above mentioned components are important to consider when addressing a chronic pain problem. There are several physiological components and categorizations that help conceptualize the chronic pain condition.

Psychological.

Treatments for pain have continued to evolve, becoming more sophisticated and technologically advanced overtime. However, the cure for pain often remains elusive, troubling both patient and physician. Turk (2002) notes that regardless of treatment modality, the average pain relief achieved is only a 35% reduction, which is unfortunately achieved in less than 50% of patients. Chronic pain patients often become extremely involved with the medical system, experimenting with a vast array of treatments and may move from doctor to doctor. This causes a great deal of stress, which can facilitate the development of various mental health disorders and/or exacerbate a premorbid psychological condition (Turk, Swanson, & Wilson, 2010). There can be many stereotypes applied to the chronic pain sufferer; related to their change in employment status, disability status, role in the home, and/or others may judge them for their medication regimen. These and other factors can often have serious psychological ramifications for the patient. Turk et al. (2010) note there are two conclusions to consider related to the psychological aspect of chronic pain, "(1) psychosocial and behavioral factors play a significant role in the experience, maintenance, and exacerbation of pain; and (2) since some level of pain persists in the majority of people with chronic pain regardless of treatment, self-management is an important complement to biomedical approaches" (p. 74).

Therefore, it becomes important to consider both the predisposing and secondary psychological factors of chronic pain. One area of interest has been personality factors that may be involved in the pain experience. Personality traits are defined as "enduring patterns of perceiving, relating to, and thinking about the environment and oneself that are exhibited in a wide range of social and personal contexts" (APA, 2000, p. 686). According to this definition, personality can impact the way someone interprets and reacts to pain. "Temperament and personality may predispose individuals toward misinterpretation of pain sensations and maladaptive pain beliefs, or they can have a protective role" (Turk et al., 2010, p. 74).

Several other predisposing variables have been considered in the research. In their outline of psychological aspects of pain; Turk et al. (2010) suggest negative affectivity and sensitivity to both anxiety and illness/injury as potential factors that may set a vulnerability to pain. Negative affectivity is thought of as a wide range of negative emotions coupled with a view of the world as dangerous and stressful (Watson, Clark, & Harkness, 1994). Anxiety sensitivity, or a fear of anxiety related sensitivity, is also associated with interpretation of bodily sensations as a sign of danger, enhanced pain experience, and avoidance (Asmundson & Taylor, 1996; Keogh, Hamid, Hamid, & Ellery, 2004). Sensitivity to illness/injury includes components such as hypervigilance to physiologic sensations and biased interpretation of ambiguous bodily signals (Stegen, Van Diest, Van de Woestijne, & van de Bergh, 2000; Stegen, 2001). This research suggests that some people may be more sensitive to feelings of anxiety and physiologic signs that may be interpreted as an illness or injury. Those who are more sensitive are more likely to be aware of these symptoms and report them to their health care providers. Extensive research has suggested the significance of predisposing factors to pain; however, research has also noted several protective factors regarding onset of chronic pain. These are optimism, hope, and benefit finding (Turk et al., 2010).

Learning theory suggests that appraisals and beliefs are shaped by past experiences. Pain appraisal, the meaning given to pain, and beliefs about pain impact an individual's response to pain (Turk et al., 2010) and adjustment of chronic pain (Turner, Jensen, & Romano, 2000). Research suggests catastrophizing and fear-avoidance beliefs are positively correlated with the experience of pain; perceived control and self-efficacy are negatively correlated with the experience and exacerbation of pain (Turk et al., 2010). There is also a great deal of evidence that hysteria, anger, depression, low self-esteem, and anxiety can actually increase pain (Elton, Stanley, & Burrows, 1983).

A considerable amount of research has investigated the link between anxiety and pain, especially given that feelings of pain normally induce feelings of worry and anxiety. Patients are likely to become even more anxious when their symptoms are relatively unexplainable, which is often the case with chronic pain. Studies considering the impact of anxiety on postoperative pain and recovery, suggest reduced levels of anxiety result in less pain and quicker healing times (Martinez-Urrutia, 1975; Pickett & Clum, 1982). Additional studies have found anxiety to be positively correlated with labor pain (Klusman, 1975; Wilson-Evered & Stanley, 1986). Reducing levels of anxiety can increase pain thresholds and pain tolerance (Wolff & Horland, 1967), even with only one session of relaxation training prior to applying a painful stimulus (Elton & Stanley, 1976). In laboratory pain studies, it has also been found that pain thresholds increase when subjects had a sense of control over the experimental procedure and therefore, less anxiety (Hill, Kornetsky, Flanary, & Winkler, 1952; Mandler & Watson, 1966).

In the case of fibromyalgia, between 44% and 51% of patients in one large-scale study, admitted they were anxious (Wolfe et al., 1990). The ongoing pain itself can cause a great deal of anxious thoughts and reactions, especially as it relates to the meaning of their symptoms and the impact it will have on their future. Examples of anxious thoughts related to pain include: will the pain increase? Will I become completely disabled and bedridden? Do people think I am lying? Will I ever be able to go back to work? The fear and anxiety often plays a dominate role in activity selection, "fears may contribute to avoidance, motivate inactivity, and, ultimately, greater disability" (Turk et al., 2010, p. 77). Those with pain often become increasingly more inactive as their fears of triggering pain takes over their mindset.

It has been suggested that 40% to 50% of chronic pain patients are depressed (Banks & Kerns, 1996; Romano et al., 1995). The findings are inconclusive regarding the cause and effect relationship between pain and depression, where some studies suggest depression is a predisposing factor to chronic pain, where others infer depression as secondary to chronic pain. Van Korff and Simon (1996) relate the relationship between pain and depression should be viewed as reciprocal, with psychological and behavioral effects impacting the experience and expression of each other. Likewise, it has been suggested that with pain relief comes relief of depression (Timmermans & Sternbach, 1974).

It is not surprising that many chronic pain patients are depressed. They face many basic life alterations, including financial, physical, and emotional changes. With all these (likely negative) changes, it is then curious that not all chronic pain patients are depressed. Research notes that the patient's appraisal of the impact of the pain on their life and the appraisal of their ability to exert control over the pain and their lives are two mediating factors of the pain-depression relationship (Rudy, Kerns, & Turk, 1988; Turk, Okifuji, & Scharff, 1995). Therefore, those who view the pain as having only a small impact on their life and who have a sense of control over the pain are less likely to be depressed.

When symptoms of chronic pain are not well understood by the patient, not only will there be some naturally occurring anxiety and worry, but patients may also become depressed. Depression is also found to be correlated with somatization and somatoform disorders, which may be associated with pain inconsistent with physiologic signs (von Knorring, 1994; Lipowski, 1990; Maier & Falkai, 1999; Jorgensen, Fink, & Olesen, 2000). It has also been suggested that depression may be a common occurrence in chronic pain patients, but it may not be central to the pain experience (Merskey, 1987). At times, a patient's depressed mood may be overshadowed by their somatic symptoms (Sternbach, 1968).

There has also been an increasing amount of interest in the relationship between personality disorders and pain. Several studies have found that in general, pain disorders are co-morbid with personality disorders (Gatchel, Polatin, & Kinney, 1995; Polatin, Kinney, Gatchel, Lillo, & Mayer, 1993; Fishbain, 1997). Research also suggests that personality disorders may affect pain disorders in a variety of ways. For example, personality disorders seem to have a significant impact on disability status (Grant et al., 2004). Moreover, it has also been found that the presence of personality disorder at the beginning of treatment for acute back pain is a significant predictor of the patient's disability status six months later (Gatchel et al., 1995).

The prevalence of personality disorders among American adults is estimated to be 14.79% (Grant et al., 2004). The rates of personality disorders among the pain patient population have been estimated to be much higher. Lowest rates have been found to vary from 24% (Gatchel et al., 1995) and 37% (Reich, Tupin, & Abramowitz, 1983), whereas some research suggests as much as 51% (Polatin et al., 1993) to 81% (Dersh, Gatchel, Polatin, & Mayer, 2002) of those with chronic pain have a personality disorder.

A review conducted by Weisberg and Keefe (1997) highlights the prevalence of the various personality disorders among the chronic pain population. For example, Reich et al. (1983) reported 47% of their sample of 43 met the diagnostic criteria for an Axis II disorder. They found the highest rates of histrionic personality disorder (14%) and dependent personality disorder (12%), but also found evidence of schizoid personality disorder, schizotypal personality disorder, narcissistic personality disorder, borderline personality disorder, and mixed personality disorder. Large (1986) found 40% of the sample of 50 met diagnostic criteria for an Axis II personality disorder; with the highest rate of mixed personality disorder (22%) and evidence of histrionic personality disorder, narcissistic personality disorder, borderline personality disorder traits, avoidant personality disorder, dependent personality disorder traits, obsessive-compulsive personality disorder traits, and passive-aggressive personality disorder. Fishbain, Goldberg, Meagher, Steele, & Rosomoff (1986) found 59% of their sample of 283 met diagnostic criteria for an Axis II disorder. The most prominent personality disorders in this study were dependent personality disorder (17%), passive-aggressive personality disorder (15%), and histrionic personality disorder (12%). There was also evidence of paranoid personality disorder, schizoid personality disorder, narcissistic personality disorder, borderline personality disorder, and obsessive-compulsive personality disorder. Polatin et al. (1993) also found a large portion (51%) of their sample of 200 met the diagnostic criteria for an Axis II disorder. Borderline personality disorder (15%), avoidant personality disorder (14%), passive-aggressive personality traits (12%), and self-defeating personality traits (10%) were among the most common diagnoses. Gatchel, Garofalo, Ellis, and Holt (1996) found borderline personality disorder (10%) and obsessive-compulsive (10%) most commonly diagnosed in their sample of 50, whereas

Weisberg, Gallagher, and Gorin (1996) found personality disorder not otherwise specified (27%), borderline personality disorder (13%), and dependent personality disorder (11%) most common in their sample of 55. Finally, Monti, Herring, Schwartzman, and Marchese (1998) found that 60% to 64% of patients with chronic pain conditions meet the diagnostic criteria for a personality disorder. See Table 1 for summary.

Personality disorder clusters have been developed based in part on the difficulty in diagnosing some personality disorders and the relatively low reliability in diagnoses. Three clusters have been developed based on descriptive similarities: Cluster A (odd/eccentric), which includes: paranoid, schizoid, and schizotypal personality disorders; Cluster B (dramatic/emotional), which includes: antisocial, borderline, histrionic, and narcissistic personality disorders; and Cluster C (anxious/avoidant), which includes: avoidant, dependent, and obsessive-compulsive personality disorders (APA, 2000). A study investigating personality disorder clusters among chronic pain patients, psychiatric patients applying for disability benefits, and psychiatric patients undergoing a mental competency hearing, found that those with chronic pain were more likely to meet the diagnostic criteria for a personality disorder than were patients undergoing assessment of competency, 37% versus 11.8% respectively (Reich & Thompson, 1987). This study found chronic pain patients were more likely to fall into Cluster C.

Each of the studies mentioned above found varying degrees of borderline personality disorder amongst their sample of chronic pain patients, which is suggestive of the high probability of borderline personality features among those with pain. Borderline personality disorder is characterized by instability in relationships with others, mood, and self-image along with disturbed sense of identity, impulsive and self-harm behavior (APA, 2000).

Given the prevalence of personality disorders amongst pain patients, researchers have specifically investigated the link between borderline personality disorder and involvement in the medical system, including treatment seeking; medical conditions, including pain disorders; and health behaviors (Frankenburg & Zanarini, 2006). As noted in Tragesser, Bruns, and Disorbio (2010) the maladaptive personality traits which compose borderline personality disorder may be associated with decreased compliance and decreased coping with pain and/or injury, which together may set the patient up for poor or delayed recovery (Dersh et al., 2002; Weisberg, 2000).

In addition to the studies noted above, research conducted by Sansone, Whitecar, Meier, & Murry (2001) found 47.1% of the patients in their sample with a pain condition met the criteria for borderline personality disorder. Finally, one study investigating medical problems in those with borderline personality disorder found this population is more likely to have a diagnosis of a pain conditions such as fibromyalgia or temporomandibular pain (Frankenburg & Zanarini, 2004). See Table 1 for a summary of findings.

Social.

The chronic pain patient does not exist in a vacuum. They live in a world with spouses, families, friends, coworkers, employers, and the medical team. Again, there is interdependence between social factors and pain, in that social norms and beliefs impact the individual's interpretation and understanding of pain, and also how others interpret the patient's experience. Social factors can also work to the benefit or detriment of the chronic pain patient, serving a protective function or predisposing, exacerbating, and/or elongating the pain experience. Both the psychological and biological components of the pain condition must be viewed within the context of the patient's social world.

In a comprehensive review of social factors associated with pain; Block, Gatchel, Deardorff, and Guyer, (2003), note several factors outside of the patient's immediate social circle which may impact chronic pain. Vocational factors, such as job dissatisfaction, are often associated with injury and pain onset (Bigos et al., 1991). Similarly, worker's compensation cases have a strong influence on the chronic pain experience. So much so that Frymoyer and Cats-Baril (1987) suggest that compensation seeking is among the strongest predictors of extreme and unnecessary disability in those with back injuries. Many past studies have suggested that patients in the worker's compensation system demonstrate poorer outcomes following spine surgery (Klekamp, McCarty, & Spengler, 1998; Glassman et al., 1998; Knox & Chapman, 1993) and diminished general surgical outcome (Davis, 1994; Greenough & Fraser, 1989; Haddad, 1987; Hudgins, 1979; Taylor et al., 2000). Similarly, it has been suggested that those with pain involved with a litigation case and/or have a potential for secondary gain resulting from their injury have poorer surgical outcomes (Finneson & Cooper, 1979).

Many factors are susceptible to change within the family with the addition of a chronic pain condition. For example, there may be a shift in roles and responsibilities. If the pain patient is not working as a result of their pain condition, a previously non-working spouse may now need to seek employment. There may also be a shift in childcare, household chores and responsibilities, and significant changes in sexual activity in the marriage. Moreover, it is within the context of the patient's close social circle, their friends and family, which sets the stage for the interpretation and meaning behind pain. Several researchers have noted the secondary gains of chronic pain associated with the family system, for example, extra attention and nurturance from family members that tend to significantly impact the pain patient's experience (Hudgens, 1979). Research suggests the family responses to pain plays a significant role in the course of the chronic pain syndrome and also influences how disabled one may feel (Sternbach, 1968; Fordyce, 1976). In some situations, the pain patient stands to gain certain benefits as a result of their pain condition (secondary gains). This may include: "controlling others, justifying dependency, earning rest, avoiding sex, gaining attention, punishing others, controlling anger, and avoiding close relationships" (Brodwin & Kleinman, 1987, p. 113).

Fordyce (1976) applied the operant condition model (Skinner, 1974) to help explain the perpetuation of pain behaviors. Pain behaviors are the "verbal or nonverbal actions understood by observers to indicate that a person may be experiencing pain and suffering" (Turk & Okifuji, 2010, p. 16). Pain behaviors allow the pain patient to communicate in a clearly observable manner to others (Fordyce, 1976). Turk et al. (2010) explain pain behaviors to include "verbal reports, paralinguistic vocalizations (sighs, moans), motor activity, facial expressions, body postures and gesturing (limping, rubbing a painful body part, grimacing), functional limitations (reclining for extensive periods of time, inactivity), and behaviors designed to reduce pain (taking medication, use of the health care system)" (p. 80). These observable behaviors are capable of provoking responses from others, either positive or negative, and therefore serve as reinforcers or extinguishers of the pain behavior. This means, for example, that if a patient's pain behaviors are positively responded to by their spouse, that is, providing attention and taking over all household responsibilities when the patient moans and groans, that behavior is likely to be reinforced and the chronic pain condition is maintained.

Turk et al. (2010) also discuss the social learning aspects of chronic pain maintenance. For example, someone may learn by observing how other similarly aged pain patients respond and behave. Learning through observation, someone may take on new behavioral responses that were not previously in their response repertoire. Similarly, people learn through the observation of their family members and their community how to respond to pain and reactions to pain. For example, a child who observes their mother overreacting to pain or injury may learn to do the same. Research has found that chronic pain patients are likely to have a least one family member with a chronic pain, an estimated 68% of the time (Violon & Giurgea, 1984).

The Chronic Pain Syndrome

The biological, psychological, and social factors taken in combination create the chronic pain syndrome. This syndrome is a combination of several co-morbidities: pain, insomnia, fatigue, sexual dysfunction, depression, and anxiety; which together negatively impact the individual's functioning (Oliver, Taylor, & Schroeder, 2003). Each of these factors impacts each other, overall functioning, and quality of life. Oliver et al. (2003) note that the key to improvement from the chronic pain syndrome is addressing each of these co-morbidities and acknowledging that true improvement comes from increased level of function and improvement in quality of life, not just relief from pain.

Those who specialize in treatment and study of chronic pain note the role of *suffering* as a component of the chronic pain presentation. Turk and Okifuji (2010) define suffering as a "reaction to the physical or emotional components of pain with a feeling of uncontrollability, helplessness, hopelessness, intolerability, and interminability. Suffering implies a threat to the intactness of an individual's self-concept, self-identity, and integrity" (p. 17). The interplay between the psychological, social, and physiological factors determines the degree of suffering experienced and expressed by the patient. This constellation forms the chronic pain condition.

This lends itself to a consideration of disability. As defined by Turk and Okifuji (2010), disability is:

> Any restriction or loss of capacity to perform an activity in the manner or within the range considered normal for a human being, such as climbing stairs, lifting groceries, or talking on a telephone. It is a task-based concept that involves both the person and the environment. Disability is essentially a social and not a medical term or classification. Level of disability should be determined only after a patient has reached maximum medical improvement following appropriate treatment and rehabilitation (p. 15).

There are several mechanisms which contribute to pain-related disability; components of the chronic pain condition. A great deal of physical deconditioning and weakness occurs as the patient becomes less and less active. This can result from voluntary or forced disuse and likely is connected to fear and avoidance of movement/functioning due to pain. Fear becomes a large component of the chronic pain patient's existence. There is the fear the activity will bring on an unbearable amount of pain and fear resulting from misinterpretations of the meaning of pain; believing the pain is an indication of a serious pathology or additional structural damage (Heuts et al., 2004; Peters, Vlaeyen, & Weber, 2005). The fear of pain and subsequent avoidance due to fear can be just as, if not more, disabling than the actual pain (Muller, 1970; Vlajen & Linton, 2000; Crombez, Vlaeyen, Heuts, & Lysens, 1999; Rainville, Ahern, & Phalen, 1993; Peters et al., 2005; Grotle, Vollestad, Veirod, & Brox, 2004). These factors contribute to continued disuse, deconditioning, disability, and helplessness (Vlajen & Linton, 2000).

A picture complicated by “psychosocial distress, physical deconditioning, secondary gains and losses, and medication issues” (Gatchel & Maddrey, 2004 p. 370) can get in the way of a patient’s recovery from a chronic pain condition. Some patients will not find relief from the natural process of healing and symptom focused treatment. These patients often become a heavy weight on the health care system as they fail to find pain relief after many long visits with a variety of providers. They frustrate themselves, their families, and their physicians and become a financial burden on their insurance companies.

These factors contribute to the development of the chronic pain condition and in many cases, may impede the pain patient from recovering from their pain condition. The many factors discussed above impact every aspect of how the patient interprets and responds to their condition. In some cases, the secondary gain associated with a pain condition is considered much more beneficial to the patient than recovering from the chronic pain condition. For others, psychological aspects such as depression, anxiety, or a personality disorder continue to exacerbate their symptoms and complicate their presentation.

Past research has also explored the idea of the “pain-prone personality.” Engel (1959) described this personality style: “For the most part these patients repeatedly or chronically suffer from one or another painful disability, sometimes with and sometimes without any recognizable peripheral change” (904). He proposed this model as a way to better understand and recognize the various pain experiences of patients. Engel noted that understanding the clinical manifestations of psychodynamic processes at the root of some pain experiences allows the physician to make more accurate interpretations and treatment recommendations for patients. It was his belief that pain reports should be interpreted within the context of the patient's psychological experience. Those who are more "pain-prone" demonstrate some or all of the following features:

1. Pain is punishment: patients have a great deal of conscious and unconscious guilt. In this sense, their experience of pain functions as "atonement."
2. Family relationships troubled with aggression, suffering, and pain. Often times, the "pain-prone" patient has a history of solicitous pain: as seen by a many injuries, surgeries, and medical treatments.
3. Unmet aggressive needs/drives, which is then manifest in the experience of pain.
4. Pain develops in response to loss, whether real, threatened, or imagined.
5. Guilt associated with sexual impulses, leading to pain.
6. Location of pain is related to identification with a loved one, again whether the pain experienced by the other is real or imagined.

There has been mixed reviews of the pain-prone personality model; however. It may be safe to suggest that a past history of abuse and difficult childhood may predispose a person to psychological problems later in life; the connection between this experience and pain later in life has not been strongly support by the research. For example, Gamsa (1990) found there to be limited association between abnormal childhood and somatoform pain. In addition, Turk and Flor (1984) found there to be no consistent evidence in support of this model. Although the model is not necessarily considered accurate at present, it is still interesting to consider additional possible roles psychology may have in the development of a chronic pain condition.

The preceding argument demonstrates strong evidence for a comprehensive evaluation of the pain patient in order to determine the best course of treatment. Evaluating and understanding the biopsychosocial aspects of the individual patient's presentation can bolster the provider's decision making process regarding allocation of resources and treatment plans for each patient. Comprehensive and multidisciplinary pain programs have been developed for exactly this reason, with the aim of treating not only the physical, but also the psychological and social aspects of pain. Therefore, psychologists have become an important component of comprehensive pain management treatment and are often involved in the treatment plan. In addition to offering psychotherapy services, psychologists can evaluate patients and offer physicians insight into the role of psychological and social factors affecting the pain condition.

Pre-Surgical Psychological Evaluations

Psychological evaluations and screenings have been used in a variety of medical specialties to determine fit and better direct medical care, such as transplant surgery, bariatric surgery, breast reconstruction, and spine surgery. Evaluations have been widely recommended in a variety of procedures, including surgical implantation with a pain management device, to help identify suitable candidates and to predict possible complications or poor outcomes of treatment. These pre-surgical evaluations are often focused on gathering information from a variety of spheres in the patient's life, based on the biopsychosocial model, including: biological/demographic variables, health behavior/lifestyle/medical factors, work related factors, psychological factors, sociological factors.

