A PSYCHOSOCIAL MODEL OF DISABILITY IN INTERSTITIAL CYSTITIS /
PAINFUL BLADDER SYNDROME

By

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Abstract

Interstitial Cystitis / Painful Bladder Syndrome (IC/PBS) is a persistent and refractory medical condition that is characterized by chronic pelvic pain along with abnormal urinary frequency and urgency. There is no widely accepted etiology or efficacious cure for IC/PBS, thus treatment often relies on pain and symptom management. IC/PBS is associated with strong functional disability but theoretical models of disability have yet to be tested with these patients. As well, psychosocial factors associated with various IC/PBS outcomes (i.e., depression, catastrophizing, social support) are also associated with disability in a variety of chronic painful medical conditions but remain untested in disability models for IC/PBS. Thus, this research evaluated psychosocial factors as potential mediators of disability within the Disablement Process Model. Female patients diagnosed with IC/PBS by a urologist in a tertiary care hospitals were recruited (n=196; females). In using structural equation modeling of a final IC/PBS disability model, negative affect and catastrophizing were found to be partial mediators on the relationship between impairments and functional disability and social support was not a significant mediator of disability. Negative affect and catastrophizing may be key psychosocial factors in IC/PBS disability. Research implications for the Disablement Process Model and potential clinical interventions are discussed in light of the current findings.
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Chapter 1: Introduction and Literature Review

**Interstitial Cystitis / Painful Bladder Syndrome.**

Interstitial Cystitis / Painful Bladder Syndrome (IC/PBS) was first described as a painful female medical condition characterized by bladder ulceration approximately 100 years ago (Hunner, 1915). From this description, the terms associated with this painful disorder have included clinical features such as Hunner’s lesions and petechial hemorrhages seen in the anesthetized bladder during hydrodistension, supporting the clinical term interstitial cystitis. With many patients also presenting with pain-associated symptoms but no objective biomedical findings, the term painful bladder syndrome has been added to more fully describe this condition, which has varying degrees of bladder-associated pathology. Indeed, a progression from the original criteria was imperative as physicians were missing more than 60% of patients using ulcer-based criteria that were experiencing symptoms of chronic and debilitating pelvic pain along with urinary urgency and frequency (Clemens, Joyce, Wise, & Payne, 2007). A diagnosis of IC/PBS can only be offered when other exclusionary diseases, such as urinary tract infections, endometriosis, and cancer of the bladder are ruled out (Peters & Carrico, 2008).

The prevalence rate of formal physician diagnosis of IC/PBS in women is quite low. However, the reported incidence rates of IC/PBS-like symptoms are high in comparison (Clemens, Joyce, et al., 2007). For example, the actual physician diagnostic rate of IC/PBS is 0.2% (Curhan, Speizer, Hunter, Curhan, & Stampfer, 1999), but the IC/PBS symptoms (i.e., pain and urinary distress) are reported to impact between 6.2 -
11.2% of North American women (Clemens et al., 2005). This large discrepancy between physician diagnosis and community-based reports likely reflects that the diagnosis is primarily based on symptoms which many physicians may be unaware of or unfamiliar with, and that there is no definite biological marker for the diagnosis (Clemens, Joyce, et al., 2007; Walker, Katon, & Hansom, 1995). Moreover, progressive symptoms have been retrospectively reported for as many as three to seven years before a physician diagnosis (Koziol, Clark, Gittes, & Tan, 1993). The primary patient experience of IC/PBS is pain, often described as constant, and many individuals characterized as severe/excruciating (Walker, et al., 1995). It is important to note that men are also diagnosed with IC/PBS, but this occurs much less frequently. In fact, the only unambiguous risk for IC/PBS is being female, with a female to male ratio of nine to one (Clemens, Joyce, et al., 2007).

IC/PBS is also associated with impaired QoL and interference with patient’s ability to carry out various activities of daily living in comparison to a control group of women (Nickel et al., 2010). In particular, women suffering from IC/PBS reported impaired physical and social functioning as well as the inability to perform normal roles due to emotional difficulties and a decreased energy level. The impairment associated with IC/PBS is significant, with greater reductions in physical functioning in comparison to samples of women with rheumatoid arthritis and hypertension (Michael, Kawachi, Stampfer, Colditz, & Curhan, 2000). Similarly, in a survey study on the history of women with IC/PBS, 70% of patients reported that family relationships and responsibilities were negatively affected (Koziol, et al., 1993). Furthermore, IC/PBS pain is often exacerbated by factors including, stress, sexual intercourse, exercise and diet (Koziol, 1994). Pain and
urinary symptom flare-ups can also occur unexpectedly, leading to increased distress, frustration and embarrassment (McCormick, 1997).