Research suggests that pre-surgical psychological evaluations are a very important component of the organ transplant evaluation (Dew et al., 2000; Dobbels et al., 2001; Levenson & Olbrisch, 1993), including evaluations for kidney, liver, lung, heart, and bone marrow transplants. The pre-surgical psychological evaluation is very important in this surgical procedure, for several reasons including: the scarcity of the resource, the importance of strict compliance, and the need for ongoing relationships with the transplant team. The pre-surgical screening of transplant patients is different from other procedures discussed, in that is it typically a life-saving surgery rather than an elective surgery geared towards improving quality of life. Typically, the goal of the evaluation is to identify areas of concern and direct the patient to necessary treatment in hopes of increasing their chances of a successful post-transplant life. Dew et al. (2000) have highlighted the following important areas to address in organ transplant psychological evaluation: psychiatric history and current status, compliance history and current status, substance use history and current status, mental status, social history of availability of support, family social and mental health history, and finally perceived health, coping style, and quality of life (p. 240).

A review of the literature suggests that transplant programs have varied interpretations of important psychosocial variables in organ transplant. As noted in Dew et al. (2001), there are some factors that are generally agreed upon as important factors in the psychosocial evaluation. Outlined in this article [as reported in Levenson and Olbrisch (1993)] are contraindications to transplant, regarded as absolute contraindications by more than 70% of programs. These include: current addictive drug use, active schizophrenia, current heavy alcohol use, history of multiple suicide attempts, current suicidal ideation, dementia, and severe mental retardation of IQ less than 50. In addition, agreed upon irrelevant factors include excessive caffeine use, cigarette smoking in past six months, current cigarette smoking, and family history of mental illness (of note, Levenson and Olbrisch (1993) were not surveying lung transplant programs, which will likely consider smoking to be a absolute contraindication).

Dew et al. (2001), also discuss the impact of pre-transplant psychosocial evaluations on transplant outcomes. It is the belief of these authors, based on review of the literature, that psychopathology and compliance were the factors that have the strongest potential impact on outcome following transplant. In their review, (see: Maricle et al., 1989; Maricle et al., 1991; Skotzko, Rudis, Kobashigawa, & Laks, 1999; Cohen, Littlefield, Kelly, Maurer, & Abbey, 1998; Leedham, Meyerowitz, Muirhead, & Frist, 1995; Popkin, Callies, Colon, Lentz, & Sutherland, 1993), most of the research suggested a limited reliable relationship between Axis I disorders or elevated psychological symptoms with several post transplant outcomes, including: “survival, medical complications such as infection, graft rejection, and physical functional limitations” (p. 245).

Again, as noted in the review conducted by Dew et al. (2001), research investigating the role of Axis II disorders/characteristics have found there to be some influence on outcome. Harper, Chacko, Kotik-Harper, Young, & Gotto, (1998) noted the relationship between Axis II characteristics and increased care costs. Grady, Jalowiec, and White-Williams, (1999) noted the relationship between length of hospital stay and functional disability resulting from emotional problems.

In addition to transplant surgery, pre-surgical psychological evaluations have been used to aid physician decision making for bariatric surgery candidates. Bariatric surgery requires patients to make many significant changes post-operatively, which must be maintained over the lifespan, or that patient is at risk for weight gain. Application of the biopsychosocial model suggests there are psychological and social factors that may be contributing to the obesity, which should be addressed prior to surgery to ensure the most successful outcome. Often the goals of these evaluations include identifying the psychological factors that may impact treatment motivation, adherence to post-operative life-style changes, and ultimately long term surgical outcome. These evaluations can offer physicians information which may help in selecting the most appropriate candidates for this serious and costly procedure. The evaluation can also then allow the psychologist to make recommendations for psychotherapy and/or behavioral modification plans that may improve the patient's chance at long-term success.

Similar to patients with pain, those who are severely obese and seeking bariatric surgery report high rates of psychological disturbance (Hsu et al., 1998; Glinski, Wetzler, & Goodman, 2001). There has been a great deal of research suggesting the presence of binge eating disorder among those seeking bariatric surgery. The research has also found that depression is very common among patients seeking this type of surgery (Guisado & Vaz, 2003; Saltzstein & Gutmann, 1980; Van Gemert, Severeijns, Greve, & Soeters, 1998; Waters et al., 1991; Sarwer et al., 2004). Kalarchian et al. (2007) found 45.5% of their sample of 288 participants met the diagnostic criteria for mood disorders. Anxiety and phobia (Saltzstein & Gutman, 1980; Waters et al., 1991; Tsushima, Bridenstine, & Balfour, 2004), hysteria (Saltzstein & Gutman, 1980; Guisado & Vaz, 2003), compulsivity (Guisado & Vaz, 2003), and somatization (Van Gemert et al., 1998) have also been found among those seeking bariatric surgery. There has also been some investigation into Axis II disorders and those seeking bariatric surgery, in their sample, Kalarchian et al. (2007) found 29% met diagnostic criteria.

There have been mixed results in the research regarding long-term outcome of bariatric patients. One study found that levels of depression, denial of emotional stress, and social incompetence had reduced to undetectable levels by an average of 85.9 months following bariatric surgery (Van Gemert et al., 1998). However, other studies have found that the mental health improvements gained after bariatric surgery may decline over time or even return to baseline, preoperative levels (Waters et al., 1991; Hsu, Sullivan, & Benotti, 1997).

Poor outcome of bariatric surgery could be determined by a patient's post-operative weight loss. In some situations patients will not lose a significant amount of weight or lose weight and eventually gain it all back. In these instances, the patient was not able to make the life changes necessary for successful surgery. The presence of binge eating disorder, depression, and anxiety has been frequently found in bariatric candidates. If these psychological factors are not appropriately identified and addressed, the patient runs the risk of sabotaging their surgical outcome. The use of pre-surgical psychological evaluations affords the psychologist and the surgeon the opportunity to evaluate these, and other psychological factors, which may impact outcome. With this knowledge, recommendations can be made regarding the most suitable candidates for this procedure.

Thirdly, psychological factors have also been examined in the context of patient satisfaction with post-mastectomy breast reconstruction, and consistent with other surgeries discussed, psychosocial factors appear to play a large role in outcome (Malata, McIntosh, & Purushotham, 2000; Stevens et al., 1984; Schain, 1991). The most significant goal of post-mastectomy breast reconstruction is to restore the woman's psychological health, which may have been compromised following mastectomy (Roth, Lowery, Davis, & Wilkins, 2007). There are several surgical procedures patients may choose from when considering reconstruction, either the use of artificial implants or use of their own tissue. Research has suggested there is a significant association between procedure type and satisfaction (Alderman, Wilkins, Lowery, Kim, & Davis, 2000). In this way, identification of particular psychological variables can improve patient selection, and ultimately lead to increased surgical success rates and significantly improved quality of life (Malata et al., 2000). A psychological evaluation can again, provide the opportunity for psychological interventions, that is, teaching coping skills, decreasing anxiety, which are likely to improve surgical outcome.

Pre-surgical Psychological Evaluations and Spine Surgery

Spine surgery research has provided a great deal of information regarding the biopsychosocial aspects of chronic pain conditions, as many spine surgeries occur following complaints of ongoing pain. Block et al. (2003) stress the importance of pre-surgical psychological evaluations for several reasons. They explain the potential negative impact of particular psychosocial factors on the outcome of spine surgery, suggesting, “Even though the physical underpinnings of chronic pain may be identified and corrected, the subjective experience of and limitations caused by pain may continue unabated” (p. 30). Therefore, screening out patients who are not likely to recover serves a benefit not only to the patient, but also the medical staff and insurance companies. They suggest several benefits of psychology screening, which includes: improving overall treatment outcome by avoiding treatment in those with strong potential for negative outcome, providing an empirically validated rationale for not proceeding with invasive procedures when they may be question regarding the patient’s appropriateness, avoidance of ineffective procedures, providing the opportunity to identify and treat emotional and behavioral problems prior to surgery, identify patients who demonstrate a potential for medication and/or compliance issues, and finally to reduce the number of patients in the surgeon's practice (Block et al., 2003).

Block et al. (2003) further suggest using pre-surgical screenings especially when any of the following are present: a patient's complaints are not consistent with the physical pathology, significant depressive and anxious symptoms, sleep disturbance, inappropriate expectations for surgical outcome, difficulty in relationships with partner or employer, emotional lability, significant functional impairment for three months or longer, increased need for narcotics or anxiolytics, litigation or ongoing disability benefits, history of medical noncompliance, and a history of psychiatric and/or psychological treatment.

An aim of a pre-surgical psychological evaluation is to assist in the identification and quantification of risk factors found to be connected to poor surgical outcome. This information is then to be shared with the surgeon to aid in the decision process regarding surgical prognosis (Block, 1996). Block et al. (2003) highlight the importance of making clinical judgments based on empirically validated risk factors, which are then to be evaluated within the context of the patient's complete presentation. The psychologist is to examine both the patient's strengths and weaknesses and weigh them within the context of the patient's experience. It is recommended that the pre-surgical psychological evaluation should include a consultation of the patient's medical chart, a semi-structured interview, and the use of psychological tests. This affords a biopsychosocial examination of the patient, as a review of the medical records lends information regarding the physical pathology and the physician's interpretation of the patient's presentation. The semi-structured interview allows the psychologist to ask a series of questions to explore possible risk factors and assess the patient's strengths and weaknesses. Finally, research suggests that the use of psychological tests is key in the prediction of surgical outcome. It has been suggested that psychological test data, even more than medical diagnostic tests, serves as the most powerful predictor of surgical outcome (Block, Ohnmeiss, Guyer, Rashbaum, & Hochschuler, 2001; Spengler, Oulellette, Battie, & Zeh, 1990; Trief, Grant, & Fredrickson, 2000; Wiltse & Rocchio, 1975). After gathering such information, the psychologist is then to make recommendations, noting both the strengths and weakness, in addition to potential risk factors. These recommendations are then components of the decision process the surgeon will face when determine their treatment plan for any particular patient.

Block et al. (2001) developed a scorecard to predict surgical outcome of 204 candidates of spine surgery. Risk factors for poor surgical outcome were identified and separated into two groups: medical and psychosocial. Medical risk factors included: duration of pain, previous spine surgery, surgery type, presence of nonorganic signs, frequent non-spine medical utilization, smoking status, and obesity. Psychosocial risk factors included: litigation status; workers compensation status; job dissatisfaction; heavy job demands; substance abuse; family reinforcement of pain; marital dissatisfaction; history of physical or sexual abuse; history of psychology treatment; presence of hypochondriasis, hysteria, chronic and/or reactive depression, anger, and anxiety, and poor coping skills. The risk factors were given weights (0, 1, or 2). A 2 x 2 matrix was then used by the authors to sort patients into good, fair, or poor outcome groups. A hierarchical regression analysis was conducted and a success rate of 84.3% was found for predicting surgery outcome.

Implanted Devices

Pre-surgical psychological evaluations are important when considering implantation with a pain management device for several reasons. The procedure is rather invasive, which posses both physical and psychological risk to the patient. There is a tremendous cost associated with these procedures. It is in the best interest of the patients, families, doctors, and insurance companies to avoid implantation in patients who are not likely to find success from this form of treatment. Therefore, pre-surgical psychological screening has become an important and often required component of the pre-implant screening process. The research suggests that many physicians find the pre-surgical psychological evaluation to be an important component in their selection process.

Patients are most often considered for implantation with a SCS or IDDS after they have exhausted most other treatment methods. If the physician determines the patient is an appropriate candidate to consider, the patient will often undergo a trial period to assess the potential effectiveness of the treatment, prior to implantation. This trial period is often very helpful in the physician's decision process, though it is not completely predictive of success once implanted. Studies suggest a success rate of only 52-59% for patients who underwent a trial period and subsequently opted for implantation with a SCS (North, Kidd, Zahurak, James, & Long, 1993; Kumar, Toth, Nath, & Laing, 1998).

Most often, the goals for implantation are to reduce the patient's pain levels, increase activity level, improve functioning, and restore a degree of psychological health. It is important for the patient's treatment team to keep in mind that reducing the patient's pain level does not necessary prompt an increase in functionality. The secondary effects of a long standing pain condition can lead to a great deal of physical deconditioning, problems with muscle strength and flexibility, fear-avoidance behavior, and a variety of psychological symptoms (Schofferman, 2006). Patients will be considered for treatment with an implantable device after they have unsuccessfully tried many other, less invasive, forms of treatment. It has been suggested that because they have not responded well to past treatments, these patients may have more biopsychosocial pathology associated with their pain condition (Jamison et al., 2008). According to the biopsychosocial model, these factors and many others can get in the way of a successful outcome following implantation.

There are few outcome studies available in the literature examining the use of pre-surgical psychological evaluations and the identification of potential risk factors for poor surgical outcome. Burchiel et al. (1995) found elevated MMPI Depression scale scores, elevated McGill Pain Questionnaire scores, and older age to correlate with poor outcome following implantation with a SCS. They found 88% of SCS implantation outcomes were correctly predicted by these three variables. In a study using psychoanalytic theory-driven questions, Dumoulin et al. (1996) found that psychological themes, based on a 24-item measure of “psychogenic functioning,” were predictive of outcome. In a study of long-term follow-up (up to seven years post-operative), it was found that 73% of patients implanted with a spinal cord stimulator were satisfied with pain relief. In this study, the authors noted that psychological factors had the most significant effect on failure (Long, Erickson, Campbell, & North, 1981). North, Kidd, Wimberly, and Edwin (1996) found patients of younger age with lower anxiety scores and high “organic symptoms” had more favorable outcomes; however, they report modest values which explain only small amounts of the observed variance. The algorithm developed by Block et al. (2001) was applied to patients seeking treatment with an implantable device, as a way to test the generalizability and determine if it is an appropriate way to screen patients in this setting. Two studies documented the utility and accuracy of using this algorithm to predict outcome for implant surgery (Schocket et al., 2008; Heckler et al., 2007).

Studies investigating the effect of personality disorders on outcome with implanted devices are limited as well. In fact, Van de Keift and De La Porte (1994) purposefully excluded those with “major personality disorders” from their study so as to not impact the results of their study on long-term pain relief, suggesting they are aware of the potential impact such a diagnosis may have on outcome. Daniel, Long, Hutcherson, and Hunter (1985) noted that personality disorders, drug dependence, unstable family and personal relationships, poor vocational adjustment, and litigation/compensation are all factors that deter SCS effectiveness if present in a “significant degree” (p. 776).

Several studies investigating biopsychosocial risk factors for poor outcome following implantation with a pain management device, have noted specific exclusionary factors. For example, Nelson, Kennington, Novy, and Squitieri (1996) noted the following exclusion criteria when considering patients for treatment with a spinal cord stimulator: 1) active psychosis; 2) active suicidality; 3) active homicidality; 4) untreated or poorly treated major mood disorders; 5) an unusually high-level somatization or other somatoform disorders; 6) substance abuse disorders; 7) unresolved worker’s compensation or litigation cases; 8) lack of appropriate social support; 9) cognitive defects that compromise adequate reasoning and memory; 10) severe sleep disorder. Similar criteria were also reported by Williams, Gehrman, Ashmore and Keefe (2003) and Doleys and Olsen (1997). In addition, Doleys and Olsen (1997) reported unrealistic expectations for pain relief, personality disorder, and incorrect beliefs about pain to be cautionary factors. Finally, Beltrutti, et al. (2004) reported the following exclusionary criteria: 1) psychosis; 2) severe depression; 3) alcohol/drug abuse, drug seeking behavior; 4) lack of social support, 5) insufficient knowledge of therapy, and 6) poor compliance.

The research examining pre-surgical psychological evaluations and SCS and IDDS devices is limited. The available research has focused on demographic, social, and very briefly on Axis I disorders. As previously noted, Axis II disorders are diagnosed at a much higher rate in the population of pain patients than the general population. Previous research has suggested Axis II variables should be considered when making a psychological recommendation for surgery; however, the research supporting this suggestion is limited.

Summary of Risk Factors Identified in Previous Research

Taken together, the research on the use of pre-surgical psychological evaluations has noted several consistent risk factors for poor outcome following surgical intervention for spine conditions, which has been reviewed several times in the literature (Block et al., 2001; Mannion & Elfering, 2006; Epker & Block, 2001).

Block et al. (2001) has listed risk factors for poor surgical outcome following spine surgery in two groups: psychosocial and medical risk factors. Psychosocial risk factors have been reported to include: job dissatisfaction, workers' compensation, heavy job demands, litigation regarding injury, family reinforcement of pain, limited social support, marital dissatisfaction, history of abuse and abandonment, substance abuse, history of psychological disturbance, pain sensitivity (MMPI Hs and Hy scales), chronic and reactive depression, anger, and anxiety. Medical risk factors have been reported to include: long duration of pain, invasiveness of surgery, presence of nonorganic signs, previous spine surgeries, prior medical problems, smoking, and obesity. These findings are consistent amongst many outcome studies (see Appendix A/Table 2). Researchers have also investigated the role of age, gender, and health behaviors, on surgery outcome with mixed results. Studies have also assessed the usefulness of variables such as income, level of education, lob level/status, pain drawings/pain behaviors, and coping strategies as predictors of surgical outcomes. With these factors, results have been mixed (see Appendix A/Table 2).

The focus of this study is directed at investigating the role of psychological variables on surgical outcome. As discussed, there are a several psychological factors that have been associated, one way or the other, with chronic pain and surgical outcome. Psychological factors are one of the most commonly investigated factors involved in the prediction of surgical outcome (Mannion & Elfering, 2006). It has even been suggested psychological factors have more predictive value in spine surgery outcome than medical factors such as radiographs, neurological signs, and computed tomography (Epker & Block, 2001).

A review of the literature demonstrates the high prevalence rates of both Axis I and Axis II disorders in the chronic pain patient population. Additional research has even suggested these disorders, among other variables, are predictors of surgical outcome. It is helpful to understand why these psychological variables play such a large role in how patients respond, react, and recover from major surgery.

Psychological factors have been found to play a role in surgery outcome, especially when surgery is related to alleviation of pain, because they tend to directly influence the pain experience. And, it goes without saying that pain can evoke strong emotional reactions from those who experience it. Many patients who have pain are depressed, it may be a premorbid condition that is exacerbated by the pain condition, or the depression may have resulted from the pain or injury. When people are depressed, they may lose energy, lack motivation, withdraw socially, develop a sleep disorder, and so forth. All these symptoms may very easily get in the way of recovering from an injury and fighting off the chronic pain syndrome. Patients who are anxious tend to exhibit doubt, worry, and fears. Past studies have demonstrated that anxious people experience more pain and have a lower pain tolerance; awareness to pain is increased with anxiety as well. Research on psychoimmunology has suggested that those who are stressed and anxious may have more difficulty healing, which directly impacts recovery from surgery.

Pain patients often become very angry, not only for having to deal with chronic, nagging pain, but also for a variety of reasons related to how their pain began in the first place. For example, patients may be angry with the other driver if their pain was secondary to a motor vehicle accident. They may become angry with their employer if an injury occurred at work. Anger has been associated with health problems and in some cases unhealthy/maladaptive lifestyle choices. A patient's anger may also get in the way of the relationship with providers, making the long term relationship even that much more challenged. Aspects of hypochondriasis and hysteria have frequently been noted as common components of the chronic pain patient's presentation. Both of these concepts are rooted in psychoanalytic theory, especially as it relates to psychogenic pain. Breuer and Freud (1895) discussed conversion symptoms; the somatic channeling of highly emotionally charged conflicts into physical symptoms, that is, pain.

Personality traits are the groundwork for how we tend to behave, react, interpret, and relate to the world around us. Personality disorders are diagnosed when the "normal" aspects of personality are "inflexible and maladaptive and cause significant functional impairment or subjective distress" (APA, 2000, p. 686). However, when patients present with a long history of personality problems and/or emotional difficulties, they are likely to have more challenges in their road to recovery (Block et al., 2003). Unfortunately, personality disorders are diagnosed at a much higher rate among those with pain conditions than the general population. Personality disorders can impact recovery from surgery for a variety of reasons.

Traits associated with paranoid personality disorder and borderline personality disorder could get in the way of establishing a trusting and collaborative relationship with providers. Not only can this get in the way of follow-up treatment, but it may also contribute to a decreased motivation to improve. Those with histrionic personality disorder have a tendency to seek out attention and experience vague physical symptoms. The stress of the surgery and the desire to maintain attention via disability status may significantly hinder the patient's motivation to improve.

Both the Axis I and Axis II disorders discussed here potentially impact the patient's experience of pain, how they respond and deal with the pain, how they heal from surgery, and relationships with health care providers; psychological factors impact every aspect of the chronic pain patient's experience. Most often the goal of SCS and IDDS implant surgeries is to reduce the patient's pain so as to change the person's behavior, that is, increase level of activity, reduce emotional disturbance, and so forth. From the medical perspective, a surgery is successful if the physiologic pathology is corrected, independent of the patient's subsequent response to the surgery. However, the biopsychosocial model stresses the importance of changing the patient's behavior and improving the quality of life. Psychological factors are key to understanding this model. Understanding the conceptual underpinnings of these psychological components allows the multidisciplinary team to assess, identify, and address potential risk factors that may prevent optimal outcome.

Purpose and Statement of the Problem

Some patients are not satisfied with the amount of pain relief and/or increase in functional ability following implantation with a SCS or IDDS. This becomes problematic given the invasiveness of this procedure, as well as the financial, physical, and psychological costs of the procedure. There has been a great deal of research suggesting the usefulness of pre-surgical psychological evaluations for a variety of medical conditions, unfortunately, information regarding psychological predictors of surgical outcome following implantation with a pain management device is limited. The research regarding predictors of outcome in spine surgery has been reviewed at length to supplement research regarding implanted devices. This type of research is presumed to have some degree of generalizability as many patients undergoing spinal surgery have also been suffering with chronic pain, and many patients implanted with these devices have chronic pain rooted in spine conditions. The previous research has afforded the opportunity to see the impact of Axis I disorders, such as depression and anxiety, on surgical outcome. In addition, studies have looked at both social and medical aspects that may contribute to surgical outcome. Research regarding the influence of Axis II (personality) disorders on outcome has been more limited. Given the high prevalence rates of Axis II disorders among those with chronic pain (see Appendix A/Table 1), the question is raised regarding the impact they may have on surgical outcome.

The aim of this study is to examine the relationships between several psychological factors (Axis I and Axis II conditions) and surgical outcome (good versus poor). The goal of this study is to expand the research on the use of pre-surgical evaluations for patients considering implantation, improve the psychological screening process which would aid in physicians' determinations of allocation of resources, better direct patient treatment planning, and ultimately better address the individual patient's particular needs.

Rationale

A vast amount of previous research has noted the incidence rates of both Axis I and Axis II disorder among those with chronic pain. In addition, many research studies have highlighted the impact of various psychological, social, and medical factors of surgical outcome. Research in the area of implanted pain management devices and surgical outcome is somewhat limited, and studies examining the impact of Axis II disorders on outcome are even more so limited. Pre-surgical psychological evaluations have been recommended for use in a variety of medical procedures to aid in the identification of those who are most likely to succeed and those who are not. Implantation with a pain management device is an expensive and invasive procedure, one with risks and side effects. It requires the placement of a foreign object in the patient’s body. After implantation, patients are required to make several life changes and are required to comply with regular medical follow-up appointments throughout the lifespan of their device. Some find their pain symptoms are reduced significantly following implantation; however, others may find little if any additional relief and continue to suffer with the chronic pain syndrome for a variety of reasons. Because of the potential risks, costs, lifestyle change, and long-term commitment associated with this procedure, selecting the most appropriate candidates is incredibly important. Pre-surgical psychological evaluations are needed for the selection process.

Research regarding the use of pre-surgical psychological evaluations across a vast array of surgical procedures has provided consistently strong evidence that negative surgical outcome is associated with psychological impairment (Johnson & Vogel, 1993; Kiecolt-Glaser, Page, Marucha, MacCallum, & Glaser, 1998). Improving this screening process most certainly benefits all involved parties in that it will aid in the allocation of resources and better direct care for those suffering with chronic pain, allowing the multidisciplinary team to offer the most appropriate support and services to patients. With the identification of which variables have the most significant impact on surgical outcome (Axis I vs. Axis II) the psychologist can better determine who is at risk for dissatisfaction with the implant and unsuccessful results. The psychologist may also then develop a treatment plan to address the most pertinent factors first and possibly affording the patient the opportunity at a later date to pursue implantation. Pre-surgical psychological evaluations are a very valuable resource when considering implantation and this process can be improved (see model, Appendix B).

Hypotheses

Hypothesis one: It is predicted that older age, female gender, high BMI scores, tobacco use, and shorter time since surgery will be positively associated with negative surgical outcome.

Hypothesis two: It is hypothesized that taken together the variables age, gender, BMI, and tobacco use will account for a significant percentage of the variance when predicting surgical outcome.

Hypothesis three: It is hypothesized that PAI T-scores of depression and anxiety scales will add to the predictive power of the regression equation, suggesting these psychological variables are predictive of surgical outcome.

Hypothesis four: Together with the groups of predictors mentioned above, it is hypothesized that PAI T-scores on the borderline, antisocial, grandiose, and paranoid scales, add to the predictive power of the regression equation; therefore, suggesting that these personality features account for a percentage of the variance above those which have been previously demonstrated in the research.

CHAPTER THREE

Method

Research Design

A retrospective follow-up design was used. Retrospective data from the participant's pre-surgical psychological evaluation was gathered as well as information regarding the participant's trial and implant status, as reported in the participant's medical chart. Time between surgery and follow up varied across participants from three years to (no less than) two months. The dependent variables are surgical outcome as either "good" (permanent implant, in use, with satisfactory pain relief) or "poor" (those not trialed, unsuccessful trails, permanent implant with dissatisfaction/explanted not due to medical reasons). Those who have been explanted for medical reasons were excluded from the study. The independent variables are: age, gender, BMI, tobacco use, pre-surgical T-scores of Axis I: depression, anxiety; and Axis II: borderline features, antisocial personality features, features of grandiosity, and paranoia.

Participants

The participants for this study were those referred for a pre-surgical psychological evaluation, conducted by an associate at David M. Cowan, PhD, and Associates; per their pain management specialist at Pain Care Associates, a comprehensive medical pain management facility. A letter of permission and support for the project was obtained from the medical director, Todd Lininger, MD, of this clinic (Appendix C). All patients who underwent a pre-surgical psychological evaluation through the office of David M. Cowan, PhD, and Associates between the years 2010-2013 were considered for inclusion in the study. Only patients being considered for implantation with one device; that is, intrathecal drug delivery system (IDDS) or spinal cord stimulator (SCS) only, not both, were considered.

Those who completed a personality assessment other than the PAI were excluded (such as MCMI, GDI), as were those who produced an invalid PAI profile based on the validity indexes. Those who left the clinic prior to completion of all trials and consideration of permanent implant were also excluded. Patients were not excluded on the basis of age, gender, race, or socioeconomic status. Participants largely resided in the Metro-Detroit area. As baseline data was retrospective, participants had already participated in a pre-surgical psychological evaluation as required by their pain management physician and/or their insurance company. Post-surgical outcome status was obtained from a retrospective chart review. There are no significant differences in demographic characteristics between those who were included and those excluded.

The demographics of the sample are as follows (Table 3a and 3b): there were 41 (44.1%) males and 52 (55.9%) females. Most of the participants were identified as white/Caucasian (*n* = 88, 94.6%) with the remaining identified as black/African American (*n* = 5, 5.4%). Most were married (*n* = 61, 65%) rather than not married, which includes those in relationships of any time duration, divorced, and widowed (*n* = 32, 34.4%). Level of education was grouped into several categories, less than 12 years of education (*n* = 6, 6.5%), high school/GED (*n* = 37, 39.8%), some college/associate's degree (*n* = 33, 35.5%), bachelor's degree (*n* = 9, 9.7%), and graduate degree (*n* = 8, 8.6%). The age of participants at the time of the initial psychological evaluation ranged from 21 to 84, with mean age 54.8 and a standard deviation of 11.72. At the time of follow-up, participants' age ranged from 22-86, with a mean of 56.2 and a standard deviation of 11.80. Body mass index (BMI) ranged from 17.4 to 58.6, with a mean of 30.38 and a standard deviation of 7.33. Thirty-one (33.3%) of the participants were smoking at the time of the initial psychological evaluation, and 62 (66.7%) were not. Employment status was grouped into several categories as well: disabled/receiving SSD/benefits (*n* = 48, 51.6%), working full/part time (*n* = 19, 20.4%), not employed, not due to disability (laid off, fired, homemaker, otherwise not employed.) (*n* = 26, 28%). Regarding auto accident related injuries, most were not (*n* = 80, 86%), with a small portion that were related to an auto accident (*n* = 13, 14%). There were also participants with work related injuries (*n* = 21, 22.6%) and those without (*n* = 72, 77.4%). Most participants did not have any litigation related to their pain-causing injuries (*n* = 74, 79.6%), some have litigation in the past (*n* = 9, 9.7%), and some with current litigation at the time of the initial psychological evaluation (*n* = 10, 10.8%). Injury/source of pain was divided into several categories, including pain related to spinal disease/injury (*n* = 75, 80.6%), RSD/CRPS (*n* = 12, 12.9%), and other forms of pain (*n* = 6, 6.5%). In regards to the implantable device, 61 (65.6%) participants were considered for a SCS, whereas 32 (34.4%) were considered for an IDDS.

Table 3a

*Demographic and Clinical Characteristics of Participants (*N *= 93)*

Characteristic	*n*	%
Gender		
Male	41	44.1
Female	52	55.9
Ethnicity		
White/Caucasian	88	94.6
Black/African American	5	5.4
Marital status		
Married	61	65.6
Not Married	32	34.4
Age at time of psychological evaluation (years)		
Less than 30	1	1.1
31-50	27	29.0
51-65	47	50.5
Greater than 65	18	19.4

Continued

Table 3a, continued

*Demographic and Clinical Characteristics of Participants (*N *= 93)*

Characteristic	*n*	%
Age at time of follow-up (years)		
Less than 30	1	1.1
31-50	23	24.7
51-65	49	52.7
Greater than 65	20	21.5
Highest education level completed		
Less than 12 years	6	6.5
High school/GED	37	39.8
Some college-associate’s degree	33	35.5
Bachelor’s degree	9	9.7
Graduate	8	8.6
BMI at time of psychological evaluation		
Underweight	2	2.2
Normal	18	19.4
Overweight	25	26.9
Obese	48	51.6
Employment Status		
SSD/Disability payments	48	51.6
Full/part time employment	19	20.4
Not employed, not due to disability	26	28.0
Auto accident related injury as source of pain		
Yes	13	14.0
No	80	86.0
Work related injury as source of pain		
Yes	21	22.6
No	72	77.4
Litigation related to pain/injury		
Yes, current	10	10.8
Yes, past	9	9.7
None	74	79.6
Smoking cigarettes at time of psychological evaluation		
Yes	31	33.3
No	62	66.7
Implant type		
SCS	61	65.6
IDDS	32	34.4
Medical diagnosis		
Pain related to spine injury/condition	75	80.6
RSD/CRPS	12	12.9
Other pain	6	6.5

Table 3b

*Demographic and Clinical Characteristics of Participants (*N *= 93)*

Characteristic	M	SD
Age at time of psychological evaluation (years)	54.8	11.72
Age at time of follow-up (years)	56.2	11.80
BMI at time of psychological evaluation	30.38	7.33

Setting and Procedure

The initial pre-surgical evaluations were conducted by a psychologist with a professional license (LP, LLP, TLLP) at the office of David M. Cowan, PhD, and Associates. Psychologists are either PhD or MA level clinicians specially trained in the administration, scoring, and interpretation of psychometric data. Master's level clinicians were supervised by a fully licensed, PhD level psychologist. Information pertinent to implant outcome was obtained from a retrospective review of participant's medical charts. There were five different clinicians conducting evaluations over the course of data collection.

As part of the evaluation, participants had previously participated in a clinical interview and responded to a variety of self-report psychometric assessments. Baseline data and information related to the independent and dependent variables was extracted from the participants' medical/psychological charts. Basic demographic information was transferred to a face sheet designed for this study. To ensure confidentiality, participants were assigned a participant number, which was included on the face sheet. No identifying characteristics, such as, patient's name, were included on this form (Appendix D).

As this was a retrospective chart review, it was not practical to obtain consent from each participant. Also, because this is a chart review and information obtained is not highly sensitive, the Institutional Review Board (IRB) allowed for waiver of informed consent.

The expected risks for participating in this study are minimal and may include: risk to confidentiality of protected medical information. Another potential risk is learning of research project and feeling concerned about whether or not the patient's information was included, or perhaps hearing about study outcomes and feeling embarrassed or worried about their implant status/satisfaction.

There may not be any direct benefit to the individual participants of this study; however, the goal is to learn more about the use of pre-surgical psychological evaluations for the purpose of improving treatment plans and allocation of resources. Participation in this study will likely benefit future patients considering implantation with a pain management device. As this is a retrospective chart review, there are no alternatives than the procedure presented and no option to withdrawal. To ensure confidentiality, participants were assigned an identification number, research materials were kept separate from their clinical file, and all materials related to the study were stored in locked filing cabinets. Electronic information was saved on a password-protected device and was only accessible to the research team. Information obtained by the researchers regarding participants' status at Pain Care Associates will not impact their current treatment at either Pain Care Associates or David M. Cowan, PhD, and Associates.

Measures

Personality Assessment Inventory.

Personality Assessment Inventory (PAI; Morey, 1991) is self-report objective measure of personality and psychopathology. This test is composed of 344 items that are answered on a four-alternative scale: totally false, slightly true, mainly true, and very true. These multiple response choices eliminate frequently reported dissatisfaction on the part of the test taker with a forced choice dichotomous responses and allows them the express a degree of truth between polar opposite responses. The test was designed in this fashion to assess more true variance per item.

Instructions for the test are as follows:

This booklet contains numbered statements. Read each statement and decide if it is an accurate statement about you. Mark your answer by filling in one of the circles on the answer sheet.

If the statement is *FALSE, NOT AT ALL TRUE,* fill in the F.

If the statement is *SLIGHTLE TRUE,* fill in the ST.

If the statement is *MAINLY TRUE,* fill in the MT.

If the statement is *VERY TRUE,* fill in the VT.

Give your own opinion of yourself. Be sure to answer every statement. DO NOT ERASE. If you need to change an answer, make an "X" through the incorrect answer and then fill in the correct circle. Do not write in this booklet.

Sample items from this measure are: "79) I do a lot of wild things just for the thrill of it", "126) Nothing seems to give me much pleasure", "185) I don't worry about things any more than most people" (Morey, 1991, Appendix E).

There are four validity scales, 11 clinical scales, five treatment consideration scales, and two interpersonal scales, making a total of 22 non-overlapping full scales.

- Validity scales: Inconsistency, Infrequency, Negative Impression, and Positive Impression.
- Clinical scales: Somatic Complaints, Anxiety, Anxiety-Related Disorders, Depression, Mania, Paranoia, Schizophrenia, Borderline Features, Antisocial Features, Alcohol Problems, and Drug Problems.
- Treatment scales: Aggression, Suicidal Ideation, Stress, Nonsupport, and Treatment Rejection.
- Interpersonal scales: Dominance and Warmth.

The PAI was designed and standardized for use in assessment of individuals over the age of 18 through adulthood. It requires a fourth grade reading level. The measure was standardized on a sample of 1,000 adults for community-dwelling settings. The sample matched 1995 U.S. census projections of gender, race, and age (Morey, 1996). The raw scores are converted to T-scores for interpretation, with a mean of 50 and standard deviation of 10. A T-score above 70 represents a deviation from typical responses of normal community respondents. The same T-score norms are used for both men and women, so not to distort normal epidemiological differences between these groups (Morey, 1996). Attempts were made during the design of the measure to eliminate items that may be subject to bias based on demographic features.

This measure has demonstrated adequate reliability and validity (Deisinger, 1995; Morey, 1991). Internal consistency alphas for PAI full scales are satisfactory, with median alphas reported for the full scales of .81 (normative sample), .82 (college sample), and .86 (clinical sample) (Morey, 1991). Test-retest reliability of the 11 full clinical scales over a four-week period was .86 (Morey, 1991). Regarding validity of the PAI, the four validity scales are designed to assess levels of conscientious responding and efforts at impression management and are included in the profile. These scales, Inconsistency (ICN), Infrequency (INF), Negative Impression (NIM), and Positive Impression (PIM), provide an assessment of response tendencies. Morey (1991) notes that in 99.4% of cases, random response simulations were identified by either ICN or INF. Correlational studies have been published which demonstrate convergent and discriminant validity of the PAI validity scales and clinical scales.

Review of the literature related to personality assessment and the chronic pain population has suggested the most frequently used measure is the MMPI (Hathaway &

McKinley, 1967) and its successor, the MMPI-2 (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989). However, there have been several criticisms regarding the use of this measure with the chronic pain population. For example, Vendrig (2000) notes that "the MMPI-2 does not appear to be very suited for the (simple) screening of candidates for chronic pain treatment programs" (p. 551) and Main and Spanswick (1995) suggest that the use of MMPI and MMPI-2 in assessment with chronic pain patients is "understandable but no longer justifiable" (p. 90). There has been argument that the content or meaning of the scales are not accurately represented by the scale titles (Turk & Fernandez, 1995), which may take away from the measures usefulness in identifying psychopathology among chronic pain patients. A second argument is related to item overlap. Some critics have argued that profile interpretation and distinction between groups is clouded by this overlap (Helmes, 1994). Thirdly, Pincus, Callahan, Bradley, Vaughn, and Wolfe (1986) have suggested that the MMPI-2 contains test items that reflect aspects of both psychiatric conditions and chronic illness, including chronic pain. Therefore, the profile for chronic pain patients should be considered invalid. Helmes (1994) further suggests that a patient's endorsing of symptoms associated with the medical condition may lead to profile elevations suggesting emotional or psychiatric disturbances.

Others have argued that several aspects of the PAI make it a well-suited measure for the assessment of patients with chronic pain. It has been noted to have low text complexity (Schinka & Borum, 1994). It is also shorter than other personality assessments, including the MMPI-2; 344 items in the PAI versus the MMPI-2's 567 items. Karlin et al. (2005) examined the clinical utility and psychometric properties of the PAI within a sample of chronic pain patients. They used a sample of 432 chronic pain patients referred for treatment to an interdisciplinary pain center. In this study, internal consistency reliability (Cronbach alpha) coefficients were acceptable and were very similar to those reported in the PAI Professional Manual (Morey, 1991). The mean alpha for the full scales was .79 and the median alpha was .80; both of which are similar to Morey's (1991) findings. Regarding mean scale and subscale profiles of the chronic pain sample, the score on Somatic Complaints (SOM) scale was significantly elevated, with a mean T-score of 72. This is more than two standard deviations above the mean elevation noted in the standardization sample (Morey, 1991). The authors also reported notable elevations on the Depression (DEP) scale and moderate elevations on the Anxiety (ANX) scale. In summary, this study suggests the PAI is an appropriate measure for use with personality assessment in chronic pain patients. The result of their study is generally consistent with the findings reported by Morey (1991) in the PAI Professional Manual.

Oswestry Disability Index Questionnaire.

The Oswestry Disability Index, previously referred to as the Oswestry Disability Index Questionnaire (Fairbank, Couper, Davies, & O'Brien, 1980) is a ten item, self-report measure designed to assess pain-related disability (Appendix F). This item was included in the pre-surgical evaluation and was completed for most participants in this study. This questionnaire, once scored, provides a percentage score of the individual's level of functioning. In referencing Garrad and Bennett (1971), Fairbank et al. (1980) notes, "by disability we mean the limitations of a patient's performance compared with that of a fit person" (p. 271). The measure was deliberately designed with a focus on physical activities, not the psychological components of pain and disability (Fairbank & Pynsent, 2000).

The questionnaire is divided into ten sections that reflect various activities of daily living. These ten categories were chosen based on the thought they were most relevant to the pain patient's experience. The categories include: 1) pain intensity, 2) personal care (washing, grooming, dressing), 3) lifting, 4) walking, 5) sitting, 6) standing, 7) sleeping, 8) sex life, 9) social life, and 10) travelling. Each section contains six statements; statements are listed in order of increasing physical difficulty in the activity noted in the category title. The authors note that the statements were designed to be easily understood and contain a single idea. They determined six statement choices was the most suitable amount for accurate assessment of the patient's experience without confusing the test-taker. The patient is asked to select one of the six options under each category which best describes their level of limitation. The measure generally takes less than five minutes to complete. Each section is scored on a zero to five scale, where a score of five reflects the greatest disability. The section scores are added to obtain a total out of 50. This score is then doubled to provide a percentage score. The interpretation of this measure based on the percentage scores is as follows:

- Minimal disability: 0-20%
- Moderate disability: 20%-40%
- Severe disability: 40%-60%
- Crippled: 60%-80%
- Scores ranging from 80%-100% reflect patients who are either bed-bound or exaggerating their symptoms.

The test makers suggest when a respondent endorses two responses in a category; the highest scoring item is used and considered the most accurate reflection of the level of disability. In the case where an item is left blank due to inapplicability (such as, sex life), the score is adjusted to calculate a percentage (Fairbank et al., 1980).

This measure has demonstrated adequate reliability and validity. Test-retest reliability when completed by 22 patients on two consecutive days yielded correlation coefficient of $r = .99$, where $p < 0.001$ (Fairbank et al., 1980). Internal consistency Chronbach’s alpha range from 0.71 (Strong, Ashton, & Large, 1994), 0.76 (Fisher & Johnson, 1997), and 0.87 (Kopec et al., 1996). This measure has demonstrated moderate correlation with the visual analogue scale ($N = 94$, $r = 0.62$) (Gronblad et al., 1993) and the McGill Pain Questionnaire (Haas & Nyiendo, 1992).

The Oswestry Disability Index Questionnaire is a popular measure used in outcome studies, especially for individuals with low back pain (Vianin, 2008). It has been used in studies as an indicator of surgical success based on health-status and quality of life factors, rather than only physiologic success. It has been found to reflect changes in functional status for individual patients and adequately distinguishes between those who improve and those who do not (Beurskens, de Vet, & Koke, 1996; Taylor, Taylor, Foy, & Fogg, 1999). It has been recommended for use by reviewers of outcome assessment instruments (Bombardier, 2000), and is therefore, a helpful measure for establishing baseline function.

Numerical Pain Scale.

A self-reported pain level was obtained from patients during the pre-surgical evaluation. They were asked to provide a number score ranging from zero to ten, where ten is the worst, most excruciating pain. This 11-point scale, measuring pain intensity, has been “recommended as a core outcome measure in clinical trials of chronic pain treatments” (Dworkin et al., 2005). Price and Harkins (1992) note that this type of scale is “very commonly used in clinical studies of pain and even in many experimental studies” (p. 113).

The Numerical Pain Scale has several advantages; it is a relatively simple measure, it can quickly ascertain changes in pain intensity, and patients and health professionals easily understand the measure. The numerical assignment, rather than choosing a descriptor word for pain, is thought to be much more straightforward and to therefore circumvent potential semantic issues (Price & Harkins, 1992). This measure has been found to be reliable and valid (Jensen & Karoly, 2001).

According to Jensen (2010) on the zero to ten scale, the rating chosen is suggested to have meaning as it relates to the impact of pain on functioning, such that:

- 1-4 = minimal impact on functioning, “mild pain”
- 5-6 = pain reported to have greater impact on functioning, “moderate pain”
- 7-10 = greatest impact on functioning, “severe pain”

Determination of Surgical Prognosis: Good vs. Poor Outcome: Information regarding the participants’ implant status was obtained from the electronic medical record, owned by Pain Care Associates. Review of records provided information regarding the patients’ trial status, permanent implant status, and their satisfaction with the device as reported to the medical team. As this is an elective procedure with the goal of improving pain control, patient satisfaction was a component of every implant procedure; both for trial and permanent devices. Outcome was coded as follows. Regarding trial status: 1) Did not trial; 2) Trial with inadequate relief, not implanted; 3) Good trial, implanted; and 4) Good trial, not implanted. If patients received a permanent device, the outcome was coded as follows: 1) In use, 2) Dissatisfaction/not in use/not explanted, 3) Explanted due to dissatisfaction, 4) Explanted due to medical reasons, and 5) Explanted due to noncompliance. For the purposes of this study, “good” outcome is defined as those who received a permanent implant, which was still in use at the time of chart review. "Poor" outcome is defined by the remaining groups. Participants who were explanted due to medical reasons were excluded from the analysis.

An additional outcome variable was used to post-hoc analysis in hopes of obtaining a more distinct demarcation between good and poor outcome. Only patients who were implanted with a permanent device were considered (n = 41). Two were excluded as they were explanted for medical reasons (infection and chronic delirium). Twenty-nine were considered to have a good outcome and were using their device at the time of follow-up. Poor outcome was defined as those who were not satisfied with the device/not using the device/not explanted (n = 8) and those who were explanted due to dissatisfaction (n = 2), with a total of 10 participants in this category.

Data Analysis

Logistic regression allows the researcher to predict a discrete outcome, that is, group membership, from a set of predictor variables (Tabachnick & Fidell, 2007). This type of analysis is very common in the health sciences research and is the most commonly used analysis in spine surgery outcome studies (Mannion & Elfering, 2006). Based on the purpose and variables of this study, a logistic regression was the most appropriate method of data analysis. There is one categorical dependent variable with two categories: good outcome and poor outcome. There are several independent, predictor variables which are either categorical or continuous in nature, that is, age, gender, BMI score, tobacco use, PAI T-scores on (Axis I): depression and anxiety, and (Axis II): borderline features, antisocial personality features, grandiosity, and paranoia.