While IC/PBS does debilitate patients and it has been the focus of clinical investigations for decades, there is no agreed upon etiology (Whitmore, 1994). Some suggest IC/PBS may be caused by a list of initiating factors including infections, neurogenic inflammations, urothelial dysfunction, vascular changes and / or autoimmune mechanisms (Rosamilia, 2005). To complicate matters further, many physicians are unfamiliar with IC/PBS and may conclude that patient’s symptoms are psychosomatic, which is a potential contributor to the delays in diagnosis (Whitmore, 1994). After diagnosis, treatment was often referred to as a trial-and-error model with a wide variety of treatments often attempted to manage the pain and urinary symptoms (Whitmore, 1994). Some patients do experience temporary symptom relief from medical procedures such as hydrostatic distention of the bladder (i.e., the bladder is filled with fluid) or bladder distention (i.e., the bladder is irrigated with a chemical agent). However, these procedures are invasive, painful, and inconvenient as each procedure requires an appointment with a physician. Intravesical and surgical treatments are also available in forms of DMSO instillments, endoscopy, implantable nerve stimulators and radical surgery (i.e., bladder removal). While these procedures are documented to provide temporary relief, the alleviation of symptoms rarely persists past 3-6 months post-procedure and relapse is common, and in patients who are totally refractory to various treatment modalities, pelvic pain persists even after radical surgery and removal of the bladder (Clemens, Joyce, et al., 2007). A number of oral medications are also used to alleviate urinary symptoms and pain. However, the majority of these medications are
used “off-label”, which means without ever being formally evaluated in patients with IC/PBS in clinical trials. Furthermore, none of the medications used to treat IC/PBS have high efficacy rates, while many of them subject patients to adverse side-effects (Clemens, Joyce, et al., 2007). Behavioral techniques may also be used to alleviate and treat IC/PBS symptoms, such as diet modification (e.g., exclude items caffeine, alcohol and acidic or spicy foods) whereas bladder relaxation training may help improve the capacity of the bladder (Clemens, Joyce, et al., 2007). Despite possible treatments options, many patients suffering from IC/PBS are unable to obtain sufficient relief from their pain and symptoms (Clemens, Joyce, et al., 2007). IC/PBS can have a devastating effect on individual’s life with marked disability in both physical and psychological areas (Clemens, Joyce, et al., 2007; Rabin, O’Leary, Neighbors, & Whitmore, 2000; Tripp et al., 2009).

What is Disability?

While the words disability and impairments are fundamental terms in the realm of disability research, the two constructs do not have distinct definitions and are often used interchangeably within the literature (Robinson & Tait, 2010). In general, disability refers to the inability to carry out daily activities in order to function in every day life, while impairments are defined as problems in body function or structure as a significant deviation or loss (World Health Organization, 2001). The critical distinction between the two concepts is at the level of analysis. Impairments are related to the function or structure of an organ or body part while disability refers to a limitation in the behavior of a person. While this distinction is reasonable on a conceptual level, it is often very unclear in actual practice. This distinction becomes even more complex when a condition
(such as IC/PBS) is incapacitating due to pain, as pain in itself is not completely distinct from organ or body dysfunction (Robinson & Tait, 2010).

**IC/PBS Disability.**

Disability is a major concern in women suffering from IC/PBS. From an economic viewpoint, disability can include costs to the medical system (e.g., inpatient / outpatient care, medications), costs to society (e.g., lost productivity, unemployment) as well as costs to self (e.g., opportunities not pursued, diminished relationships and poorer Quality of Life; QoL) (Clemens, Joyce, et al., 2007). The IC/PBS literature has primarily focused on the economic impact of disability. In an analysis of the direct medical costs, as recorded by 25 large employer’s medical and pharmacy claims in the US in 2002, the mean annual cost associated with IC was $8,420 (versus $4,169 for individuals without IC/PBS) (Clemens, Joyce, et al., 2007). A more recent analysis assessed the economic impact of IC/PBS in a sample of women from a tertiary care urology clinic in the US (Clemens, Markossian, & Calhoun, 2009). Approximately 80% of patients with IC/PBS reported direct medical costs in the preceding three months due to their condition.