Initially, a chi-square test or *t* tests were run on the predictor variables; demographic and medical variables that have been found to correlate with surgical outcome in past research were tested to assess for potential bivariate relationships. In this study, age, gender, BMI, and tobacco use were considered as predictor variables.

The predictor variables were analyzed in a hierarchical fashion. The first group of predictors entered was age, gender, BMI, and tobacco use, which have been mentioned in previous research. The second group of variables entered into the equation was Axis I disorders: depression and anxiety. The final group of predictors entered in the formula was Axis II disorders: borderline features, antisocial personality features, grandiosity, and paranoia. Entering the groups of predictors in this hierarchical fashion allows the researcher to determine the amount of variance accounted for by the various Axis II disorders above and beyond other predictors already entered. In this way, the demographic/medical variables and Axis I disorders were “held constant” while Axis II disorders are entered into the analysis (See Appendix G for hypotheses chart).

A power analysis was conducted with the assistance of G*Power 3.1.3, a downloaded computer program designed to perform high-precision statistical power analyses for the most common statistical tests in behavioral research (Faul, Erdfelder, Buchner, & Lang, 2009; Faul, Erdfelder, Lang, & Buchner, 2007). The standard alpha of .05, power of .8, and two-tailed test parameter was used for this power analysis (Cohen, 2001). The estimated overall basic probability of poor outcome in the population without any prediction involved was set at .3 based on the findings in previous research. When the odds ratio is equal to 1.5, a sample size of 242 is needed. When the odds ratio is equal to 2.0, a sample size of 92 is needed. Finally, when the odds ratio is equal to 3.0, a sample size of 46 is needed. For this project, an odds ratio of 2.0 was used, which will likely produce clinically significant results within a feasible framework.

As a hierarchical logistic regression was used, when R squared of another predictor is included in the power analysis will account for 10% of the variance, a sample size of 102 is needed; whereas 20% would require a sample size of 115, and 30% would require a sample size of 132. Based on these analyses, the desired sample size is 100 participants. In addition, variable selection is based on the estimate of approximately 10 participants per predictor entered into the analysis.

The data was entered into the Statistical Pack for the Social Sciences (SPSS) software. As described, a logistic regression was conducted to determine the amount of variance in surgical outcome account for by three groups of predictor variables. Data screening was conducted for missing data and outliers. Statistics for the overall model were calculated and reviewed and the following goodness of fit indices was addressed: log-likelihood, goodness of fit, and model chi-square with degree of freedom and level of significance. The next step of interpretation included a review of the classification table, where the percentage of correctly classified cases is presented (Tabachnick & Fidell, 2007).

Regression results were reviewed to determine the statistically reliability of the overall model in distinguishing between good and poor surgical outcome. Tables presenting test statistics, regression coefficients, and information regarding *B, Wald, df*, level of significance, and odds ratio are included (Mertler & Vannatta, 2005).

As the original outcome variable proposed for use is rather broad, two refined outcome variables were designed for post-hoc analyses. Post-hoc analyses include repeating hypotheses testing with both of these modified outcome variables. Additional post-hoc testing was done to examine the relationships between the outcome variable and Numerical

Pain Scale score, Oswestry Disability Index score, PAI clinical scales, source of pain, employment status, and the psychological evaluation recommendation. These relationships were explored using *t* tests and chi-square.

CHAPTER FOUR

Results

The goal of this study is to examine the relationship between several psychological features and surgical outcome. More explicitly, the relationships between Axis I conditions: depression and anxiety; and Axis II features: borderline, anti-social, paranoia, and grandiosity. The hypotheses of this study include analyses using the following predictor variables: age at time of psychological evaluation, gender, BMI scores, tobacco use, and PAI T-scores on the following scales: depression, anxiety, borderline, antisocial, grandiosity, and paranoia. The variable of time since surgery was to also be examined as originally proposed; however, as not all participants received a permanent implant (implanted n = 39, not implanted n = 52), the predictor of time since surgery was removed from the analyses so as to not contribute to noise or error in the following hypothesis tests.

Data Management

Prior to hypothesis testing, several data screening procedures were conducted. First, all variables of interest were examined through the statistical software program SPSS 21.0 for accuracy of data entry, missing values, normality of distributions, and multivariate outliers. Several scores that were miscoded upon data entry were corrected after examining original responses from participants. In the current study, there were no missing data on items pertinent to the hypotheses. Regarding the variables used in post-hoc analyses, there were several cases missing one piece of information (evaluation recommendation or Oswestry Disability Index Score). These cases were therefore excluded from the post-hoc analyses. Data screening procedures identified two participants who explanted due to medical reasons (infection and chronic delirium), and were therefore not included the final sample (*N* = 91).

Descriptive Statistics

In regards to the participants' recommendations based on their psychological evaluations, nine (9.8%) were considered "excellent" candidates, 66 (71%) were considered "good" candidates, nine (9.7%) were considered "fair" candidates, and eight (8.6%) were considered "poor" candidates (one participant was not given a score on this variable) (Table 4).

As each patient must first undergo trial before the placement of a permanent device, it was also important to get information about the participants' trial status/outcome. Twenty-five (26.9%) did not trial (fear, changed their mind, life changes), 24 (25.8%) had inadequate pain relief with trial, and 44 (47.3%) had a successful trial. Considering trial status as an outcome variable, 44 (47.3%) are considered to have had a "good" trial (those with a successful trial), whereas 49 (52.7%) were considered to have a "poor" (those not trialed, those with inadequate relief) trial (Table 4).

Of those considered for a permanent implants, 29 (31.2%) were using the device at the time of follow-up and reporting satisfactory results. There were eight (8.6%) participants who were dissatisfied with their device (and perhaps no longer using it, although not explanted), there were two (2.2 %) participants who were explanted due to dissatisfaction, two (2.2%) explanted due to medical concerns (infection, delirium), and 52 (55.9%) participants who decided against implant of permanent device. When considering outcome as defined as "good" (those who received a permanent implant, which was still in use at the time of chart review) and "poor" (those dissatisfied and explanted not due to medical reasons). After removing those explanted for medical reasons (2 participants), of the sample of 91 participants, 29 (31.2%) were considered to have a good outcome and 62 (68.1%) were considered to have a poor outcome (Table 4).

The means and standard deviations of scores of PAI scales are listed below (Table 5). Oswestry Disability Index scores at the time of the pre-surgical psychological evaluation ranged from 22 - 92, with a mean score of 53.13 (*N* = 90, *SD* = 14.09) (see Table 6). Pain scores at the time of the initial psychological evaluation for this group range from 3/10 to 10/10, mean a mean of 7.13 and standard deviation of 1.7 (Table 7).

Table 4

*Clinical Characteristics of Participants (*N *= 93)*

Characteristic	*n*	%
Evaluation Recommendation		
Excellent	9	9.8
Good	66	71.0
Fair	9	9.7
Poor	8	8.6
Missing	1	1.1
Device trial status		
Did not trial	25	26.9
Trial with inadequate relief (no implant)	24	25.8
Successful trial	41	44.1
Successful trial, not implanted	3	3.2
Permanent device status		
In use	29	31.2
Not in use, dissatisfaction (not explanted)	8	8.6
Explanted due to dissatisfaction	2	2.2
Explained due to medical complications	2	2.2
Not implanted	52	55.9
Trial Outcome		
Good	44	47.3
Poor	49	52.7
Outcome (permanent implant)		
Good	29	31.2
Poor	64	68.8

Table 5

*Participant's T-scores on PAI Full Scales (*N *= 93)*

Scale	*M*	*SD*
Inconsistency	53.17	9.67
Infrequency	48.33	6.64
Negative impression	52.56	8.42
Positive impression	53.29	9.07
Somatic complaints	70.66	10.79
Anxiety	52.96	11.09
Anxiety related disorders	50.25	10.98
Depression	60.57	11.09
Mania	43.62	7.54
Paranoia	44.76	7.69
Schizophrenia	47.73	9.23
Borderline	48.16	8.77
Antisocial	46.15	7.12
Alcohol problems	46.53	7.45
Drug Problems	50.33	7.60
Aggression	45.55	8.55
Suicidal ideation	48.86	8.23
Stress	51.69	9.60
Nonsupport	46.04	7.54
Treatment rejection	52.52	8.17
Dominance	50.8	10.44
Warmth	52.99	10.04

Table 6

*Scores on the Oswestry Disability Index Questionnaire (*N *= 90)*

Measure	*n*	%	*M*	*SD*
Oswestry Disability Index Questionnaire			53.13	14.089
Minimal disability	0	0		
Moderate disability	18	19.4		
Severe disability	46	49.5		
Crippled	24	25.8		
Bed bound/exaggerated	2	2.2		
Missing	3	3.2		

Table 7

*Scores on the Numerical Pain Scale (*N *= 93)*

Measure	M	SD
Numerical Pain Scale	7.13	1.702

Hypothesis Testing

Hypothesis one: Based on review of the literature, it was predicted that older age, female gender, high BMI scores, and tobacco use would be positively associated with negative surgical outcome. An independent samples *t* test was used to explore the relationship between the continuous predictor variables age and BMI scores and chi-square tests were used for the dichotomous outcome variable (good/poor outcome).

The mean age of those with a good outcome was found to be 53.1 ($n = 29$, $SD =$ 10.95) and mean age of those with poor outcome was 55.42 ($n = 62$, $SD = 12.22$). There is no significant difference in age between those with good outcome and those with poor; $t(89) = -.870$, $p = .387$ (two-tailed) (Table 8). The mean BMI score of those with good outcome was 30.6 ($n = 29$, $SD = 7.35$) and the mean of those with poor outcome was 30.4 ($n = 62$, $SD = 7.4$). There is no significant difference in BMI scores between those with good outcome and those with poor; $t(89) = .114$, $p = .909$ (two-tailed) (Table 8).

Table 8

*Group differences for good and poor outcome between age and BMI (*N *= 91)*

	Good outcome		Poor outcome				
Predictors	*M*	*SD*	*M*	*SD*	*t*(89)	*p*	Cohen's *d*
Age	53.10	10.95	55.42	12.22	-.870	.387	-.199
BMI	30.6	7.35	30.41	7.43	.114	.909	.026

A chi-square test was done to explore the relationship between the categorical predictor variables gender and tobacco use and the outcome variable. There were 13 males and 16 females with a good outcome and 28 males and 34 females with a poor outcome. There is no significant relationship between gender and outcome; χ^2 (1) = .001, $p = .976$ (Table 9). Of those with good outcome, there are eight participants who use tobacco and 21 who do not. Of those with poor outcome, there are 23 participants who use tobacco and 39 who do not. There is no significant relationship between tobacco use and outcome, $\chi^2(1) =$ .796, $p = .372$ (Table 9).

Table 9

*Occurrence Rates of Gender and Tobacco Use of Those with Good Outcome (*n *= 29) and Poor Outcome (*n *= 62)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(1)$	*p*
Gender	29	32	62	68	.001	.976
Male	13	14	28	31		
Female	16	18	34	37		
Tobacco use	29	32	62	68	.796	.372
Yes	8	9	23	25		
No	21	23	39	43		

Hypothesis two: It was hypothesized that the variables age, gender, BMI, and tobacco use would account for a significant percentage of the variance when predicting surgical outcome. A logistic regression was performed using these variables to determine the likelihood that participants would have a good versus poor outcome. The model contained four independent variables (age, gender, BMI, and tobacco use). The full model containing all predictors was not statistically significant, χ^2 (4) = 1.865, p = .761 (Table 10a, 10b, 10c), indicating that the model was not able to distinguish between participants who had a good outcome and those who had a poor outcome. The model as a whole explained 2% (Cox and Snell R Squared) and 3% (Nagerlkerke R Squared) of the variance in outcome, and correctly classified 69.2% of cases. None of the independent variables made a unique statistically significant contribution to the model.

Table 10a

*Mean Values or Frequencies for Predictor Variables as a Function of Outcome (*N *= 91)*

Predictors	Good outcome (*n = 29*)	Poor outcome (*n =62*)	*t* (89) χ^2 (4)	*p*
Age	53.10	55.42	-.870	.387
Gender (%)	32	68	.001	.976
BMI	30.6	30.41	.114	.909
Tobacco (%)	32	68	.796	.372

Note: Chi-square test used for gender and tobacco variable; *t* test used for other variables

Table 10b

*Intercorrelations for Outcome and Predictor Variables (*N *= 91)*

Measure	1	2	3	4	5
1. Outcome	--				
2. Age	.092	--			
3. BMI	-.012	-.119	--		
4. Gender	-.003	.120	-.055	--	
5. Tobacco	-.094	.142	.131	.095	--

Table 10c

*Summary of Logistic Regression Analysis Predicting Outcome (*N *= 91)*

Variable	*B*	*SE*	*OR*	95% CI	Wald statistic	*p*
Age	.020	.020	1.02	[0.98, 1.06]	1.03	.310
BMI	.005	.031	1.01	[0.95, 1.07]	.022	.883
Gender	-.021	.463	.979	[0.04, 2.23]	.002	.964
Tobacco	-.518	.507	.596	[0.22, 1.61]	1.04	.307

Note. CI = confidence interval for odds ratio (OR).

Hypothesis three: It was hypothesized that PAI T-scores on the depression and anxiety scales would add to the predictive power of the regression equation, suggesting that these psychological variables are predictive of surgical outcome.

An independent samples *t* test was used to explore the relationship between the predictor variables of anxiety and depression T-scores and good/poor outcome. The mean anxiety T-score of those with good outcome was 51.79 ($n = 29$, $SD = 10.18$) and the mean anxiety T-score of those with poor outcome was 53.69 ($n = 62$, $SD = 11.62$). There is no significant relationship between anxiety T-scores and outcome; $t(89) = -.755$, $p = .452$ (two-tailed) (Table 11).

The mean depression T-score of those with good outcome was 59.10 ($n = 29$, $SD = 8.63$) and the mean T-score of those with poor outcome was 61.58 ($n = 62$, $SD = 12.08$). There is no significant relationship between depression T-scores and outcome; $t(89) = -.991$, $p = .324$ (two-tailed) (Table 11).

Table 11

*Group Differences for Good and Poor Outcome Between T-Scores of Anxiety and Depression (*N *= 91)*

	Good outcome		Poor outcome				Cohen's
Predictors	*M*	*SD*	*M*	*SD*	*t*(89)	*p*	*d*
Anxiety	51.79	10.182	53.69	11.620	-.755	.452	-.174
Depression	59.10	8.63	61.58	12.08	-.991	.324	-.236

A logistic regression was performed to assess the impact of T-scores of depression and anxiety and the likelihood that participants would have a good versus poor outcome. The model contained two independent variables (depression, anxiety). The full model containing all predictors was not statistically significant, χ^2 (2) = .592, *p* = .592 (Table 12a, 12b, 12c), indicating that the model was not able to distinguish between participants who had a good outcome and those who had a poor outcome. The model as a whole explained 1.1% (Cox and Snell R Squared) and 1.6% (Nagerlkerke R Squared) of the variance in outcome, and correctly classified 68.1% of cases. None of the independent variables made a unique statistically significant contribution to the model.

Table 12a

*Mean Values for Predictor Variables as a Function of Outcome (*N *= 91)*

Predictors	Good outcome (*n* = 29)	Poor outcome (*n* =62)	*t*(89)	*p*
Anxiety	51.79	53.69	-.755	.452
Depression	59.10	61.58	-.991	.324

Table 12b

*Intercorrelations for Outcome and Predictor Variables (*N *= 91)*

Measure	1	2	3
1. Outcome	--		
2. Depression	.104	--	
3. Anxiety	.080	.626*	--

* *p* < .01

Table 12c

*Summary of Logistic Regression Analysis Predicting Outcome (*N *= 91)*

Variable	*B*	*SE*	*OR*	95% CI	Wald statistic	*p*
Anxiety	.005	.027	1.005	[0.95, 1.06]	.036	.849
Depression	.018	.027	1.018	[.966, 1.073]	.451	.502

Note. CI = confidence interval for odds ratio (OR).

Hypothesis four: Together with the groups of predictors mentioned above, it was hypothesized that PAI T-scores on the borderline, antisocial, grandiose, and paranoid scales, would add to the predictive power of the regression equation; therefore, suggesting that these personality features account for a percentage of the variance above those which have been previously demonstrated in the research.

An independent samples *t* test was used to explore the relationship between the predictor variables of borderline, antisocial, grandiose, and paranoid scales and good/poor outcome. The mean borderline T-score of those with good outcome was 47.72 (n = 29, SD = 7.91) and the mean borderline T-score of those with poor outcome was 48.4 (n = 63, SD = 9.32). There was no significant relationship between borderline T-scores and outcome; $t(89) = -.339$, $p = .735$ (two-tailed) (Table 13). The mean antisocial T-score of those with good outcome was 46.79 (n = 29, SD = 8.27) and the mean antisocial T-score of those with poor outcome was 45.97 (n = 62, SD = 6.66). There was no significant relationship between antisocial T-scores and outcome; $t(89) = .509$, $p = .612$ (two-tailed) (Table 13). The mean grandiose T-score for those with good outcome was 45.66 (n = 29, SD = 7.89) and the mean grandiose T-score for those with poor outcome was 44.32 (n = 62, SD = 9.15). There is no significant relationship between grandiose T-scores and outcome; $t(89) = .675$, $p = .502$ (two-tailed) (Table 13). Finally, the mean paranoia T-score for those with good outcome was 45.9 (n = 29, SD = 7.72) and the mean paranoia T-score for those with poor outcome was

44.55 (*n* = 62, *SD* = 7.61). There is no significant relationship between paranoia T-scores and outcome; *t*(89) = .784, *p* = .435 (two-tailed) (Table 13).

Table 13

*Group Differences for Good and Poor Outcome Between T-Scores of Paranoia, Borderline, Antisocial, and Grandiosity (*N *= 91)*

	Good outcome		Poor outcome				
Predictors	*M*	*SD*	*M*	*SD*	*t*(89)	*p*	Cohen's *d*
Paranoia	45.90	7.715	44.55	7.606	.784	.435	.176
Borderline	47.72	7.905	48.40	9.322	-.339	.735	-.103
Antisocial	46.79	8.269	45.97	6.665	.509	.612	.109
Grandiosity	45.66	7.893	44.32	9.154	.675	.502	.157

A hierarchical logistic regression was performed to assess the impact of a number of factors on the likelihood that participants would have a good versus poor outcome. The independent variables were entered into three different steps. Step one independent variables: age, gender, BMI, and tobacco use. Step two independent variables: T-scores of depression and anxiety. Step three independent variables: T-scores of borderline, antisocial, grandiosity, and paranoia.

Step one: the model contained four independent variables (age, gender, BMI, and tobacco use). The full model containing all predictors was not statistically significant, χ^2 (4) = 1.865, *p* = .761, indicating that the model was not able to distinguish between participants who had a good outcome and those who had a poor outcome.

Step two: with the addition of independent variables depression and anxiety, the block was not statistically significant, χ^2 (2) = 1.55, *p* = .462. The overall model at this step was also not significant, χ^2 (6) = 3.41, *p* = .756. The model as a whole explained 3.7% (Cox and Snell R Squared) to 5.2% (Nagerlkerke R Squared) of the variance in outcome, and correctly classified 69.2% of cases. None of the independent variables made a unique statistically significant contribution to the model.

Step three: with the addition of independent variables, T-scores of borderline, antisocial, grandiose, and paranoid scales, the block was not statistically significant, χ^2 (4) = 2.32, $p = .677$. The overall model at this step was also not significant, χ^2 (10), $p = .837$ (Table 14a, 14b, 14c). The model as a whole explained between 6.1% (Cox and Snell R Squared) to 8.5% (Nagerlkerke R Squared) of the variance in outcome, and correctly classified 70.3% of cases. None of the independent variables made a unique statistically significant contribution to the model.

Table 14a

*Mean Values of Frequencies for Predictor Variables as a Function of Outcome (*N *= 91)*

Predictors	Good outcome ($n = 29$)	Poor outcome ($n = 62$)	$t(89)$ $\chi^2(10)$	p
Age	53.10	55.42	-.870	.387
Gender (%)	32	68	.001	.976
BMI	30.6	30.41	.114	.909
Tobacco (%)	32	68	.796	.372
Anxiety	51.79	53.69	-.755	.452
Depression	59.10	61.58	-.991	.324
Paranoia	45.90	44.55	.784	.509
Borderline	47.72	48.40	-.339	.735
Antisocial	46.79	45.97	.509	.612
Grandiosity	45.66	44.32	.675	.502

Note: Chi-square test used for gender and tobacco variable; *t* test used for other variables

Table 14b

*Intercorrelations for Outcome and Predictor Variables (*N *= 91)*

Measure	1	2	3	4	5	6	7	8	9	10	11
1. Outcome	--										
2. Age	.092	--									
3. Gender	-.003	.120	--								
4. BMI	-.012	-.119	-.055	--							
5. Tobacco	-.094	.142	.095	.131	--						
6. Anxiety	.080	-.152	.049	.055	-.159	--					
7. Depression	.104	-.211*	.009	.139	-.032	.626**	--				
8. Paranoia	-.083	-.135	-.239*	.073	.102	.309**	.318**	--			
9. Borderline	.036	-.205	-.079	.235*	-.151	.694**	.617**	.548**	--		
10. Antisocial	-.054	.004	-.497**	.008	-.110	.196	.138	.449**	.386**	--	
11. Grandiosity	-.071	-.031	-.280**	-.091	.027	-.116	-.120	.028	-.148	.046	--

* $p < .005$, ** $p < .01$

Table 14c

*Summary of Logistic Regression Analysis Predicting Outcome (*N *= 91)*

Variable	*B*	*SE*	*OR*	95% CI	Wald statistic	*p*
Gender	-.558	.609	.572	[0.17, 1.88]	.840	.359
Age	.027	.022	1.03	[0.99, 1.07]	1.617	.203
BMI	-.004	.033	.996	[0.93, 1.06]	.011	.915
Tobacco	-.468	.550	.626	[0.21, 1.84]	.724	.395
Anxiety	.009	.033	1.01	[0.95, 1.08]	.074	.786
Depression	.033	.032	1.03	[0.97, 1.10]	1.090	.297
Paranoia	-.034	.041	.966	[0.89, 1.05]	.691	.406
Borderline	.004	.048	1.00	[0.91, 1.10]	.006	.937
Antisocial	-.035	.043	.966	[0.88, 1.05]	.667	.414
Grandiosity	-.017	.028	.983	[0.93, 1.04]	.391	.532

Note. CI = confidence interval for odds ratio (OR).