Indirect costs associated with chronic medical conditions are often overlooked when calculating the economic burden of IC/PBS, which is characterized by flare-ups. While costs related to lost work productivity could not be quantified, one in five patients with IC/PBS reported lost wages in the preceding three months due to symptoms. Further, increased symptom severity was associated with greater economic impact on the individual. The economic costs associated with IC/PBS are similar or greater to those associated with other chronic pain conditions, such as low back pain, fibromyalgia, rheumatoid arthritis and peripheral neuropathy (Clemens, et al., 2009).
The IC/PBS literature has primarily focused on the economic impact of disability. The economic impact of IC/PBS speaks to the need to examine mechanisms associated with disability within this chronic pelvic pain population. While disability has been proposed as a precursor to diminished QoL (Verbrugge & Jette, 1994), the QoL and disability terms are often used interchangeably as outcomes within the health impairment literature (Bai et al., 2009). In the IC/PBS literature, several new studies have started to examine diminished functional ability using assessments of health-related QoL. For example, recent IC/PBS research predicting QoL has examined the contribution of demographics, IC/PBS status, pain, and psychosocial and functional variables from tertiary care urology clinics in Canada and the US (Tripp, et al., 2009). Diminished physical health was associated with greater symptom duration and pain, with pain as the most robust predictor. Further, diminished mental health-related QoL was predicted by younger age and a greater feeling of helplessness catastrophizing. Nickel and colleagues compared psychosocial factors in women diagnosed with IC/PBS to an age and cohort matched control group (Nickel, et al., 2010). One difference between the two groups was status of employment, with significantly more women diagnosed with IC/PBS who reported unemployment. Additionally, patients with IC/PBS reported significantly more pain, sleep dysfunction, depression, anxiety, stress, catastrophizing, sexual dysfunction and poorer self-reported social support. Patients with IC/PBS also reported significantly decreased mental and physical functioning health related QoL in comparison to controls.

While the assessment of economic disability and functional difficulties are valuable, other aspects of pain-related disability are largely unexamined. Indeed, the IC/PBS literature has yet to provide an evaluation of how IC/PBS affects specific
components of individual’s daily activities and functioning. Furthermore, the processes and mechanisms of pain-related disability have not been examined within a theoretical model in IC/PBS. In order to examine issues of pain-related disability in IC/PBS and the rationale for selecting particular psychosocial factors of interest, it is important to review the influence and limitations of the biomedical model, which is a mainstay in general medical practice today.

*The Biomedical Model.*

Our current clinical and theoretical understanding of pain and its impact on peoples’ lives has been formed through various scientific and cultural shifts in thought. Although pain models predate Grecian medicine, many consider Descartes’ dualistic concept of pain as significant from a conceptual change perspective. For Descartes, pain was reported by people in equal amounts to that of observable physical pathology. In other words, Descartes posited a one to one ratio between tissue damage and an individual’s perception of pain arguing that the mind had no authority over physical pain (Rey, 1993). The Descartes mechanical pain model was viewed more skeptically in the 1900’s with new research challenging beliefs that pain was a biomedical procedure only. For example, a biomedical model could not explain why anxiety was so strongly associated with pain sensitivity (Hill, Kornetsky, Flanary, & Wikler, 1952) or why wounded soldiers expressing relief from being in war used significantly less pain medication than did civilians having similar procedures (Beecher, 1956).

The Gate Control Theory of pain was a landmark model, largely promoting the combined role of pathophysiology and cognitive influences on one’s pain experience
Physiological pain pathways could either augment or reduce subjective pain experiences. For example, the afferent nervous system was known to signal pain to the central nervous system from the extremities. In contrast, in a top-down manner, efferent pathways were shown to assist the neurophysiological influence of emotional and cognitive activity travel down the spinal cord, modulating incoming afferent signals at the dorsal horn. In other words, strong negative emotional states were suggested to increase subjective reports of pain through facilitated sensory processing, while positive emotions were expected to decrease subjective pain through decreased afferent processing, like the swinging gate analogy (Melzack, Wall, & Ty, 1982). This work and the research it inspired lead to pain being described as much more than a sensory experience, to one that can vary tremendously based on “subjective” personal appraisals of sensations, situations, and resources of the individual (Sullivan et al., 2001). As suggested by Melzack, cognitive factors have been shown to be either protective or inflammatory to reported pain experience. Indeed, negative ruminatory or helpless appraisals about one’s pain (i.e., pain catastrophizing) are robust predictors of greater experimental and clinical pains (e.g., Sullivan, et al., 2001; Tripp et al., 2006).

Chronic pain is now being discussed from a neuromatrix perspective, wherein people are described as having individualized patterns of responding to pain that are part genetic, psychological, and environmentally-based. How these patterns of physical and psychological responding are laid out in nerve impulses and activated by various sensory or perceptual inputs, are described as independent of what may have happened at a peripheral location (Melzack, 1999). The neuromatrix model is a diathesis-stress process wherein physiological predispositions interact with the acute stressors and pain is “stress”
that reduces bodily homeostasis and demands change in function (Turk, 2002). The presence of persistent pain creates a constant physiological activation and other psychological loads (i.e., helplessness or anxiety) further reduce bodily homeostasis by augmenting pain. Several underlying neuroanatomical pathways, neurophysiological mechanisms, and several well known psychosocial factors can therefore be involved in pain experience (Loeser, Butler, Chapman, & Turk, 2001).

It is clear that chronic pain is not simply a symptom of a disorder but it can be conceptualized as a disease process onto itself often associated with high levels of disability (Gunter, 2008). The International Association of the Study of Pain defines chronic pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.” In the particular case of IC/PBS, and as mirrored in the neuromatrix model of pain, chronic pelvic pain likely results from many changes in the pain signaling pathways associated within somatic and visceral structures and the excitatory processes in both the peripheral and central nervous system. Through the process of central sensitization of the pain signaling pathways (i.e., convergence), initial physical traumas in the viscera have been associated with chronic pains and referred pathophysiological findings such as tenderness and pain (Gunter, 2008). This concept of convergence explains how neurogenic inflammation, and in particular, its pain and pathology can stretch between organ systems in chronic pain states (Fields, Basbaum, & Heinricher, 2006). IC/PBS is associated with distinct clinical phenotypes based on identification of overlapping syndrome patterns that are associated with increasing levels of reported disability. As patients with IC/PBS move from a localized (i.e., IC/PBS diagnosis only) to more regional or even systemic clinical
presentation (i.e., fibromyalgia), pain and depression increase while social support, sexual functioning and QoL deteriorate (Nickel, et al., 2010). Interestingly, catastrophizing (i.e., negative appraisals of one’s pain management ability) was associated with diminished physical QoL regardless of whether the patient suffered from IC/PBS only or if they reported coexisting comorbid medical conditions such as irritable bowel syndrome (IBS) (Nickel, et al., 2010).

A strict biomedical approach to IC/PBS management would discount significant research on the strong influences of psychological factors. The biopsychosocial model asserts that biological aspects of chronic illness (i.e., changes in muscles, joints, or nerves generating nociceptive input) affect psychological factors (mood, catastrophizing, helplessness) and the social context of the individual (social activity, activity of daily living, interpersonal relationships) in a recursive manner (Turk & Okifuki, 2002). It is generally understood that biomedical chronic pain models, focused solely on etiological or pathophysiological explanations, cannot account for the extent and range of pain-related disability and negative outcomes associated with syndromes like IC/PBS.

Psychosocial Models of Disability.

Biopsychosocial conceptualizations of pain allow for a comprehensive understanding of the complex relationships between pain, pain-related disability, and the particular psychosocial factors that influence these relationships (Sullivan, Thorn, Rodgers, & Ward, 2004). Although replete with examples of how pain and functional disability may act to impact patient outcomes in IC/PBS, there are no proposed models for such effects. In fact, in reviewing the disability literature, there are surprisingly few
models suggested for pathways to disability in general. The two disability models that are primarily examined within the disability literature are the International Classification of Functioning, Disability and Health (World Health Organization, 2001) and The Disablement Process (Verbrugge & Jette, 1994).

The International Classification of Functioning, Disability and Health (ICF). The ICF offers a framework for conceptualizing functioning and disability associated with health conditions that is intended to be used with its companion classification, the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) (World Health Organization, 1992, 2001). This model is based on the incorporation of the medical and social models of disability, emphasizing the biological, individual, and societal perspectives of health within a biopsychosocial approach. According to the ICF, disability refers to any impairments, activity limitations or participation restrictions or to “the outcome or result of a complex relationship between an individual’s health condition and personal factors, and of the external factors that represent the circumstances in which the individual lives”.

The core structure of the ICF consists of two components and two subcomponents (See Figure 1). The first component is related to functioning and disability. The two subcomponent within functioning and disability include body functions and structures as well as activities and participation. Within the first subcomponent, body functions and structures are classifications that relate to the body systems as evaluated by changes in physiological systems or anatomical structures. In relation to the second subcomponent, activities and participation address the individual and societal perspective of disability as
determined by performance and functional abilities. Functioning as described by activities and participation can be classified as either non-problematic or as disability.