Hypotheses one through four have all been rejected as there is no relationship between this group of predictors and the outcome variable, and the predictor variables have not been found to distinguish between good and poor outcome as originally hypothesized.

Post-Hoc Analyses

A modified outcome variable considering only those who received the permanent implant (n = 39) was also used to test the hypotheses as mentioned above. In this group, there were 24 participants who were implanted with a SCS and 15 with an IDDS. There were 29 cases of good outcome and 10 cases of poor outcome (dissatisfaction/not in use/explanted). Again, two cases were excluded as they were explanted due to medical reasons. Considering those who were implanted with a SCS, 14 had a good outcome and 10 had a poor outcome. Considering those implanted with an IDDS, 15 had a good outcome and none of these participants had a poor outcome.

Revised hypothesis one: An independent samples t test was used to explore the relationship between the continuous predictor variables age and BMI scores and the dichotomous outcome variable (good/poor outcome). The mean age of those with a good outcome was found to be 53.1 (n = 29, SD = 10.95) and mean age of those with poor outcome as 62 (*n* = 10, *SD* = 12.64). There was a significant difference in age between those with good outcome and those with poor; *t*(37) = -2.131, *p* = .040 (two-tailed) (Table 15); suggesting those younger in age were more likely to have a good outcome than those older in age. Based on Cohen's *d* (-.752) this is nearing a large effect size.

The mean BMI score of those with good outcome was 30.597 (*n* = 29, *SD* = 7.34) and the mean of those with poor outcome was 30.29 (*n* = 10, *SD* = 6.53). There is no significant difference in BMI scores between those with good outcome and those with poor; *t*(37) = .117, *p* = .908 (two-tailed) (Table 15).

Table 15

*Group Differences for Good and Poor Outcome Between Age and BMI (*n *= 39)*

	Good outcome		Poor outcome				Cohen's
Predictors	*M*	*SD*	*M*	*SD*	*t*(37)	*p*	*d*
Age	53.10	10.949	62.00	12.640	-2.131	.040*	-.752
BMI	30.597	7.348	30.290	6.538	.117	.908	.044

Note: * $p < .05$

A chi-square test was done to explore the relationship between the categorical predictor variables gender and tobacco use and the outcome variable. There were 13 males and 16 females with a good outcome and six males and four females with a poor outcome. There is no significant relationship between gender and outcome; χ^2 (1) = .685, *p* = .408 (Table 16). Of those with a good outcome, there are there are eight participants who use tobacco and 21 who do not. Of those with poor outcome, there are three participants who did use tobacco and seven who do not. There is no significant relationship between tobacco use and outcome, χ^2 (1) = .021, *p* = .884 (Table 16).

Table 16

*Occurrence Rates of Gender and Tobacco Use of Those with Good Outcome (*n *= 29) and Poor Outcome (*n *= 10)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(1)$	*p*
Gender	29	75	10	25	.685	.408
Male	13	33	6	15		
Female	16	41	4	10		
Tobacco use	29	75	10	25	.021	.884
Yes	8	21	3	7		
No	21	54	7	18		

Revised hypothesis two: A logistic regression was performed to assess the impact of a number of factors on the likelihood that participants would have a good versus poor outcome. The model contained four independent variables (age, gender, BMI, and tobacco use). The full model containing all predictors was not statistically significant, χ^2 (4) = 5.733, *p* = .220 (Table 17a, 17b, 17c), indicating that the model was not able to distinguish between participants who had a good outcome and those who had a poor outcome. The model as a whole explained 13.7% (Cox and Snell R Squared) and 20.1% (Nagerlkerke R Squared) of the variance in outcome, and correctly classified 74.4% of cases. Age was the only predictor that made a significant contribution to the model, with an odds ratio of 1.087. This indicates that those of older age are one times more likely to have poor outcome, controlling for all other factors in the model.

Table 17a

*Mean Values or Frequencies for Predictor Variables as a Function of Outcome (*n *= 39)*

Predictors	Good outcome (*n* = 29)	Poor outcome (*n* =10)	*t*(37) $\chi^2(4)$	*p*
Age	53.10	62.00	-2.131	.040*
Gender (%)	74	25	.685	.408
BMI	30.597	30.290	.117	.908
Tobacco (%)	75	25	.021	.884

Note: Chi-square test used for gender and tobacco variable; *t* test used for other variables
* *p < .05*

Table 17b

*Intercorrelations for Outcome and Predictor Variables (*n *= 39)*

Measure	1	2	3	4	5
1. Outcome	--				
2. Age	.331*	--			
3. BMI	-.019	-.152	--		
4. Gender	-.133	-.020	-.056	--	
5. Tobacco	-.023	.069	.285	-.041	--

Note. * *p*< .05

Table 17c

*Summary of Logistic Regression Analysis Predicting Outcome (*n *= 39)*

Variable	*B*	*SE*	*OR*	95% CI	Wald statistic	*p*
Age	.084	.042	1.087	[1.00, 1.18]	3.971	.046*
BMI	.004	.067	1.00	[0.88, 1.14]	.003	.953
Gender	.681	.805	1.98	[0.41, 9.57]	.717	.397
Tobacco	.514	.922	1.67	[0.28, 10.18]	.311	.577

Note. CI = confidence interval for odds ratio (OR).
* *p*< .05

Revised hypothesis three: An independent samples *t* test was used to explore the relationship between the predictor variables of depression and anxiety T-scores and good/poor outcome. The mean anxiety T-score of those with good outcome was 51.79 (*n* = 29, *SD* = 10.18) and the mean anxiety T-score of those with poor outcome was 54.10 (*n* = 10, *SD* = 11.2). There is no significant relationship between anxiety T-scores and outcome; *t*(37) = -.603, *p* = .550 (two-tailed) (Table 18). The mean depression T-score of those with good outcome was 59.10 (*n* = 29, *SD* = 8.63) and the mean T-score of those with poor outcome was 58.20 (*n* = 10, *SD* = 9.86). There is no significant relationship between depression T-scores and outcome; *t*(37) = .275, *p* = .785 (two-tailed) (Table 18).

Table 18

*Group Differences for Good and Poor Outcome Between T-scores of Anxiety and Depression (*n *= 39)*

	Good outcome		Poor outcome				
Predictors	*M*	*SD*	*M*	*SD*	*t*(37)	*p*	Cohen's *d*
Anxiety	57.79	10.182	54.10	11.20	-.603	.550	.345
Depression	59.10	8.629	58.20	9.864	.275	.785	.097

A logistic regression was performed to assess the impact of a number of factors on the likelihood that participants would have a good versus poor outcome. The model contained two independent variables (depression, anxiety). The full model containing all predictors was not statistically significant, χ^2 (2) = .966, *p* = .617 (Table 19a, 19b, 19c), indicating that the model was not able to distinguish between participants who had a good outcome and those who had a poor outcome. The model as a whole explained 2.4% (Cox and Snell R Squared) and 3.6% (Nagerlkerke R Squared) of the variance in outcome, and correctly classified 74.4% of cases. None of the independent variables made a unique statistically significant contribution to the model.

Table 19a

*Mean Values for Predictor Variables as a Function of Outcome (*n *= 39)*

Predictors	Good outcome (*n = 29*)	Poor outcome (*n =10*)	*t*(37)	*p*
Anxiety	57.79	54.10	-.603	.550
Depression	59.10	58.20	.275	.785

Table 19b

*Intercorrelations for Outcome and Predictor Variables (*n *= 39)*

Measure	1	2	3
1. Outcome	--		
2. Depression	-.045	--	
3. Anxiety	.099	.565*	--

Note. * $p < .01$

Table 19c

*Summary of Logistic Regression Analysis Predicting Outcome (*n *= 39)*

Variable	*B*	*SE*	*OR*	95% CI	Wald statistic	*p*
Anxiety	.041	.044	1.042	[0.96, 1.14]	.869	.351
Depression	-.041	.054	.960	[0.86, 1.07]	.565	.452

Note. CI = confidence interval for odds ratio (OR).

Revised hypothesis four: An independent samples *t* test was used to explore the relationship between the predictor variables of borderline, antisocial, grandiose, and paranoid scales and good/poor outcome. The mean borderline T-score of those with good outcome was 47.72 (*n* = 29*, SD* = 7.91) and the mean borderline T-score of those with poor outcome was 47.20 (*n* = 10*, SD* = 8.626). There was no significant relationship between borderline T-scores and outcome; *t*(37) = .177, *p* = .861 (two-tailed) (Table 20). The mean antisocial T-score of those with good outcome was 46.79 (*n* = 29, *SD* = 8.269) and the mean antisocial T-score of those with poor outcome was 44.80 (*n* = 10, *SD* = 6.268). There was no significant relationship between antisocial T-scores and outcome; *t*(37) = .694, *p* = .492 (two-tailed) (Table 20). The mean grandiose T-score for those with good outcome was 45.66 (*n* = 29, *SD* = 7.893) and the mean grandiose T-score for those with poor outcome was 45.40 (*n* = 10, *SD* = 7.662). There is no significant relationship between grandiose T-scores and outcome; *t*(37) = .089, *p* = .930 (two-tailed) (Table 20). Finally, the mean paranoia T-score for those with good outcome was 45.90 (*n* = 29, *SD* = 7.715) and the mean paranoia T-score for those with poor outcome was 43.30 (n = 10, SD = 9.440). There is no significant relationship between paranoia T-scores and outcome; $t(37) = .867$, $p = .392$ (two-tailed) (Table 20).

Table 20

*Group Differences for Good and Poor Outcome Between T-scores of Paranoia, Borderline, Antisocial, and Grandiosity (*n *= 39)*

	Good outcome		Poor outcome				Cohen's
Predictors	*M*	*SD*	*M*	*SD*	*t*(37)	*p*	*d*
Borderline	47.72	7.905	47.20	8.626	.177	.861	.063
Antisocial	46.79	8.269	44.80	6.268	.694	.492	.271
Grandiosity	45.66	7.893	45.40	7.662	.089	.930	.033
Paranoia	45.90	7.715	43.30	9.44	.867	.392	.301

Given the limited sample size and the amount of predictor variables, it would not be appropriate to run the logistic regression as outline in hypothesis four. Hypotheses one through three were rejected when testing with this outcome variable.

SCS Participants Only: Considering the refined outcome variable (n = 39), all patients with an IDDS had a good outcome. As those who were planted with the IDDS were so successful, it was worth exploring outcomes with only the SCS participants. When the IDDS participants were removed from the analyses and only SCS participants were considered, 14 had a good outcome and 10 had a poor outcome (n = 24). Chi-square analyses were run to examine the relationship between outcome and both gender [χ^2 (1) = 1.368, p = .239.] and tobacco use [χ^2 (1) = .006, p = .939.], neither of which demonstrated a significant relationship (Table 21). An independent samples *t* test was used to examine the relationship between outcome and age and BMI score. BMI was not found to be significantly related to outcome [$t(22) = .156$, $p = .877$ (two-tailed)]; however, age was: $t(22) = -2.259$, $p = .034$ (two-tailed) (Table 22). The effect size of this relationship based on Cohen's *d* (-.9375) is large. The mean age of those with good outcome was 50.00 (n = 14, SD = 12.956) and the mean age of those with poor outcome was 62.00 (n = 10, SD =

12.640); suggesting that those of a younger age are more likely to have a good outcome than those of older age. Independent samples *t* tests examined the relationship between this outcome variable and the other independent variables of interest, none of which were found to be significantly related: anxiety [*t*(22) = -.591, *p* = .561 (two-tailed)], depression [*t*(22) = .336, *p* = .740 (two-tailed)], paranoia [*t*(22) = .387, *p* = .702 (two-tailed)], borderline [*t*(22) = .440, *p* = .665 (two-tailed)], antisocial [*t*(22) = .342, *p* = .736 (two-tailed)], and grandiosity [*t*(22) = -.659, *p* = .517 (two-tailed)] (Table 22). Similar to the other outcome variables, hypotheses one through four were again rejected when testing with this outcome variable.

Table 21

*Occurrence Rates of Gender and Tobacco Use of Those with Good Outcome (*n *= 14) and Poor Outcome (*n *= 10)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(1)$	*p*
Gender	14	58	10	41	1.386	.239
Male	5	21	6	25		
Female	9	38	4	17		
Tobacco use	14	58	10	42	.006	.939
Yes	4	17	3	13		
No	10	41	7	29		

Table 22

*Group Differences for Good and Poor Outcome Between Age, BMI, PAI T-Scores of Anxiety, Depression, Paranoia, Borderline, Antisocial, and Grandiosity (*n *= 24)*

	Good outcome		Poor outcome				Cohen's
Predictors	*M*	*SD*	*M*	*SD*	*t*(22)	*p*	*d*
BMI	30.75	7.492	30.29	6.538	.156	.877	.0654
Age	50.00	12.956	62.00	12.640	-2.259	.034*	-.9375
Anxiety	51.64	9.153	54.10	11.200	-.591	.561	-.2241
Depression	59.64	10.689	58.20	9.864	.336	.740	.1400
Paranoia	44.50	5.748	43.30	9.440	.387	.702	.1535
Borderline	48.57	6.676	47.20	8.626	.440	.665	.1776
Antisocial	45.79	7.402	44.80	6.268	.342	.736	.1443
Grandiosity	43.50	6.442	45.40	7.662	-.659	.517	-.2684

Note: * $p < .05$

As the hypotheses were rejected and minimal relationships between predictor variables and outcome were found, it was of interest to examine other possible relationships among other information gleaned from the pre-surgical psychological evaluation and outcome. These additional variables include: Numerical Pain Scale, Oswestry Disability Index score, PAI clinical scales, source of pain, employment status, and psychological evaluation recommendation.

Numerical Pain Scale and Oswestry Disability Index: As Numerical Pain Scale and Oswestry Disability Index are measures often used in pain research and pre-surgical psychological evaluations, analyses were run to explore the relationship between these scores and the various outcome variables: the original outcome variable encompassing the largest group of participants ($N = 91$), the smaller outcome group considering only those who received an implant ($n = 39$), and finally, the group of implanted SCS patients ($n = 24$).

Several participants ($n = 3$) were missing scores on the Oswestry Disability Index and were therefore excluded from the following analyses. Using the original outcome variable ($n = 88$), the mean Oswestry Disability Index score for those with good outcome was 49.32 ($n = 28$, $SD = 14.565$) while the mean score for those with poor outcome was 55.45 ($n = 60$, $SD = 13.448$). There was a relationship very near to significance between this outcome variable and Oswestry Disability Index score, $t(86) = -1.939$, $p = .056$ (two-tailed) (Table 23). This suggests those with a higher Oswestry Disability Index score are more likely to have a poor outcome. The effect size based on Cohen's d (-.4373) is suggestive of a nearly medium relationship. The mean pain score for those with good outcome was 7.34 ($n = 28$, $SD = 1.289$) while the mean score for those with poor outcome was 7.09 ($n = 60$, $SD = 1.868$). There is no significant relationship between this outcome variable and pain score, $t(89) =$

.667, *p* = .507 (two-tailed) (Table 24).

When considering the smaller outcome set; participants who were implanted with a device (*n* = 37), the mean Oswestry Disability Index score for those with good outcome was 49.32 (*n* = 28, *SD* = 14.565) while the mean score for those with poor outcome was 46.78 (*n* = 9, *SD* = 14.864). There was no significant relationship between Oswestry Disability Index Disability Score and this outcome variable, *t*(35) = .454, *p* = .653 (Table 23). The mean pain score for those with good outcome was 7.34 (*n* = 28, *SD* = 1.289) while the mean score for those with poor outcome was 6.30 (*n* = 9, *SD* = 1.889). There is a near significant relationship between this outcome variable and pain score, *t*(37) = 1.954, *p* = .058 (two-tailed) (Table 24). This suggests that those with a higher pain score at the time of pre-surgical psychological evaluation are more likely to have a good surgical outcome. The effect size for this relationship based on Cohen's *d* (.6431) is suggestive of a medium relationship.

Considering the SCS outcome only, the mean Oswestry Disability Index score for those with good outcome was 43.77 (*n* = 13, *SD* = 13.343) while the mean score for those with poor outcome was 46.78 (*n* = 9, *SD* = 14.864). There was no significant relationship between this outcome variable and Oswestry Disability Index score, *t*(20) = -.497, *p* = .625 (two-tailed) (Table 23). The mean pain score for those with good outcome was 7.21 (*n* = 13, *SD* = 1.369) while the mean score for those with poor outcome was 6.30 (*n* = 9, *SD* = 1.889). There is no significant relationship between this outcome variable and pain score, *t*(22) = 1.378, *p* = .182 (two-tailed) (Table 24).

Table 23

Group Differences for Good and Poor Outcome Between Oswestry Disability Index Scores Using Three Outcome Variables

	Good outcome		Poor outcome					
Predictors	*M*	*SD*	*M*	*SD*	*df*	*t*	*p*	Cohen's *d*
ODI (*n* = 88)	49.32	14.565	55.45	13.448	86	-1.94	.056	-.4373
ODI (*n* = 37)	49.32	14.565	46.78	14.864	35	.454	.653	.1726
ODI (*n* = 22)	43.77	13.343	46.78	14.864	20	-.497	.625	-.2131

Note: ODI = Oswestry Disability Index

Table 24

Group Differences for Good and Poor Outcome Between Numerical Pain Scale Scores Using Three Outcome Variables

	Good outcome		Poor outcome					
Predictors	*M*	*SD*	*M*	*SD*	*df*	*t*	*p*	Cohen's *d*
NPS (*N* = 91)	7.34	1.289	7.09	1.868	89	.667	.507	.1558
NPS (*n* = 39)	7.34	1.289	6.30	1.889	37	1.954	.058	.6431
NPS (*n* = 24)	7.21	1.369	6.30	1.889	22	1.378	.182	.5516

Note: NPS = Numerical Pain Scale

PAI Scales: As the PAI has rarely been used in the research with pain patients and within the context of pre-surgical psychological evaluations; it was of interest to examine the relationships between the clinical scales and the various outcome variables. It was the hope to evaluate the utility of this measure in pre-surgical psychological evaluations for pain patients. Both the clinical scales and treatment consideration scales were used for the following analyses.

Using the original outcome variable (*N* = 91), there are no significant relationships between any of the clinical scales and this outcome variable (Table 25).

Table 25

*Group Differences for Good and Poor Outcome Between PAI Scales with Outcome (*N *= 91)*

	Good outcome		Poor outcome				Cohen's
Predictors	*M*	*SD*	*M*	*SD*	*t*(89)	*p*	*d*
Inconsist	53.00	8.860	53.15	10.042	-.067	.947	-.0158
Infreq	47.00	6.118	48.98	6.906	-1.323	.189	-.3034
Neg Imp	53.48	8.895	52.11	8.298	.717	.475	.1592
Pos Imp	53.76	7.458	53.00	9.895	.367	.715	.0867
Som Com	70.52	8.998	70.94	11.587	-.172	.864	-.0404
Anxiety	51.79	10.182	53.69	11.620	-.755	.452	-.1739
ARD	49.90	10.072	50.63	11.556	-.293	.770	-.0673
Depression	59.10	8.629	61.58	12.081	-.991	.324	-.2362
Mania	45.17	6.574	42.82	7.970	1.382	.170	.3216
Paranoia	45.90	7.715	44.55	7.606	.784	.435	.1762
Scz	46.62	5.919	48.39	10.442	-.848	.399	-.2085
Borderline	47.72	7.905	48.40	9.322	-.339	.735	-.0786
Antisocial	46.79	8.269	45.67	6.665	.509	.612	.1491
Alc Prb	46.90	6.281	46.37	8.094	.309	.758	.0732
Drg Prb	50.03	5.622	50.35	8.213	-.190	.850	-.0454
Aggression	45.62	9.221	45.65	8.298	-.013	.990	-.0034
SI	47.62	6.925	49.29	8.651	-.911	.365	-.2131
Stress	51.55	9.410	51.84	9.803	-.132	.895	-.0301
Nonsupport	45.31	6.730	46.55	7.936	-.726	.470	-.1685
Trtm Rej	51.45	9.081	52.84	7.808	-.751	.455	-.1641
Dominance	51.55	10.176	50.31	10.653	.527	.600	.1190
Warmth	53.79	10.897	52.53	9.772	.553	.582	.1217

Note: Inconsist = Inconsistency, Infreq = Infreqency, Neg Imp = Negative Impression, Pos Imp = Positive Impression, Som Com = Somatic Complaints, ARD = Anxiety Related Disorders, SCZ = Schizophrenia, Alc Prb = Alcohol Problems, Drg Prb = Drug Problems, SI = Suicidal Ideation, Trtm Rej = Treatment Rejection

When considering the smaller outcome set; participants who were implanted with a device ($n = 39$), there was one scale found to be significantly related to outcome: treatment rejection, $t(37) = -2.226$, $p = 0.032$ (two-tailed) (Table 26), where the mean T-score for those with good outcome is 51.45 ($n = 29$, $SD = 9.081$), and the mean T-score for those with poor outcome is 58.50 ($n = 10$, $SD = 7.091$). This suggests that those with high T-scores on this scale are more likely to have a poor outcome.

Table 26

*Group Differences for Good and Poor Outcome Between PAI Scales with Outcome (*n *= 39)*

	Good outcome		Poor outcome				
Predictors	*M*	*SD*	*M*	*SD*	*t*(37)	*p*	Cohen's *d*
Inconsist	53.00	8.860	52.60	10.080	.119	.906	.0421
Infreq	47.00	6.118	48.90	6.523	-.833	.410	-.3004
Neg Imp	53.48	8.895	52.70	7.761	.247	.806	.0934
Pos Imp	53.76	7.458	52.10	12.315	.509	.614	.1630
Som Com	70.52	8.998	67.20	7.465	1.046	.302	.4016
Anxiety	51.79	10.182	54.10	11.200	-.603	.550	-.2150
ARD	49.90	10.072	52.30	12.482	-.612	.544	-.2116
Depression	59.10	8.629	58.20	9.864	.275	.785	.0971
Mania	45.17	6.574	43.80	8.613	.525	.602	.1788
Paranoia	45.90	7.715	43.30	9.440	.867	.392	.3015
Scz	46.62	5.919	47.40	8.996	-.313	.756	-.1024
Borderline	47.72	7.905	47.20	8.626	.177	.861	.0629
Antisocial	46.79	8.269	44.80	6.268	.694	.492	.2712
Alc Prb	46.90	6.281	47.90	9.291	-.384	.703	-.1261
Drg Prb	50.03	5.622	50.80	8.904	-.318	.753	-.1034
Aggression	45.62	9.221	45.60	8.897	.006	.995	.0020
SI	47.62	6.925	46.60	7.633	.392	.697	.1399
Stress	51.55	9.410	49.00	8.433	.758	.453	.2854
Nonsupport	45.31	6.730	42.40	6.670	1.182	.245	.4343
Trtm Rej	51.45	9.081	58.50	7.091	-2.226	.032*	-.8653
Dominance	51.55	10.176	55.90	8.425	-1.213	.233	-.04656
Warmth	53.79	10.897	54.50	10.773	-.177	.860	-.0655

Note: Inconsist = Inconsistency, Infreq = Infreqency, Neg Imp = Negative Impression, Pos Imp = Positive Impression, Som Com = Somatic Complaints, ARD = Anxiety Related Disorders, SCZ = Schizophrenia, Alc Prb = Alcohol Problems, Drg Prb = Drug Problems, SI = Suicidal Ideation, Trtm Rej = Treatment Rejection
* $p < .05$

When considering only those who were implanted with a SCS participants (*n* = 24); there were no significant relationships between outcome and T-scores on these scales. Using this outcome variable, the treatment rejection scale trended towards significance, *t*(22) = -1.750, *p* = .094 (two-tailed) (Table 27), with the mean T-score for those with good outcome is 52.79 (*n* = 29, *SD* = 8.396) and the mean T-score for those with poor outcome is 58.50 (*n* = 10, *SD* = 7.091).