The second component consists of contextual factors, including the two subcomponents of environmental factors and personal factors. Environmental factors are described as physical or social variables and attitudes that can either facilitate or hinder functioning and disability. Within the ICF model, personal factors are individual variables that can affect health and functioning and may include gender, race, age, fitness, religion, lifestyle, habits, upbringing, coping styles, social background, education, profession, past and current experiences, behavioral patterns, character style, individual and psychological assets and various other health conditions. All of the classifications (except for the personal factors subcomponent) are qualified with numeric codes in order to specify the magnitude or extent of disability and the degree to which contextual factors facilitate or act as a barrier in relation to disability. Lastly, all of the components within the model have reciprocal relations and pathways between each other. Figure 1 exemplifies the conceptual framework of the ICF.
There are several caveats in the application of the ICF as a conceptual model of disability. Foremost, personal factors are not specifically coded or classified within the model’s framework even though they are an essential consideration within the overall model as they can influence outcomes and interventions. Thus, the ICF is somewhat incomplete as it does not evaluate how personal factors can impact and influence disability (Peterson, 2005). Furthermore, while the ICF may be a useful tool, the framework is insufficient for describing the situation of a person with chronic illness and needs to be adapted to become more patient-centred. The ICF has continually been criticized for having the purpose of helping health care systems to document and plan for
the consequences of disease while neglecting individual and psychosocial factors as well as issues such as QoL (Wade & Halligan, 2003).

*The Disablement Process Model.* The Disablement Process Model (DPM) (Verbrugge & Jette, 1994) is a psychosocial model of disability describing how medical conditions affect body systems, physical functioning and the activities of everyday life (See Figure 2). The novelty of the DPM is the inclusion of how personal and environmental factors speed or slow the process of disablement. Similar to the ICF, the DPM defines disability as the difficulty experienced when attempting to participate in a broad range of role behaviors in one’s everyday life due to a disease or condition. These domains range from basic self-care to more complex social and occupational roles. Furthermore, disability within a particular domain may impact one individual differently than another. As mentioned above, the primary advantage of the DPM is the inclusion of explanatory factors that help to explain the unique experiences of disability in patients with otherwise similar conditions, impairments and limitations (Jette, 2006).

The main pathway of the DPM is based on the Nagi Scheme and demonstrates the linear relationship between 1) pathology, 2) impairments, 3) functional limitations and 4) disability (Nagi, 1965, 1979, 1991). Pathology involves the presence of a disease or condition. Impairments refer to the dysfunctions and structural abnormalities in specific bodily symptoms due to pathology (such as pain or disease-specific symptoms). Functional limitations can be defined as the restrictions in performing fundamental actions that are used in everyday life that develop due to one’s disease or condition (such as the difficulty walking). Finally, disability refers to experiencing difficulty in doing
activities in various life domains (such as the inability to care for one’s family or maintain a job).

The DPM includes explanatory factors that impact the primary pathway of disablement. The explanatory factors include variables that focus on psychological features (such as symptoms of depression or anxiety) and variables that pertain to the external, environmental and social context in which the disablement process occurs (such as social and external supports). Figure 2 displays a depiction of the DPM. Below is a brief description of the existing literature on DPM. There has been research generated by the DPM. The first area of research that will be reviewed is in regards to the primary pathway of disablement. The second review of the literature to follow will examine the psychosocial factors that impact the process of disablement.

**Figure 2.** The Disablement Process Model (Verbrugge & Jette, 1994).
Research on the Primary Pathway of Disablement. Numerous studies have evaluated the relationships amongst the constructs within the primary pathway of disablement. One investigation evaluated the relationship between risk factors, impairments, functional limitations and disability in a cohort of older adults (Lawrence & Jette, 1996). This study was unique due to its prospective design and ability to assess for the actual process of disability. The sample consisted of individuals who were non-disabled who were then re-interviewed six years later. To test the hypotheses of the DPM, structural equation modeling (SEM) was employed (Lawrence & Jette, 1996). Functional limitations were defined as musculoskeletal problems that caused restrictions in performing physical activities (such as reaching or walking), and disability referred to the inability to carry out activities of daily living (such as household management). The results of this study confirmed the basis that functional limitations (i.e., musculoskeletal problems) lead to disability (i.e., activities of daily living) and are responsible for driving the disablement process (Lawrence & Jette, 1996).

Similar relationships between functional limitations and disability were reported in samples of patients with rheumatoid arthritis, multiple sclerosis and fibromyalgia (Escalante, Haas, & del Rincon, 2005; Phillips & Stuifbergen, 2010). Using SEM, impairments (as defined by self-report knee pain) displayed a positive direct path toward functional limitations (as measured by performance-based rheumatology functioning tests) in a sample of patients with rheumatoid arthritis (Escalante, et al., 2005). Similarly, in a sample of patients with multiple sclerosis or fibromyalgia, a positive path was established using SEM between functional limitations (measured by physical functioning...
and health-related QoL) and disability (as assessed by limitations to domains of life roles) (Phillips & Stuifbergen, 2010).

While the literature has been able to support some of the pathways suggested by the DPM, there has been some confusion within this literature in differentiating the constructs of impairments (i.e., dysfunctions and structural abnormalities in specific bodily symptoms due to pathology), functional limitations (i.e., the restrictions in performing fundamental actions that are used in everyday life that develop due to one’s disease or condition) and disability (i.e., experiencing difficulty in doing activities in various life domains). For example, Bai et al. reported a two-factor solution for the primary pathway of disablement, including impairments and physical health related QoL, with no explicit discussion of either functional limitations or disability (Bai, et al., 2009). Studies by Phillips and Stuifbergen also report a two-factor solution. However, within the measurement model, there is no rationale as to why they have indexed particular variables for each of the two factors. For example, physical health related QoL was indexed as functional limitations (i.e., physical functioning) while other QoL variables were indexed as disability (i.e., emotional, role and social functioning) (Phillips & Stuifbergen, 2009; Phillips & Stuifbergen, 2010). It is apparent from the literature that there is no clear consensus in relation to the factor structure and composition of the primary pathway of disablement. In turn, these data pose questions about the construct validity of impairments, functional limitations and disability as posited by the DPM. Perhaps more importantly, while the relationships within the primary pathway of disablement have been examined in various factor combinations in several medical
samples, few studies have emphasized or evaluated the impact of explanatory factors on the process of disablement.

Research on Psychosocial Explanatory Factors. Less interest has focused to the second component of the disablement process in evaluating the effects of explanatory factors on the relationships within the primary pathway. In a sample of women diagnosed with either multiple sclerosis or fibromyalgia, explanatory factors such as depression, social support and economic adequacy were found to partially mediate the effect of functional limitations on disability (Phillips & Stuifbergen, 2009; Phillips & Stuifbergen, 2010). These partial mediation effects suggest that other potential explanatory factors should be examined in the DPM. The moderating effects of personality as an explanatory factor within a sample of rheumatoid arthritis patients have also been examined (Bai, et al., 2009). Self-sacrificing defense style was found to moderate the relationship between impairments and functional limitations. These recent studies show that explanatory factors in disability models may be useful in understanding the complex relationships in the processes of disability. To date, no research has examined such associations and the applicability of these findings in a sample of women suffering from IC/PBS.

The research areas of the DPM described above are of significant value as it facilitates the conceptualization of the process of disability in a number of medical samples (i.e., rheumatoid arthritis, multiple sclerosis, fibromyalgia) (Escalante, et al., 2005; Phillips & Stuifbergen, 2009; Phillips & Stuifbergen, 2010). This line of research can elucidate how individual’s with the same disease and symptoms report such different experiences of impairments and disability. However, this literature can be advanced from studies that examine only components of the DPM to evaluating the factors within a
biopsychosocial perspective. The Disablement Process literature has yet to examine how empirically pertinent psychosocial factors like negative affect, catastrophizing and social support may affect pain, functional limitations and pain-related disability.

*Psychosocial Mediators of Disability.*

*Negative Affect.* Negative affect (i.e., depression and anxiety) plays a critical role in how pain is perceived as well as how chronic pain manifests itself behaviorally (Keogh, McCracken, & Eccleston, 2005). Furthermore, the relationship between negative affect and disability has been reported as strong, over above the effects of pain, in a number of studies and medical samples (Hirsh, Waxenberg, Atchison, Gremillion, & Robinson, 2006; Keogh, et al., 2005). Hirsh et al. (2006) evaluated the mediation effects of negative affect on the relationship between pain and disability in a sample of women and men with various chronic pain conditions (i.e., low back, myofascial, neck, arthritis and fibromyalgia) from a university pain clinic. Interestingly, the relationship between negative affect and disability relationship was stronger in women than men. More specifically, in women, negative mood fully mediated the relationship between pain and both voluntary disability indices (i.e., family / home responsibilities, social activities, recreational activities, occupation and sexual behavior) and obligatory disability indices (i.e., life support activities and self-care).