Table 27

*Group Differences for Good and Poor Outcome Between PAI Scales with Outcome (*n *= 24)*

	Good outcome		Poor outcome				
Predictors	*M*	*SD*	*M*	*SD*	*t*(22)	*p*	Cohen's *d*
Inconsist	55.64	7.909	52.60	10.080	.829	.416	.3355
Infreq	46.14	4.688	48.90	6.523	-1.208	.240	-.4859
Neg Imp	54.57	9.967	52.70	7.761	.495	.625	.2093
Pos Imp	52.64	8.563	52.10	12.315	.128	.900	.0509
Som Com	70.71	10.687	67.20	7.465	.893	.381	.3807
Anxiety	51.64	9.153	54.10	11.20	-.591	.561	-.2405
ARD	51.71	11.138	52.30	12.482	-.121	.905	-.0498
Depression	59.64	10.689	58.20	9.864	.336	.740	.1400
Mania	45.07	8.589	43.80	8.613	.357	.724	.1476
Paranoia	44.50	5.748	43.30	9.440	.387	.702	.1535
Scz	46.29	5.370	47.40	8.996	-.380	.708	-.1498
Borderline	48.57	6.676	47.20	8.626	.440	.665	.1776
Antisocial	45.79	7.402	44.80	6.268	.342	.736	.1443
Alc Prb	46.29	6.580	47.90	9.291	-.500	.622	-.1999
Drg Prb	49.00	6.164	50.80	8.904	-.587	.563	-.2350
Aggression	44.21	8.031	45.60	8.897	-.399	.694	-.1640
SI	49.07	8.801	46.60	7.633	.715	.482	.2998
Stress	51.29	10.766	49.00	8.433	.559	.582	.2368
Nonsupport	43.36	4.413	42.40	6.670	.424	.676	.1697
Trtm Rej	52.79	8.396	58.50	7.091	-1.750	.094	-.7347
Dominance	50.79	10.282	55.90	8.425	-1.291	.210	-.5436
Warmth	52.29	12.238	54.50	10.773	-.459	.651	-.1916

Note: Inconsist = Inconsistency, Infreq = Infreqency, Neg Imp = Negative Impression, Pos Imp = Positive Impression, Som Com = Somatic Complaints, ARD = Anxiety Related Disorders, SCZ = Schizophrenia, Alc Prb = Alcohol Problems, Drg Prb = Drug Problems, SI = Suicidal Ideation, Trtm Rej = Treatment Rejection

Source of Pain: Participants were sorted into three different groups based on the source of their pain: spine pain, reflex sympathetic dystrophy syndrome/complex regional pain syndrome (RSD/CRPS), and other pain conditions. It is interesting to separate these conditions into different groups, as spine pain and RSD/CRPS are different types of pain conditions all together. The participants grouped into the spine pain condition reported the primary medical issue was related to an issue with the spine leading to back/neck pain. This would include pain conditions related to injury or disease to the spinal column, conditions such as, but not necessarily limited to: degenerative disc disease, herniated discs, arthritis/osteoarthritis, and post-laminectomy syndrome. RSD/CRPS is a condition thought to be the result of damage to the nervous system. There may be medical problems with the blood vessels, muscles, skin, nerves, and bones as a result of nerves that are no longer able to properly control and regulate sensation, temperature, and blood flow. This condition has two forms: either caused by an injury to the nerve, or a chronic nerve disorder, generally in arms or legs, which occurs after injury. This is an incurable condition and with worsening course, leaving patients with significant physiological changes to the affected area, muscle wasting, pain in the entire limb, and limited functionality (“Complex regional pain syndrome,” 2012).

Using the original outcome variable (*N* = 91), there were 23 spine pain participants with good outcome and 50 with poor outcome. There were six RSD/CRPS with good outcome and six with poor outcome, and there were six participants with other pain conditions who had poor outcome and zero with good outcome. As there were few participants in the other category, this was dropped from the analysis. Even still, this sample did not meet the assumption of expected frequency; therefore, the Fisher’s Exact Probability Test was used in place of Person chi-square test. No significant relationship was found, χ^2 (2) = 1.568, *p* = .324 (Table 28).

Table 28

*Occurrence Rates of Source of Pain of those with Good Outcome (*n *= 29) and Poor Outcome (*n *= 56)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(2)$	*p*
Source of Pain	29	32	62	68	1.568	.324
Spine	23	25	50	54		
RSD/CPRS	6	7	6	7		

When considering the smaller outcome set; participants who were implanted with either device (*n* = 39), there were 23 spine pain participants with good outcome and nine with poor outcome. There were six RSD/CRPS with good outcome and one with poor outcome, and there were no participants with other pain conditions in this grouping. This sample did not meet the assumption of expected frequency; therefore, the Fisher's Exact Probability Test was used in place of Person chi-square test. No significant relationship was found, χ^2 (1) = .577, *p* = .653 (Table 29).

Table 29

*Occurrence Rates of Source of Pain of those with Good Outcome (*n *= 29) and Poor Outcome (*n *= 10)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(1)$	*p*
Source of Pain	29	74	10	26	.577	.653
Spine	23	59	9	23		
RSD/CPRS	6	15	1	3		
Other	0	0	0	0		

Considering the SCS outcome only (*n* = 24), there were eight spine pain participants with good outcome and nine with poor. There were six RSD/CPRS participants with good outcome and one with poor. There were no participants with other pain conditions in this grouping. This sample did not meet the assumption of expected frequency; therefore, the Fisher's Exact Probability Test was used in place of Person Chi-square test. No significant relationship was found, χ^2 (1) = 3.048, *p* = .172 (Table 30).

Table 30

*Occurrence Rates of Source of Pain of those with Good Outcome (*n *= 14) and Poor Outcome (*n *= 10)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(1)$	*p*
Source of Pain	14	58	10	42	3.048	.172
Spine	8	33	9	38		
RSD/CPRS	6	25	1	4		

Employment Status: Participants were sorted into five different groups based on their employment status: SSD, SSI, worker's compensation/auto missed wages, employment (full or part time), and other (homemaker, laid off, otherwise not working not due to disability). In this population (*N* = 93), participants only endorsed the following three categories: SSD (*n* = 48, 51.6%), employment (*n* = 19, 20.4%), and other (*n* = 26, 28.0%).

Using the original outcome variable (*N* = 91), there were 12 participants receiving SSD with a good outcome and 35 with a poor outcome. There were 10 participants who were employed with a good outcome and nine with a poor outcome. Finally, there were seven participants in the "other" category with good outcome and 18 with poor outcome. The relationship between employment status and this outcome variable trended towards significance, χ^2 (2) = 4.814, *p* = .090 (Table 31). This suggests that those who are employed, whether full-time or part-time, are more likely to have successful outcome.

Table 31

*Occurrence Rates of Employment Status of those with Good Outcome (*n *= 29) and Poor Outcome (*n *= 62)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(2)$	*p*
Emp Stat	29	32	62	68	4.814	.090
Dis Ben	12	14	35	39		
Emp	10	11	9	10		
Other	7	5	18	21		

Note: Emp Stat = Employment Status, Dis Ben = Disability Benefits, Emp = Employment

When considering the smaller outcome set; participants who were implanted with either device (*n* = 39), there were 12 participants receiving SSD with a good outcome and 3 with a poor outcome. There were 10 participants who were employed with good outcome and two with poor outcome. Finally, there were seven participants in the "other" category with good outcome and five with poor outcome. This sample did not meet the assumption of expected frequency; and the Fisher's Exact Probability Test was not generated. Therefore, this relationship cannot be evaluated using SPSS. When using the Pearson Chi-Square, there was no significant relationship between this outcome variable and employment status, χ^2 (2) = 2.374, *p* = .305 (Table 32).

Table 32

*Occurrence Rates of Employment Status of those with Good Outcome (*n *= 29) and Poor Outcome (*n *= 10)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(2)$	*p*
Emp Stat	29	74	10	27	2.374	.305
Dis Ben	12	31	3	8		
Emp	10	26	2	5		
Other	7	17	5	13		

Note: Emp Stat = Employment Status, Dis Ben = Disability Benefits, Emp = Employment

Considering the SCS outcome only group (*n* = 24), there were four participants receiving SSD with a good outcome and three with a poor outcome. There were six participants who were employed with a good outcome and two with a poor outcome. Finally, there were four participants in the "other" category with good outcome and five with poor outcome. This sample did not meet the assumption of expected frequency; and the Fisher's Exact Probability Test was not generated. Therefore, this relationship cannot be evaluated using SPSS. When using the Pearson Chi-Square, there was no significant relationship between this outcome variable and employment status, χ^2 (2) = 1.633, *p* = .442 (Table 33).

Table 33

*Occurrence Rates of Employment Status of those with Good Outcome (*n *= 14) and Poor Outcome (*n *= 10)*

Predictors	Good outcome *n*	%	Poor outcome *n*	%	$\chi^2(2)$	*p*
Emp Stat	14	58	10	42	1.633	.442
Dis Ben	4	17	3	13		
Emp	6	25	2	8		
Other	4	17	5	20		

Note: Emp Stat = Employment Status, Dis Ben = Disability Benefits, Emp = Employment

Psychological Evaluation Recommendation: The pre-surgical psychological evaluations at the office of David M. Cowan, PhD, and Associates are rather comprehensive. The typical protocol for these evaluations includes a detailed semi-structured clinical/diagnostic interview, the Pain Assessment and Treatment Tracking Inventory (a measure designed by Dr. Cowan as a comprehensive self-report assessment of patient's pain experiences), PAI-2, Screener and Opioid Assessment for Patients with Pain (SOAPP), Oswestry Disability Index, Survey of Pain Attitudes – Revised, Pain Catastrophizing Scale (PCS), McGill Quality of Life Questionnaire, Modified West Haven-Yale Multidimensional Pain Inventory, and the Pain Behavior Rating Scale. At the conclusion of the evaluation, the findings were interpreted and a recommendation for surgical candidacy was made, either: excellent, good, fair, or poor. Over the course of this data collection period, there were five clinicians evaluating patients; all master's level clinicians were supervised by Dr. Cowan on all cases.

For the purposes of these analyses in order to meet assumptions of chi-square testing, the original variable was collapsed and a new variable was created: excellent/good and fair/poor. There is one participant who was not given an evaluation recommendation and was excluded from the following analyses.

Using the original outcome variable (*N* = 90), there were 73 participants who were rated excellent/good; 27 who had a good surgical outcome and 46 who had a poor surgical outcome. There were a total of 17 participants who were rated as fair/poor; two with a good surgical outcome and 15 who had a poor surgical outcome. A chi-square test reveals there was a statistically significant relationship between the rating made and outcome [χ^2 (1) = 4.016, *p* = .045) (Table 34). The results suggest the clinicians were fairly good at predicting outcome, albeit with quite a few false positives (46/71).

Table 34

*Occurrence Rates of Psychological Evaluation Recommendations of those with Good Outcome (*n *= 29) and Poor Outcome (*n *= 61)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(1)$	*p*
Recommendation	29	32	61	68	4.016	.045*
Ex/Good	27	30	46	51		
Fr/Poor	2	2	15	17		

Note: Ex/good = Excellent/Good, Fr/Poor = Fair/Poor
* *P < .05*

When considering the smaller outcome set; participants who were implanted with either device (*n* = 39), there were 35 participants given a rating of excellent/good; 27 had a good surgical outcome and eight had a poor surgical outcome. There were four participants who were given a rating of fair/poor; two had a good surgical outcome and two had a poor surgical outcome. This sample did not meet the assumption of expected frequency; therefore, the Fisher's Exact Probability Test was used in place of Person chi-square test; there was no significant relationship (χ^2 (1) = 1.387, *p* = .267) (Table 35).

Table 35

*Occurrence Rates of Psychological Evaluation Recommendations of those with Good Outcome (*n *= 29) and Poor Outcome (*n *= 10)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(1)$	*p*
Recommendation	29	74	10	26	1.387	.267
Ex/Good	27	69	8	21		
Fr/Poor	2	5	2	5		

Note: Ex/good = Excellent/Good, Fr/Poor = Fair/Poor

Considering the SCS outcome only (*n* = 24), there were 21 participants given the rating of excellent/good; 13 with good surgical outcome and eight with poor surgical outcome. There were three participants given the rating of fair/poor; one with a good surgical outcome and two with a poor surgical outcome. This sample did not meet the assumption of expected frequency; therefore, the Fisher's Exact Probability Test was used in place of Person Chi-square test. No significant relationship was found, χ^2 (1) = .882, *p* = .550 (Table 36).

Table 36

*Occurrence Rates of Psychological Evaluation Recommendations of those with Good Outcome (*n *= 14) and Poor Outcome (*n *= 10)*

	Good outcome		Poor outcome			
Predictors	*n*	%	*n*	%	$\chi^2(1)$	*p*
Recommendation	14	58	10	42	.882	.550
Ex/Good	13	55	8	33		
Fr/Poor	1	4	2	8		

Note: Ex/good = Excellent/Good, Fr/Poor = Fair/Poor

CHAPTER FIVE

Discussion

Past research has noted the increased rate of psychological disorders, both Axis I and Axis II, among those with chronic pain. Research has also noted the significant impact of various psychological, social, and medical factors on surgical outcome. Research in the area of implanted pain management devices and surgical outcome is somewhat limited, and studies examining the impact of Axis II disorders on outcome are even more so limited. Implantation with a pain management device is an expensive and invasive procedure, one with risks and side effects. There are several post-surgical changes and requirements, with which patients must adhere. Many patients are able to find relief with these devices; unfortunately, some do not. Because of the potential risks, costs, lifestyle changes, and long-term commitment associated with this procedure, selecting the most appropriate candidates is incredibly important. As such, pre-surgical psychological evaluations are needed to aid in the selection process. Therefore, it is of upmost importance to identify the most meaningful evaluation process in hopes of properly allocating resources and helping patients optimize pain management. The goal of this dissertation is to identify a constellation of psychological symptoms/conditions that can be identified as predictors of success following implantation with a pain management device.

It was hypothesized that age, gender, BMI, and tobacco use; in addition to PAI T-scores of depression, anxiety, borderline, antisocial, grandiosity, and paranoia scales would all be associated with surgical outcome. Furthermore, it was predicted that above and beyond other factors mentioned, that PAI T-scores of borderline, antisocial, grandiose, and paranoid features would serve as significant predictors of outcome.

Findings: Contrary to previous research; in this study, the relationships between gender, age, BMI, and tobacco use and outcome were not statistically significant, when using the broad outcome variable (*N* = 91). These findings are not consistent with previous research that indicates these variables are predictive of outcome. This inconsistency may be associated with the broad outcome variable and/or the small sample size. In addition, the physician, who has most likely been working with the patient for some time, refers for this procedure. It is possible that physicians are screening out those who display more overt signs of psychopathology and/or those they believe will not be good candidates for these procedures, prior to even referring for psychological evaluation.

When considering the self-report of Axis I conditions (depression and anxiety) there was very little difference in mean T-scores between the two outcome groups. Both the participants with good outcome and poor outcome were somewhat depressed, albeit not clinically significant (T-score means ranging from 59-61, respectively). There was less evidence of anxiety among this population than would be expected given findings in past research (T-score means ranging from 51-53). Taken as a whole, there were only 18 participants with clinically significant T-scores on the depression scale and there were seven with clinically significant T-scores on the anxiety scale. The incidence of these symptoms in this population is lower than what would be expected based on the literature. These two independent variables were not found to have any statistically significant predictive power.

A similar pattern was also found between the self-report of Axis II features. The mean borderline T-scores were lower than the normative sample mean of 50 (47-48), as was for antisocial (45-46), paranoia (44-45), and grandiosity (44-45) scales as well. In fact, out of the 93 participants, only one had a clinically significant T-score on borderline, one on antisocial, one on paranoia, and one on grandiosity (four different participants). The self-report Axis II pathology was not a strong presence in this population. These clinical features were not found to be predictive of outcome.

None of the expected variables (self-report assessments of psychopathology) were found to be significantly related to outcome or to have any predictive ability. There are several reasons why this may be happening: first of all, the PAI is a self-report measure. Participants may be minimizing their level of pathology, perhaps to “fake good” in order to be perceived as a good candidate for implantation. It is also possible that on these particular scales, the participant population has low levels of pathology. Further, this is a small sample size. With a larger sample it may be possible to have uncovered more issues based on self-report.

Post-hoc analyses, revised hypotheses testing: There is some potential that the outcome variable was too broadly defined and therefore interfered with the ability to find statistically significant relationships between the variables of interest. In hopes of resolving this limitation, two additional outcome variables were devised, which used a smaller subset of this population. The first additional outcome variable was cleaner than the original in the sense that only participants who were actually implanted were included (n = 39). As such, there were 29 participants with a good outcome and 10 with poor. Given that this is even a smaller sample size and there are so few participants with poor outcome, it would be expected that little, if any significance could be found. However, when using this refined outcome variable, it was found that those who were younger in age were more likely to have a good outcome. This is consistent with past research and makes sense clinically; it would be expected that those who are younger are quite possibly in better physical shape and are perhaps better equipped physically to tolerate and manage chronic pain. This was the only variable found to be related to outcome; there was no relationship between BMI, gender, and tobacco use. Based on the small sample size and the number of predictors, it is not appropriate to run a logistic regression as outlined in hypothesis four.

Similar to the original outcome variable, there was very little difference between the mean T-scores of those with good outcome and those with poor outcome on self-report of depression, anxiety, borderline, antisocial, paranoia, and grandiose features. When entered into a logistic regression, these variables were not able to predict outcome.

With additional investigation, it was discovered that when considering this refined group of participants (those who had actually received the permanent implant); all of those who were implanted with an IDDS (intrathecal drug delivery system) had a good outcome. Therefore, a further revision of the outcome was devised, using only participants who were implanted with a SCS (spinal cord stimulator) (n = 24). Of these, 14 had a good outcome and 10 had a poor outcome. This sample is even further limited given the small numbers; however, it is an even purer outcome sample. There was no relationship found between outcome and gender, BMI, and tobacco use, which is consistent with all other variations of outcome used in this study. Consistent with the previously mentioned outcome variable (n = 39), age was found to be significantly related to outcome. Again, suggesting that those of younger age are more likely to have a good outcome. There were no relationships between this outcome variable and the self-reported levels of depression, anxiety, borderline, antisocial, paranoia, and grandiosity.

No matter how outcome was defined, there was very little to be said about the relationships between the predictor variables and outcome, in this study. In addition, as the outcome variable was refined, a significant relationship between the variables (with the exception of age) was not predictive of outcome. This suggests there are other, more significant variables that may be more predictive of surgical outcome.

Implant type: Despite the insignificance of the hypothesis testing, there were several interesting findings within the post-hoc analyses that are worthy of discussion. Most significant, when considering those who were implanted with a permanent device, all of those who were implanted with an IDDS had a successful outcome, whereas, 42% of those with SCS had a poor outcome.

There are several reasons why this may be the case. First, patients may have a different set of expectations when considering the IDDS rather than the SCS. They may believe this device is more likely to be helpful and therefore have a more positive outlook following implantation. In addition, the IDDS may be more successful than SCS due to the mode of treatment: the IDDS dispenses pain medication directly to the spinal cord, whereas the SCS sends an electrical signal with the goal of covering the sensation of pain with a tingling sensation. There is no medication involved in this form of treatment.

A review of the literature did not produce any research in support of the above hypothesized relationships. However, the research does suggest the importance of pre-operative expectations on spine surgery outcome. In their study, Iversen, Daltroy, Fossel, and Katz (1998) found that those with more ambitious expectations for physical functioning following surgery were associated with improved function at follow-up. Those with many expectations before surgery (especially those with lower baseline levels of functioning) reported more post-operative improvement in functioning than those who had lower expectations. Taken together, their findings suggest that those who had higher expectations regard functioning after surgery were more likely to report improvement than those who had minimal expectations. Although this is a different procedure, it does speak to the importance of patient expectations on surgical outcome when considering patients who have pain. As such it could be speculated that those who have higher expectations for a device and believe that it will be effective, are more likely to have a positive outcome. The results of this study and the current study suggest the importance of speaking with patients pre-operatively regarding expectations.

Significant findings on self-report measures: Based on some of the findings, it appears that participant's self-perception of their pain condition may have some bearing on outcome. When using the broad sample ($N = 91$), there was a significant relationship found between Oswestry Disability Index score, employment status, and outcome, suggesting that those with a higher Oswestry Disability Index score (those who see themselves as more disabled), and those who are not employed (and may be receiving disability benefits); are more likely to have a poor outcome. At the point these patients are considering implantation with one of these devices; they have likely been in the medical system for quite some time and have been struggling with their chronic condition. Given their long standing pain issues and likely functional impairments, they may have developed a deeply ingrained the identity of being in pain and being disabled. There may be a variety of secondary gain issues associated with remaining disabled, which remain even after this type of procedure. For example, they may be receiving a variety of disability benefits; they may be excused from social, family, marital responsibilities, and so forth. They have become psychologically invested in the idea of disability and the sick role and are therefore geared towards maintaining this identity even after the most medically advanced treatment attempts are made to manage their pain.

In one study investigating illness beliefs before cardiac surgery as a predictor of disability, quality of life, and depression three months post-surgery, Juergens, Seekatz, Moosdorf, Petrie, and Rief (2010) found that illness beliefs was predictive of disability, physical functioning, and depression. This is consistent with the explanation above in that the beliefs patients hold about disability and illness continue to impact their physical and psychological functioning following surgical intervention.

Interestingly, when using the revised outcome group of only participants who were implanted with a device (n = 39), there was also a significant relationship between pain score and outcome, suggesting that those with a higher pain score at the time of the pre-surgical psychological evaluation are more likely to have a good outcome. Perhaps this is due to the fact that patients with self-perceived higher levels of pain are more open to these treatment modalities and have more room for decreased pain scores following implantation. A meta-analysis aimed at reviewing psychological characteristics as determinates of outcome following implantation of SCS (a total of 95 articles) did not make any reference to pain scores and the relationship between pain score and outcome as discussed above (Sparkes et al., 2010). Additional review of the literature did not find the Numerical Pain Scale score used as a predictor of outcome.

It was also observed that those who score higher on the treatment rejection scale of the PAI (using the n = 39 outcome and trending towards significance in n = 24 sample) were more likely to have a poor outcome. According the Morey (1991), this scale “provides a measure of attributes and attitudes associated with an interest in personal changes of a psychological or emotional nature. Items tap the relative willingness to participate actively in treatment, acknowledgment of personal problems, and the disposition to accept responsibility for problems in one's life…the scaling of [this scale] is such that elevations suggest little motivation for treatment" (p. 20). This sample was normed based on a community-dwelling sample, rather than a treatment sample, therefore even T-scores within the average range may be suggestive of poor motivation for treatment. According to Morey (1991) T-scores that range from 53-62 are "indicative of persons who are generally satisfied with themselves as they are and see little need for major changes in their behavior" (p. 20). As such, using the $n = 39$ sample, the mean T-score for those with good outcome is 51.45 (*SD* = 9.081), and the mean T-score for those with poor outcome is 58.50 (*SD* = 7.091); similarly with the $n = 24$ sample, 52.79 (*SD* = 8.396) and the mean T-score for those with poor outcome is 58.50 (*SD* = 7.091). This suggests that those with poor outcome were likely unmotivated to make the necessary personal changes and to take an active role in their treatment. This way of thinking may very well contribute to the character issues that lead to poor outcome following implantation with a pain management device.

Psychological Evaluations: As mentioned above, there is more to the pre-surgical psychological evaluations conducted at the office of David M. Cowan, PhD and Associates than the data points used in this study: the semi-structured clinical/diagnostic interview and a variety of short self-report inventories. There is the potential that the additional measures obtained during these psychological evaluations were influential in the pre-surgical screening process and clinical decision making regarding recommendations for surgery. In addition, these results may also suggest that the clinical opinion/judgment of the evaluating psychologist can be a fruitful and important component of the comprehensive evaluation.

The question now becomes, what is it about this population that cues the clinician to the potential for poor outcome?

The importance of subjective clinical judgment has been acknowledged in the literature. As reported by Shedler, Mayman, and Manis (1993), communication can convey multiple levels of meaning, and the keen ear of the clinician may find more than what is simply reported on self-report inventories. The authors suggest that additional meaning surfaces when communications are not overly structured and that "another human being is the best (as of now, perhaps only) 'instrument' for registering these meanings" (p. 1118). In their study investigating self-report measures and clinical judgment, these researchers note the "critical importance" of subjective clinical judgment. They found that mental health scales may not always actually assesses mental health issues, rather in some cases, a sense of denial on the part of the participant. The interpretation of their findings suggests that mental health assessments/measures are not identifying psychological distress/pathology in those who take a defensive test-taking approach. This research is consistent with findings of this study; such that clinical judgment is an important component is psychological case conceptualization and decision-making.

Given the above findings, it is appropriate to explore and examine the common theme between these significant findings: the relationships between Oswestry Disability Index score, Numerical Pain Scale score, Treatment Rejection Scale, employment status and clinical decision making and outcome: good/poor. Although not as initially hypothesized, the clinical presentation of participants who had a poor outcome is similar. They have high Oswestry Disability Index scores, lower Numerical Pain Scale scores, higher Treatment

Rejection scale T-scores, are not working and/or receiving disability benefits and are considered to be poor candidates based on clinical judgment.

There are two issues worth exploring further. The first relates to the participant's self-perception and the second relates to participant characteristics. Those who are seeing themselves as more disabled and perhaps follow the disabled lifestyle, that is, not working and/or receiving disability benefits, are more likely to have a poor outcome. It can be speculated that they do not see themselves as able to recover, to move forward with their lives now that their pain treatment regimen has improved. Perhaps it is because of this belief, this way of viewing themselves, that some patients do not find satisfactory relief with this advanced form of treatment.

Clinical experience would suggest that those who take an active role in their treatment, those who are open and willing to work *with* their providers to appropriately manage chronic pain, are more likely to have success with medical interventions. Those who are not likely to be successful are the opposite, and although perhaps not overtly, they may refute the possibility that this form of treatment will actually reduce their pain. There are certainly patients in this population who have become psychologically invested in maintaining their pain/disability/illness. As mentioned above, this may be the result of several secondary gain issues. Unfortunately, in some cases, there is the possibility that these patients are not interested in getting better, despite their actual report of wanting to reduce their pain. These patients have become a victim of their pain; they have not found adequate relief despite all efforts from the physicians, and do not believe there is anything that can be done to address their pain. They seek out help, appear open to suggestions, but ultimately reject solutions offered. They tend to avoid taking responsibility for making change. This can often be an exhausting and frustrating population to work with. A review of the literature has not revealed research exploring the issue of personal responsibility and medical outcome. However, the relationship between motivation factors and surgical outcome is explored in the research, and suggests those who are more motivated will be more successful than their less motivated counterparts (see Block et al., 2003 for review).

It is hypothesized that these characteristic styles mentioned above, taken together are consistent with an established personality style: the help-rejecting complainer.

This profile was originally identified in the group therapy setting, first by Frank et al. (1952) and used again by Yalom and Leszcz (2005). According to Yalom and Leszcz (2005), the help-rejecting complainer (or HRCs):

> Implicitly or explicitly *request* help from the group by presenting problems or complaints and then *reject* any help offered. HRCs continually present problems in a manner that makes them to appear insurmountable…They often tend to exaggerate their problems and to blame others, often authority figures on whom they depend in some fashion. HRCs seem entirely self-centered, speaking only of themselves and their problems. (p. 403)

In addition, Yalom and Leszcz (2005) note the close association between help rejecting complaining and somatic channeling of emotional distress; which would be consistent with the constellation of chronic pain patients with this personality style. However, a literature review using PubMed, Medline, and PsychInfo did not produce any research on the subject of the help-rejecting complainer and chronic pain.

Clinical implications

From the medical perspective, the findings of this study suggest that implantation with an IDDS is more likely to be successful than SCS. The clinical implication of this finding is that perhaps more patients should be considered for treatment with an IDDS rather than a SCS. In doing so, more patients may find success and improved pain control.

From a psychological perspective, there are several important clinical implications of these findings. This study did not find evidence of a specific constellation of personality disorder features that lead to poor outcome following implantation with a pain management device, based on the self-report measures used as personality disorder scores were quite low in this study. Rather, the results and ensuing interpretation suggests there may be other psychological factors at play. For one, the patient's self-perception regarding disability status and also whether they fit the profile of the help-rejecting complainer. This construct was not clearly measured on the scales used for this study (and it does not appear that a scale for this construct is available based on literature review); however, the keen judgment of the clinician in identifying patients who are likely to be unsuccessful, coupled with several symptom-specific scales, may help identify those with a strong self-perception of being disabled and also the help-rejecting complainer style, and therefore, assist the clinician in making more accurate and helpful clinical recommendations regarding surgical intervention. It is suggested that the health psychologist be aware of these features and consider these psychological issues when making clinical recommendations and decisions.

Pre-surgical psychological evaluations are comprehensive and time consuming. Based on a review of the literature, clinicians often rely on a variety of psychometric measures to make clinical recommendations when considering a variety of medical procedures. Perhaps the evaluations are not tapping into the most appropriate/meaningful psychological constructs for this purpose. It may be prudent to reconsider the current assessment batteries and utilize measures that assess for self-perception regarding disability and the construct of the help-rejecting complainer. In addition, it would be helpful to seek and implement strategies for treating this patient population, in hopes of improving their chances for success in the medical setting and to also (hopefully) improve the overall quality of life (through improved interpersonal and intrapersonal relations). Also, when considering the instruments typically used in these assessments, it may be beneficial to use additional assessments of psychological factors that do not solely rely on self-report, given potential defensiveness and biases.

Limitations

As with all research, this study is not without limitations. To begin, a discussion regarding the outcome variable used for this study is warranted. The outcome variable is broad and may not clearly capture the construct of good and poor outcome. The refined outcome variables likely provide a clearer demarcation between good and poor; however, the samples are quite small, which limits the statistic power of analyses using these variables. With that said, using this outcome variable was not in the initial study design and proposed, but rather a modification as a result of very low response rates of follow-up surveys.

The proposed design of this study was to administer a follow-up survey to participants after they were implanted with their device with the aim of gaining specific details of their post-operative experiences. This information was then to be used to create an outcome variable, which incorporated several aspects of emotional, social, and physical function; including: participants' satisfaction with the implant, their level of activity since implant, pain score, their employment status, and Oswestry Disability Index assessment.

This would have allowed for a comprehensive, richer, and more meaningful outcome variable. However, there were several set-backs in the process of gathering this helpful follow-up information.

According to the proposed study, there were several methods of connecting participants with post-surgical follow-up surveys: potential participant's charts were flagged at the pain clinic to cue the medical staff to offer the survey to patients during their follow-up medical appointments. As some patients had consented to participation in research at the time of their initial evaluation, a select group of potential participants were solicited over the phone. Finally, for those who had not consented to participate in research, a survey was sent in the mail, along with a stamped/addressed return envelope. Unfortunately, return/response rate in all three of these avenues was very low.

A running list of potential participants was started in September 2010; following the modification of the consent form to include participation in future research. All patients who called the office of David M. Cowan PhD and Associates to schedule an appointment for a pre-surgical evaluation were recorded. At the time of follow-up, there were 146 patients who had called to schedule an appointment. Of these patients, 20 canceled or no-showed their appointment. The remaining 124 were considered for the follow-up survey. Two of patients were deceased at the time of follow-up, many patients had not been implanted, some were not interested in participating, and many never returned the phone call (three attempts were made to each potential participant). Out of this effort, 22 surveys were completed over the phone. For those who did not return a call (after three attempts), surveys were sent by mail. Surveys were also mailed to implant patients who had received a pre-surgical psychological evaluation at the office of David M. Cowan, PhD between 2008 and 2013. In total, 154 surveys were sent in the mail: 11 participants mailed back the survey incomplete requesting not to be included in the study, eight completed the survey (two of whom had already completed the survey at the pain clinic), and seven surveys were returned with no forwarding address. There were six eligible surveys completed at the pain clinic. In total, attempts were made with 280 former patients; there were 39 potentially eligible follow-up surveys. This *N* was deemed unacceptable and alternative follow-up method was considered.

As such, a new outcome variable was devised. For the purposes of this study, the good outcome group consisted of those who were implanted with a permanent device, which they then reported satisfactory pain relief. Those in the poor outcome group were those who were dissatisfied/not using the device and explanted due to dissatisfaction. There were two participants who were explanted due to medical concerns and they were removed from analyses. There were no participants who were explanted due to noncompliance. The original variable nearly met the projected sample size projected by the power analysis ($N = 100$), with a total of 93 participants. This sample was a broad, perhaps too broad, to capture the experiences of these participants.

In an attempt to improve the outcome variable, two additional outcome variables were made from this group. One looking at only those who received a permanent implant and the second considered only those who were implanted with a SCS. These outcome variables were more focused than the original, however, they were quite small. In all three of the outcome variables, the *N*/*n* was small, which limits the power and generalizability.

Self-report is often used in research and clinical practice, as it is a cost-effective and convenient way to get information needed from patients and research participants. Unfortunately, there are several problems noted with the use of/reliance on self-report measures in psychological research and research in other fields. Problems with self-report include response biases, defined as "any systematic tendency to answer questionnaire items on some basis that interferes with accurate self-reports" (Paulhus, 2002, p. 49). Participants may be guarded and defensive and minimize their problems; while on the other hand, some participants may exaggerate their responses to make themselves appear in more distress. They may also attempt to choose moderate responses or desirable responses. Another problem may include response fatigue, the assessments are long and participants, especially given their problems with chronic pain, may have had difficulty attending to the items throughout the evaluation. Finally, as Shedler et al. (1993) note, self-report measures may not actually assess the constructs they are designed to assess, especially when the participant is defensive in the test-taking approach.

Demographically, the sample was limited as well. In addition, if participants did not provide their race/ethnicity on the information sheet, this information was obtained based on the physician's documentation, which may be inconsistent with how the patient identifies. The sample was not as diverse as was hoped for, which also may be limiting generalizability.

Finally, it is also important to note the possible role of Type I error on the findings. As the significance level used in this study was .05, there is a 1/20 chance of a false positive result, meaning the possibility of concluding two variables were related when the relationship does not truly exist. With the number of *t* tests run in this study, there is certainly the possibility of Type I error.

Future Directions

There are several suggestions for future research. It is suggested that the originally proposed study be carried out to get a better sense of participants' perceptions of their outcome following implantation. Suggestions for improving the study include longer data collection period, the researcher should have a close relationship with the pain clinic and have a regular presence at the facility, and the study should be discussed with the patients at the time of the psychological evaluation in order to increase their interest. It may also be helpful to offer compensation to each participant for taking the time to complete the survey. Obtaining this information will provide a richer and perhaps more meaningful exploration into the issues discussed throughout this dissertation. Also, it would be beneficial to find additional means of assessment rather than relying only on self-report for psychological/psychopathological characteristics. An investigation into the relationship between the psychological diagnosis made at the time of the evaluation and outcome may also provide additional helpful information in the screening process.

Given the findings of this study, a deeper investigation into the idea of the help-rejecting complainer character style and chronic pain would be interesting. In addition, it will also be beneficial to evaluate the utility of the battery used for pre-surgical psychological evaluations; perhaps a revamped evaluation would assist the psychologist in making more reliable and valid surgical recommendations.

There is potential to expand this research in hopes of significantly improving the psychological screening process and also improve clinical judgment regarding surgical candidacy. Ultimately the goal is to better help the patient and more research is clearly warranted in this field in order to best serve this population.

Appendix A

Table 1: *Prevalence of Personality Disorder Diagnosis in Chronic Pain Patients*

Table 2: *Summary of Studies Regarding Predictors of Outcome in Spine Surgery*

Appendix A

Table 1

Prevalence of Personality Disorder Diagnosis in Chronic Pain Patients

	Reich, Tupin, & Abramowitz (1983)	Large (1986)	Fishbain, Goldberg, Meagher, Steele, & Rosomoff (1986)	Polatin, Kinney, Gatchel, Lillo, & Mayer (1993)	Gatchel, Garofalo, Ellis, & Holt (1996)*a*	Weisberg, Gallagher, & Gorin (1996)
Participants	*n* = 43	*n* = 50	*n* = 283	*n* = 200	*n* = 50	*n* = 55
Diagnostic measure	Flow sheet interview	Maudsley-style	2-hour semistructured	SCID-II	SCID-II	Longitudinal
Reliability	None reported	Kappa = .46	None reported	Kappa = .63 (*n* = 20)	None reported	Kappa = .52 (*n* = 10)
Axis II disorders (total)	47%	40%	59%	51%	Non reported	31%
Paranoid PD			3%	33%	18%	2%
Schizoid PD	2%		2%	4%		2%
Schizotypal PD	5%			4%	2%	4%
Histrionic PD	14%	6%	12%	4%	8%	
Antisocial PD				5%		
Narcissistic PD	2%	4%	2%	5%		2%
Borderline PD	7%	2% (traits)	1%	15%	10%	13%
Avoidant PD		2%		14%	4%	
Dependent PD	12%	2% (traits)	17%	3%		11%
Obsessive-compulsive PD		8% (traits)	7%	6%	10%	
Passive-aggressive PD*b*		4%	15%	12%	6%	2%
Self-defeating PD*b*				10%	4%	7%
Mixed PD*b*	5%	22%				
PD not otherwise specified				2%	2%	27%

Note: Adapted from Weisberg and Keefe (1997). Copyright 1997 by W.B. Saunders Company

a Based on chronic TMD patients only

b DSM-III-R passive-aggressive, self-defeating, and mixed categories.

Appendix A/Table 2

Summary of Studies Regarding Predictors of Outcome in Spine Surgery

Reference:	Older age	Male gender	Smoking	Obesity	Chemical dependency	Low income	Low education	Low job level	Litigation	Work comp/disability	Heavy job	Job dissatisfaction	MMPI scales	Fear of movement/reinjury	Negative outcome expectancy	Depression/psych distress	Anxiety	Anger	Neuroticism	Hx of trauma	Lack of optimism	Maladaptive beliefs about pain	Family reinforcement	No spouse support	Limited coping	Chronicity	Previous Surgery	Medical utilization/poor health
Block et al., 2001						-				-	-		-							-			-		-			
Carragee et al., 2003	0	0								-	0	0														0		
Junge et al., 1995	0	0						-	-	-						0							-		0	-	Mix	0
Kohlboeck et al., 2004																-									0			
Nygaard et al., 2000	0	0																								-		
Hagg, et al., 2003	-	0	0					0		0			-			0			-							0		0
Schade et al., 1999				0								+				-							-	-		0		
Spratt et al., 2004																												0
Rothoerl et al., 2002			-																							-		
Carragee,& Kim, 1997	0	+	0	0						-																0		-

Note: + = positive effect on outcome; - = negative effect on outcome; 0 = no effect on outcome; Mix = some positive, some negative, some no effect

Continued

Appendix A/Table 2, continued

Summary of Studies Regarding Predictors of Outcome in Spine Surgery

Reference:	Older age	Male gender	Smoking	Obesity	Chemical dependency	Low income	Low education	Low job level	Litigation	Work comp/disability	Heavy job	Job dissatisfaction	MMPI scales	Fear of movement/reinjury	Negative outcome	Depression/psych distress	Anxiety	Anger	Neuroticism	Hx of trauma	Lack of optimism	Maladaptive beliefs about	Family reinforcement	No spouse support	Limited coping	Chronicity	Previous Surgery	Medical utilization/poor health
McGregor, & Hughes, 2002a,b	0	0	0																							0	0	-
Ng, & Sell, 2004			0																							-		
Peolsson et al.,2003	0	0	-																									
Solberg et al., 2005																0												
Trief et al., 2000	0	0					0			0			-			-	-						-			-		
Woertgen et al., 1999	0	0	0				-				0															-		
Katz et al., 1999	0	0			-	0										0												-
Peolsson et al., 2004	0	+	0																									
Glassman et al., 1998										-																		
Groth-Marnat & Fletcher, 2000										-																		

Note: + = positive effect on outcome; - = negative effect on outcome; 0 = no effect on outcome; Mix = some positive, some negative, some no effect

Continued

Appendix A/Table 2, continued

Summary of Studies Regarding Predictors of Outcome in Spine Surgery

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Klekamp et al., 1998										-																		
Taylor et al., 2000									-	-																		
Dvorak et al., 1988																		-										
Herron et al., 1988																		-										
Andersen et al., 2006																-												
Derby et al., 2005																-												
Deyo et al., 2005										-						-												
Graver et al., 1999																-												
Van Susante et al., 1998																-												
Schofferman et al., 1993																				-								

Note: + = positive effect on outcome; - = negative effect on outcome; 0 = no effect on outcome; Mix = some positive, some negative, some no effect

Continued

Appendix A/Table 2, continued

Summary of Studies Regarding Predictors of Outcome in Spine Surgery

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Schofferman et al., 1992																				-								
Spengler et al., 1980					-																							
Uomoto et al., 1988					-																							
den Boer, et al., 2006							-					-		-	-	-	-					-			-			
Cashion & Lynch, 1979																					-							
Burchiel et al., 1995																						-						
Samwel et al., 2000																						-						
Andersen et al., 2001			-																									
LaCaille et al., 2005			-						-																			
Manniche et al., 1994			-																									

Note: + = positive effect on outcome; - = negative effect on outcome; 0 = no effect on outcome; Mix = some positive, some negative, some no effect

Continued

Appendix A/Table 2, continued

Summary of Studies Regarding Predictors of Outcome in Spine Surgery

Reference:	Older age	Male gender	Smoking	Obesity	Chemical dependency	Low income	Low education	Low job level	Litigation	Work comp/disability	Heavy job	Job dissatisfaction	MMPI scales	Fear of movement/reinjury	Negative outcome expectancy	Depression/psych distress	Anxiety	Anger	Neuroticism	Hx of trauma	Lack of optimism	Maladaptive beliefs about pain	Family reinforcement	No spouse support	Limited coping	Chronicity	Previous Surgery	Medical utilization/poor health
Christensen et al., 1999			0																									
Bernard, 1993									-	-																		
DeBerard et al., 2001									-																			
Greenough et al.,1994										-																		
Epker & Block, 2001									-	-			-		-			-		-			-	-	-			