A similar study evaluated sex as a moderator on the relationship between depression and pain-related disability in a sample of patients with musculoskeletal pain conditions (Adams et al., 2008). Results indicate that depression augments activity-related pain in women, but not in men. In women, high levels of depression were
associated with approximately 40% more intense pain while performing pain-related activities. This finding may help to explain why women may be at a greater risk for prolonged disability. Further, depressive symptoms may amplify pain-related symptoms in women leading them to reach tolerance limits more quickly thereby affecting participation in activity.

The relationship between pain, disability and negative affect has also been reported in samples of women with IC/PBS. In a study comparing healthy age and cohort-matched controls to women diagnosed with IC/PBS, a strong correlation was found between depression and anxiety with symptoms, pain and QoL in the women with IC/PBS (Nickel, et al., 2010). Moreover, a study aimed at clinically phenotyping women diagnosed with IC/PBS in order to improve the understanding of IC/PBS etiology reported similar findings (Nickel, Shoskes, & Irvine-Bird, 2009). Women diagnosed with IC/PBS by a staff urologist were classified into the following categories: urinary, psychosocial, organ specific, infection, neurological/systemic and tenderness. The psychosocial domain included patients that were determined to be clinically depressed, those with maladaptive coping mechanisms (e.g., high levels of pain catastrophizing) as well as those who reported poor social support. Being included in the psychosocial domain was predictive of higher pain as well as having worse urinary urgency and frequency symptoms. While the associations between pain, disability and negative affect have been reported in various female pain samples, these relationships need to be further elucidated in order to understand the complex relationships within the process of disablement.
**Pain Catastrophizing.** One of the strongest psychological predictors of pain-related outcomes is pain catastrophizing (Sullivan, et al., 2001; Sullivan, et al., 2004; Tripp, et al., 2009; Tripp et al., 2006). Catastrophizing has been defined as “an exaggerated negative mental set brought to bear during an actual or anticipated painful experience”. The individual with high levels of catastrophizing has the tendency to magnify or exaggerate the threat value of pain sensations (Sullivan, et al., 2001). The factor structure of catastrophizing indicates that there are three components: helplessness, magnification and rumination. Helplessness can be described as the perceived inability to deal with painful situations, while magnification, involves the amplification of the unpleasantness of painful situations and expectancies for negative outcomes. Lastly, rumination can be characterized by having ruminative thoughts, worrying as well as the inability to inhibit pain-related thoughts (Sullivan, Bishop, & Pivak, 1995).

The association between catastrophizing, pain and disability has been consistently reported in the literature (Jensen, Moore, Bockow, Ehde, & Engel, 2011; Sullivan, et al., 2001; Sullivan, et al., 2004; Tripp, et al., 2009; Tripp, et al., 2006). In a sample of patients with soft tissue injuries to the neck, shoulders or back following work or motor vehicle accidents, higher levels of catastrophizing were associated with greater pain intensity, higher ratings of occupational disability, and greater likelihood of unemployment (Sullivan, Stanish, Waite, Sullivan, & Tripp, 1998). In particular, catastrophizing predicted ratings of occupational dysfunction even after controlling for patients’ level of pain, with the rumination subscale acting as the strongest predictor of pain and disability.
Catastrophizing is also acknowledged to be a robust predictor of disability within samples of patients with urogenital chronic pelvic pain. In a sample of men with chronic prostatitis / chronic pelvic pain syndrome (CP/CPPS), physical, cognitive / behavioral and environmental predictors of pain and disability were examined (Tripp, et al., 2006). Catastrophizing was identified as a unique predictor of CP/CPPS pain, with urinary symptoms and depression also making significant contributions. Catastrophizing was also shown to be significantly and strongly associated with greater patient pain, depression and pain-related disability. Catastrophizing has also been evaluated in women with IC/PBS. Coping strategies in women with IC/PBS were evaluated in relation to QoL and depressive symptomology (Rothrock, Lutgendorf, & Kreder, 2003). Patients who reported greater levels of catastrophizing reported greater impairments in pain, general mental health, social functioning, vitality and depressive symptoms. Similarly, in comparison to health controls, high levels of catastrophizing in women diagnosed with IC/PBS were associated with greater pain and a decreased physical and mental QoL (Nickel, et al., 2010).