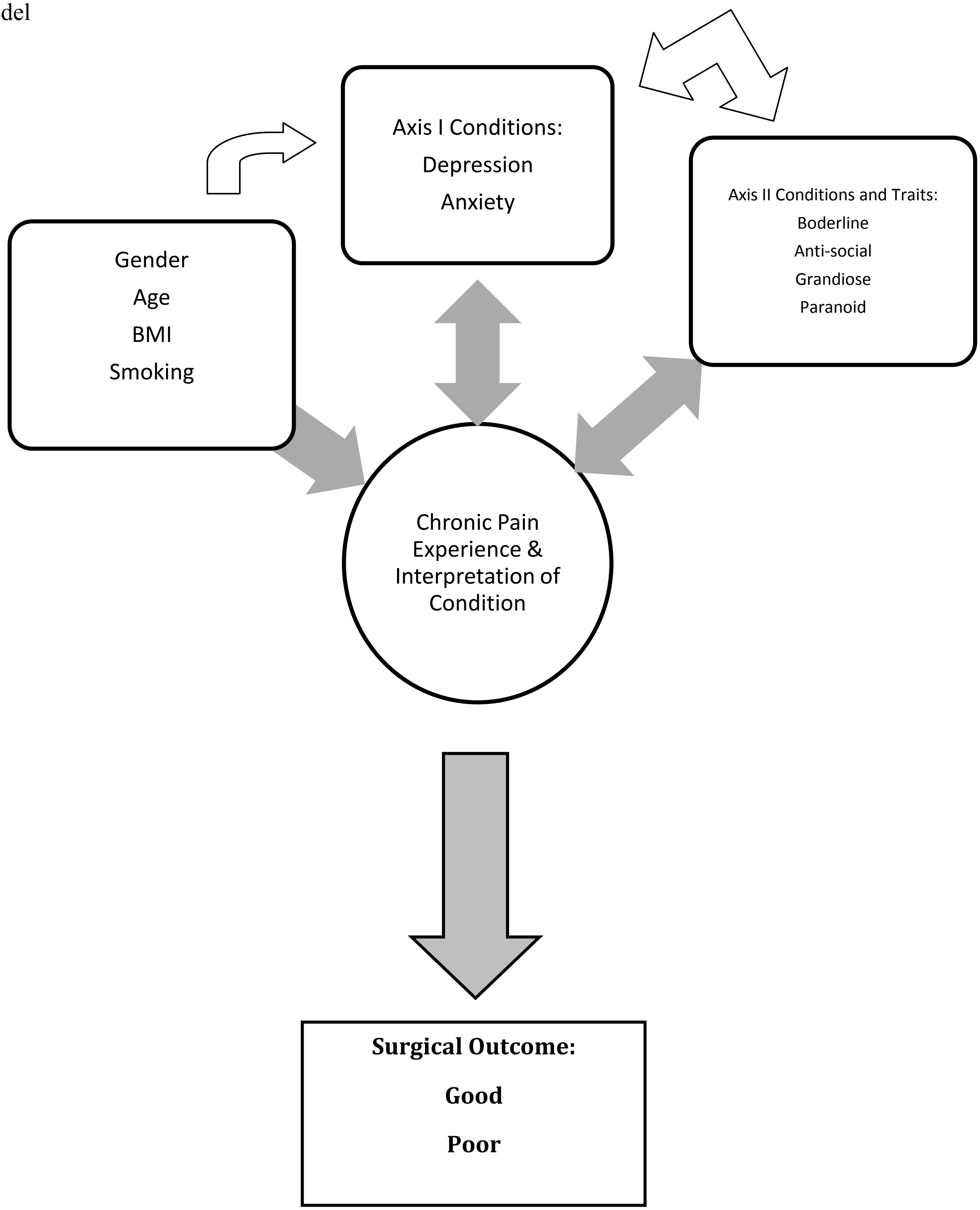
Note: + = positive effect on outcome; - = negative effect on outcome; 0 = no effect on outcome; Mix = some positive, some negative, some no effect

Appendix B

Model

Appendix B

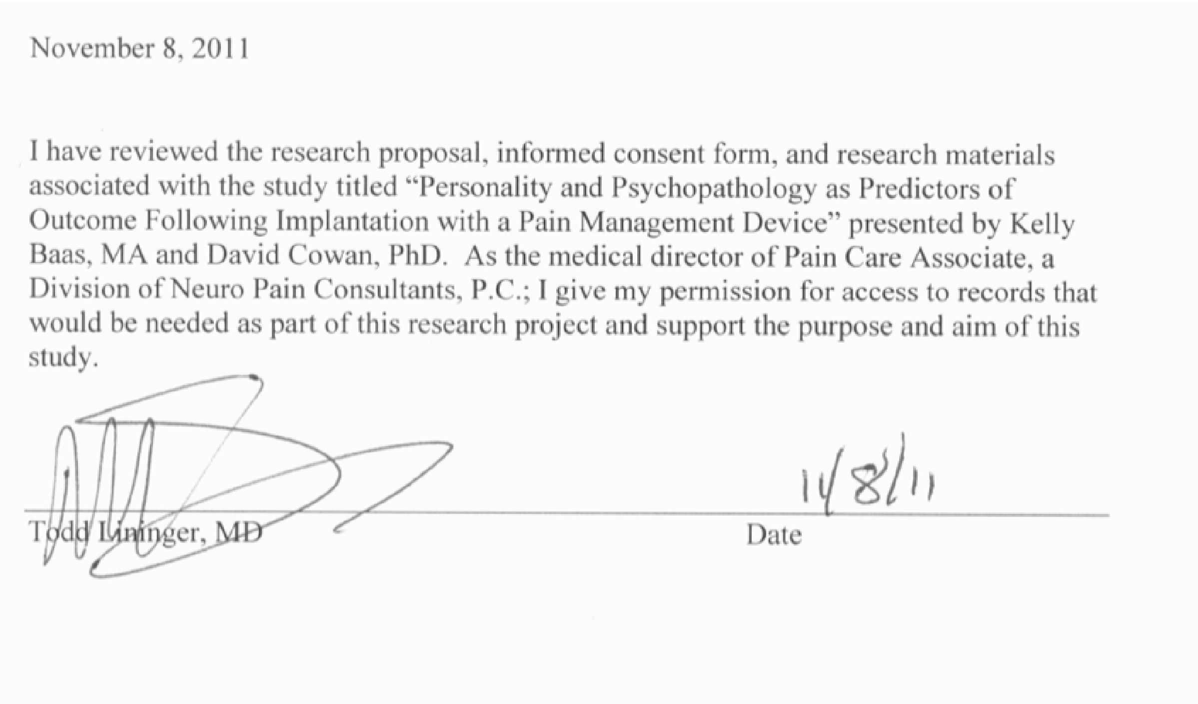
Model



Appendix C

Pain Care Associates Letter of Permission

Medical Director, Dr. Todd Lininger



November 8, 2011

I have reviewed the research proposal, informed consent form, and research materials associated with the study titled “Personality and Psychopathology as Predictors of Outcome Following Implantation with a Pain Management Device” presented by Kelly Baas, MA and David Cowan, PhD. As the medical director of Pain Care Associate, a Division of Neuro Pain Consultants, P.C.; I give my permission for access to records that would be needed as part of this research project and support the purpose and aim of this study.

11/8/11

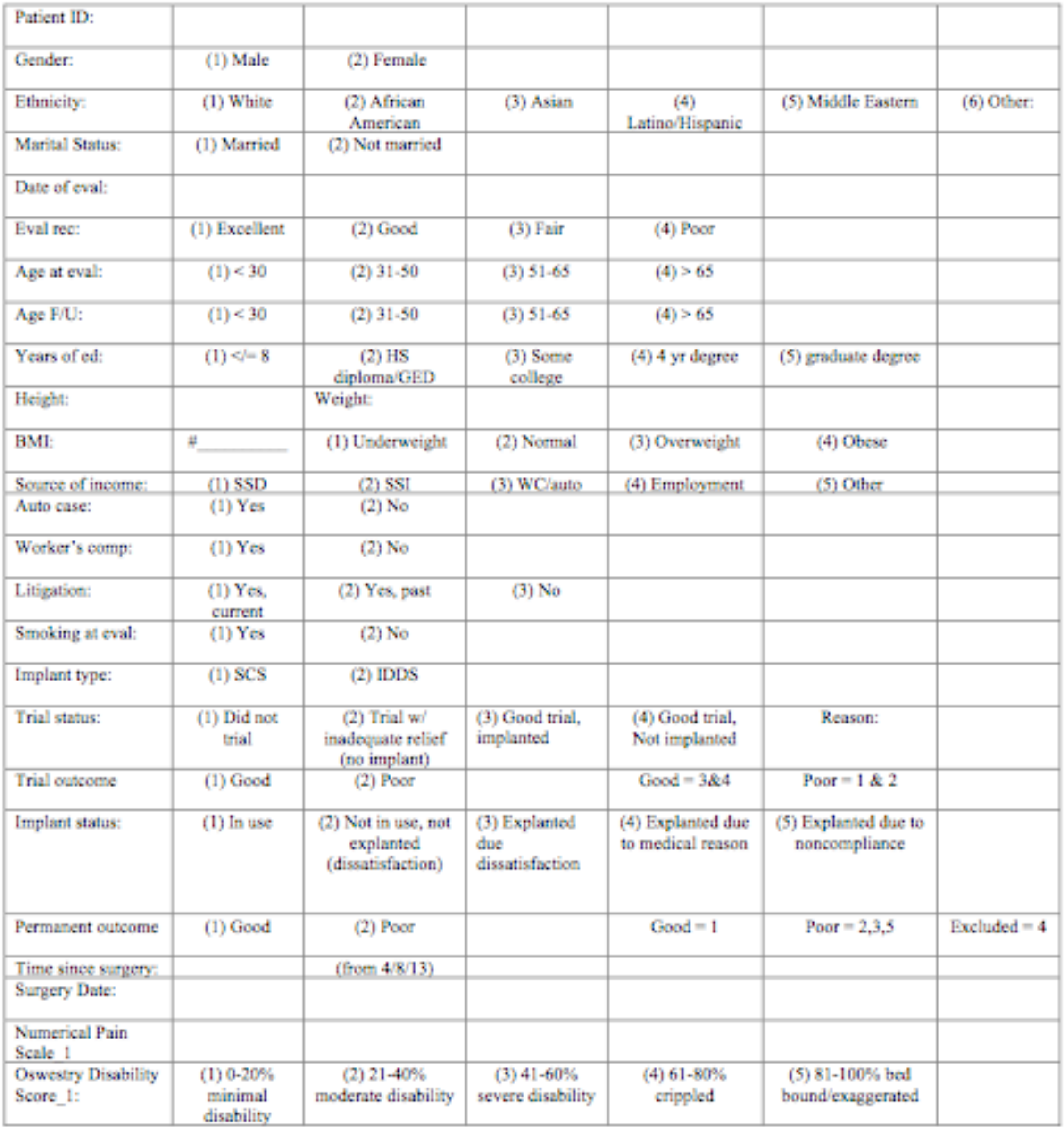
Todd Lininger, MD

Date

Appendix D

Demographics Form

PSYCHOLOGICAL FACTORS AND SURGICAL OUTCOME RESEARCH STUDY



Patient ID:						
Gender:	(1) Male	(2) Female				
Ethnicity:	(1) White	(2) African American	(3) Asian	(4) Latino/Hispanic	(5) Middle Eastern	(6) Other:
Marital Status:	(1) Married	(2) Not married				
Date of eval:						
Eval rec:	(1) Excellent	(2) Good	(3) Fair	(4) Poor		
Age at eval:	(1) < 30	(2) 31-50	(3) 51-65	(4) > 65		
Age F/U:	(1) < 30	(2) 31-50	(3) 51-65	(4) > 65		
Years of ed:	(1) </= 8	(2) HS diploma/GED	(3) Some college	(4) 4 yr degree	(5) graduate degree	
Height:		Weight:				
BMI:	#__________	(1) Underweight	(2) Normal	(3) Overweight	(4) Obese	
Source of income:	(1) SSD	(2) SSI	(3) WC/auto	(4) Employment	(5) Other	
Auto case:	(1) Yes	(2) No				
Worker's comp:	(1) Yes	(2) No				
Litigation:	(1) Yes, current	(2) Yes, past	(3) No			
Smoking at eval:	(1) Yes	(2) No				
Implant type:	(1) SCS	(2) IDDS				
Trial status:	(1) Did not trial	(2) Trial w/ inadequate relief (no implant)	(3) Good trial, implanted	(4) Good trial, Not implanted	Reason:	
Trial outcome	(1) Good	(2) Poor		Good = 3&4	Poor = 1 & 2	
Implant status:	(1) In use	(2) Not in use, not explanted (dissatisfaction)	(3) Explanted due dissatisfaction	(4) Explanted due to medical reason	(5) Explanted due to noncompliance	
Permanent outcome	(1) Good	(2) Poor		Good = 1	Poor = 2,3,5	Excluded = 4
Time since surgery:		(from 4/8/13)				
Surgery Date:						
Numerical Pain Scale_1						
Oswestry Disability Score_1:	(1) 0-20% minimal disability	(2) 21-40% moderate disability	(3) 41-60% severe disability	(4) 61-80% crippled	(5) 81-100% bed bound/exaggerated	

Diagnoses:

(1) Spine related pain

(2) RSD/CRPS

(3) Other pain disorder

PAI Data:

Full scales:

SCALE	*T SCORE*	*SCALE*	*T SCORE*
Inconsistency (ICN)		Borderline (BOR)	
Infrequency (INF)		Antisocial (ANT)	
Negative Impression (NIM)		Alcohol Problems (ALC)	
Positive Impression (PIM)		Drug Problems (DRG)	
Somatic Complaints (SOM)		Aggression (AGG)	
Anxiety (ANX)		Suicidal Ideation (SUI)	
Anxiety-Related Disorders (ARD)		Stress (STR)	
Depression (DEP)		Nonsupport (NON)	
Mania (MAN)		Treatment Rejection (RXR)	
Paranoia (PAR)		Dominance (DOM)	
Schizophrenia (SCZ)		Warmth (WRM)	

CLUSTER SCORES:

Scale	*T Score*	*Scale*	*T Score*
1) NA		6) Schizophrenia, borderline	
2) Depression, schizophrenia		7) Depression, anxiety	
3) Alcohol, somatic complaints		8)Somatic complaints, anxiety	
4) Antisocial, depression		9) Alcohol, drug problems	
5) Anxiety, borderline		10) Borderline, depression	

Appendix E

PAR Permission Agreement

PAR Credit

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Telephone: 813.968.3003 • Fax: 813.968.2598 • Web: www.parinc.com

Sent Via Email: KellyLynn89@hotmail.com

August 15, 2011

Kelly Baas, MA
University of Detroit Mercy
4001 W. McNichols
Detroit, MI 48221

Dear Ms. Baas:

In response to your recent request, permission is hereby granted to you to include up to a total of three (3) sample items from the Personality Assessment Inventory (PAI) in your dissertation proposal/paper titled, *Personality and Psychopathology as Predictors of Outcome Following Implantation with a Pain Management Device*. If additional material is needed, it will be necessary to write to PAR for further permission.

This Agreement is subject to the following restrictions:

(1) Any and all materials used will contain the following credit line:

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TWO COPIES of this Permission Agreement should be signed and returned to me to indicate your agreement with the above restrictions. I will then sign it for PAR and return a fully executed copy to you for your records.

Sincerely,

Vicki M. McFadden
Permissions Specialist
vmark@parinc.com
1-800-331-8378 (phone)
1-800-727-9329 (fax)

ACCEPTED AND AGREED:	**ACCEPTED AND AGREED:**
BY: , MA KELLY BAAS, MA	BY: VICKI M. MCFADDEN
DATE: 8·15·11	DATE: August 15, 2011

PAI Information and Credit:

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Appendix F

Oswestry Disability Index Questionnaire

Oswestry Disability Index Questionnaire Scoring

Oswestry Disability Questionnaire

This questionnaire has been designed to give your doctor information as to how your back pain has affected your ability to manage in everyday life. Please answer every section and mark only the ONE box which best applies to you at this moment.

SECTION 1-PAIN INTENSITY

- ☐ I can tolerate the pain that I have without the use of medication.
- ☐ The pain is bad but I manage without taking pain medication.
- ☐ Pain medication gives me complete relief from pain.
- ☐ Pain medication gives me moderate relief from pain.
- ☐ Pain medication gives me very little relief from pain.
- ☐ Pain medication has no effect on the pain and I do not use it.

SECTION 2-PERSONAL CARE (washing, dressing, etc.)

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

SECTION 3-LIFTING

- ☐ I can lift heavy weights without increasing my pain.
- ☐ I can lift heavy weights but it does increase my pain.
- ☐ Pain prevents me from lifting heavy weights off the floor, but I manage if they are conveniently positioned (e.g., on a table).
- ☐ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
- ☐ I can only lift very light weights at the most.
- ☐ I cannot lift or carry anything at all.

SECTION 4-WALKING

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

SECTION 5-SITTING

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

SECTION 6-STANDING

- ☐ I can stand as long as I want without increasing my pain.
- ☐ I can stand as long as I like but it increases my pain.
- ☐ Pain prevents me from standing for more than one hour.
- ☐ Pain prevents me from standing for more than 30 minutes.
- ☐ Pain prevents me from standing for more than 10 minutes.
- ☐ Pain prevents me from standing at all.

SECTION 7-SLEEPING

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

SECTION 8-SEX LIFE

- ☐ My sex life is normal and causes no increase in pain.
- ☐ My sex life is normal but causes some increases in my pain.
- ☐ My sex life is nearly normal but is very painful.
- ☐ My sex life is severely restricted by my pain.
- ☐ My sex life is nearly absent because of my pain.
- ☐ Pain prevents any sex life at all.

SECTION 9-SOCIAL LIFE

- ☐ My social life is normal and does not increase my pain.
- ☐ My social life is normal, but increases my pain.
- ☐ Pain has no significant effect on my social life apart from limiting my more energetic interests, e.g., dancing, etc.
- ☐ Pain has restricted my social life and I do not go out as often.
- ☐ Pain has restricted my social life to my home.
- ☐ I have no social life because of my pain.

SECTION 10-TRAVELLING

- ☐ I can travel anywhere without increasing my pain.
- ☐ I can travel anywhere but it increases my pain.
- ☐ My pain is bad but I manage trips over two hours.
- ☐ My pain restricts my travel to journeys of less than one hour.
- ☐ My pain restricts me to short, necessary trips under 30 minutes.
- ☐ Pain prevents me from traveling except to my medical appointments or to the hospital.

Oswestry Disability Questionnaire
Interpretation of Disability Scores

0%-20%: Minimal disability

This group can cope with most living activities. Usually no treatment is indicated, apart from advice on lifting, sitting posture, physical fitness, and diet. In this group some patients have particular difficulty with sitting, and this may be important if their occupation is sedentary, e.g., a typist or truck driver.

20%-40% Moderate disability

This group experiences more pain and problems with sitting, lifting, and standing. Travel and social life are more difficult and they may well be off work. Personal care, sexual activity, and sleeping are not grossly affected, and the back condition can usually be managed by conservative means.

40%-60%: Severe disability

Pain remains the main problem in this group of patients, but travel, personal care, social life, sexual activity, and sleep are also affected. These patients require detailed investigation.

60%-80%: Crippled

Back pain impinges on all aspects of these patients' lives—both at home and at work—and positive intervention is required.

80%-100%

These patients are either bed-bound or exaggerating their symptoms. This can be evaluated by careful observation of the patient during medical examination.

Minimum Detectable Change (90% confidence): **10% points** (Change of less than this may be attributable to error in the measurement)

Appendix G

Hypotheses Table

Hypotheses Table

	Hypothesis	Variables	Statistical test
H1a	It is predicted that age will be positively associated with negative surgical outcome.	IV=age DV=outcome	T-test
H1b	It is predicted that female gender will be positively associated with negative surgical outcome.	IV=gender DV=outcome	Chi square
H1c	It is predicted that high BMI scores will be positively associated with negative surgical outcome.	IV=BMI DV=outcome	T-test
H1d	It is predicted that tobacco use will be positively associated with negative surgical outcome.	IV=tobacco use DV=outcome	Chi square
H2	It is hypothesized that taken together the variables age, gender, BMI, and tobacco use will account for a significant percentage of the variance when predicting surgical outcome.	IV=age, gender, BMI, tobacco DV=outcome	Logistic regression
H3	It is hypothesized that PAI T-scores of depression and anxiety scales will add to the predictive power of the regression equation, suggesting these psychological variables are predictive of surgical outcome.	IV=depression, anxiety DV=outcome	Logistic regression
H4	Together with the groups of predictors mentioned above, it is hypothesized that PAI T-scores on the borderline, antisocial, grandiose, and paranoid scales, add to the predictive power of the regression equation; therefore, suggesting that these personality features account for a percentage of the variance above those which have been previously demonstrated in the research.	IV= borderline, antisocial, grandiose, paranoid DV=outcome	Logistic regression

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ABSTRACT

PERSONALITY AND PSYCHOPATHOLOGY AS PREDICTORS OF OUTCOME FOLLOWING IMPLANTATION WITH A PAIN MANAGEMENT DEVICE

By

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Chronic pain affects millions of individuals and has many life alerting implications. Once pain becomes intractable, patients can often exhaust most conservative treatment options. Current changes in medical technologies have evolved to include treatment with implantable pain management devices and have since become the standard of care. Given the nature of these devices, the need for high levels of compliance with these devices, and post-operative lifestyle changes, the role of the psychologist has become increasingly more important in the patient selection process. Pre-surgical psychological evaluations are used in a variety of medical specialties to aid physicians when determining candidacy for surgeries. It has been well documented that psychological and social factors have been associated with surgical outcome in a variety of surgical procedures. Research investigating the key psychological variables associated with outcome following implantation with a pain management device is limited. As such, the aim of this study is to investigate the role of several psychological variables on surgical outcome post implantation with a pain management device; notability differentiating between Axis I disorders, such as depression and anxiety, and features associated with Axis II personality disorders. The goal is to delineate more specifically the psychological factors which contribute to outcome in implanted pain management therapy. Preliminary analyses suggest no relationship between age, gender, BMI, tobacco use, and PAI T-scores on anxiety, depression, borderline, antisocial, paranoia, and grandiose scales when using a broad good/poor outcome variable. Additional analyses with a more refined outcome variable did find a significant relationship between younger age and good outcome. Post-hoc analyses suggest a relationship between participants' scores on the Oswestry Disability Index, employment status, and the treatment rejection scale on the PAI. Psychologists' clinical judgment was also found to be related to outcome. Discussion includes an exploration into participant's self-perception and functional status and the idea of the help rejecting complainer character style. Study limitations and clinical implantations based on the current findings are discussed.

Autobiographical Statement

Kelly Bryce

Kelly Bryce received her Bachelor of Science degree in psychology, with a specialization in bioethics, humanities, and society, from Michigan State University in May 2005. While an undergraduate, she became involved with several research labs and volunteer opportunities. She also had the opportunity to work within a multidisciplinary neurorehabilitation team and was trained in the administration, scoring, and interpretation of neuropsychological assessments; where she gained additional experience in the year after graduation, before attending graduate school.

In September 2006, she moved to Detroit, Michigan to attend the University of Detroit Mercy (UDM); an APA accredited clinical psychology doctoral program. She earned a Master of Arts degree in clinical psychology from UDM in August 2009. Kelly completed an internal practicum at the UDM Psychology Clinic. An external practicum was completed at the Life Stress Center at Detroit Receiving Hospital, where training was focused on addressing adjustment issues with trauma patients in the hospital setting. A second external practicum and additional clinical work was completed at a private practice specializing in health psychology and neuropsychology, which was also closely affiliated with a medical pain clinic. She completed a one year, APA accredited internship at Henry Ford Hospital in Detroit, with training focused on consultation/liaison work and health psychology. Rotations included psychiatric consultation/liaison, transplant psychiatric, psycho-oncology, emergency department, bariatric surgery, and outpatient behavioral health. She will complete a post-doctoral fellowship with the John D. Dingell VAMC in Detroit, which offers specialty training in primary care/mental health integration and health psychology. Research interests include: health promotion/disease prevention, personality disorders and chronic pain, and allocation of medical resources. She hopes to begin her career working as a health psychologist.