While catastrophizing has been implicated as a robust predictor of pain-related outcomes (Sullivan, et al., 2001; Sullivan, et al., 2004; Tripp, et al., 2009; Tripp, et al., 2006), there has been some debate over whether catastrophizing is a distinct or less important construct when depression is considered. Attempting to determine the core dimensions required to assess chronic pain, an exploratory factor analysis of nine commonly used psychosocial assessment tools found a seven-factor model to most appropriately fit the data (Davidson, Tripp, Fabrigar, & Davidison, 2007). Catastrophizing was included in a negative affect factor within the seven-factor model,
thus suggestion that perhaps it is somewhat redundant with depression. However, Sullivan et al. (2001) asserts that catastrophizing is distinct from depression. In Sullivan’s theoretical review on catastrophizing, research on the constructs of catastrophizing and depression were reviewed. Prospective studies have shown that catastrophizing predicts future depression, even when accounting for initial levels of depression. Furthermore, cross-sectional studies have shown that catastrophizing predicts pain-related outcomes, even when controlling for depression. Sullivan concluded that while catastrophizing is correlated with various indices of emotional distress, it appears to contribute unique variance to the prediction of pain-related outcomes (Sullivan, et al., 2001). Also, although Tripp’s data showed catastrophizing was significantly associated with greater disability, it was not a significant predictor in the pain-related disability multivariable regression (Tripp et al., 2006), indicating that catastrophizing may be a weak predictor in some samples in regard to disability modeling. Such inconsistencies of construct measurement are problematic in the assessment of chronic pain and models of disability.

**Social Support.** The social context in which an individual experiences chronic pain has significant influence on outcomes, with greater levels of perceived social support being associated with less pain and disability (Jensen, et al., 2011; Kerns, Rosenberg, & Otis, 2002). Conversely, persons with disabilities and pain who report living in an environment where spouses or family members are solicitous in response to pain behaviors do more poorly. They report higher levels of pain and lower levels of physical functioning (Jensen, et al., 2011). One study examined the contributions of self-appraised problem-solving competence and pain-related social support in the prediction of pain, depression, and disability in chronic pain patients from a Pain Management Centre
Hierarchical multiple-regression analyses revealed that lower self-appraised problem-solving competence was related to increased levels of pain, depression, and disability. Interestingly, high levels of pain-relevant social support were found to buffer the relation between poorer self-appraised problem solving competence and depressive symptoms (Kerns, et al., 2002). Similar findings were demonstrated in samples of women with IC/PBS. In the Nickel et al. study women with IC/PBS reported a greater perception of lower social support than controls (Nickel, et al., 2010).

IC/PBS Disablement Process Modeling.

In reviewing the general disablement literature, a comprehensive model that simultaneously assesses for the process of disablement as well as the impact of potential mediation of the psychosocial explanatory factors on this process is warranted. Further, disability is a major concern in women suffering from IC/PBS and has been primarily examined from an economic viewpoint (Clemens et al., 2007). With the IC/PBS research promoting several empirically supported variables for possible mediation of disability factors (e.g., negative affect, catastrophizing, social support) the examination of multiple explanatory factors that may mediate the influence of factors on disability within an IC/PBS sample is not only novel but may have significant clinical meaning. Determining the strength of explanatory factors associated with disability may help direct future models of disability as well as current psychosocial interventions within this chronic pelvic pain population. Thus, this study’s general research objective was to determine which explanatory / psychosocial factors (e.g., depression, anxiety, catastrophizing, social support) may mediate the relationships within the primary pathway of disablement; that is between impairments, functional limitations and patient disability. To accomplish this
general research objective, a series of hypotheses and analyses were used. In particular, the general procedures of a structural model building methodology as defined by Mulaik and Millsap (2000) were employed. These model-building procedures provide a framework from which the three major hypotheses of this thesis will be tested. Each step of the modeling process is tied to the associated hypothesis and is explained in greater detail below.

In keeping with the initial steps of the Mulaik and Millsap (2000) procedure, the first aim was to determine the structure and composition of the common factors underlying the measured variables within the DPM. This aim was accomplished by employing exploratory factor analyses (EFA), followed by Confirmatory Factor Analyses (CFA). EFA is a procedure that is used to reduce a number of measured variables into a smaller number of factors that summarize an underlying process, whereas the CFA procedure provides confirmation of the constructs specified from the EFA using SEM (Tabachnick & Fidell, 2007). EFA and CFA assume the same conceptual model (i.e., the common factor), however the methodology of model fitting is quite different between the two procedures. Whereas EFA is an exploratory procedure, CFA is not as the model to be tested must be specified precisely. CFA using SEM produces standardized regression coefficients and model fit indices in order to evaluate how well the specified model fits the data.

**Aim 1: EFA and CFA of the Primary Pathway of the Disablement Process.**

The first task of this aim was to examine the structure and composition of the common factors underlying the measured variables within the primary pathway of the
DPM (see Figure 2). Within the DPM literature, studies are unclear in reporting the structure and compositions of the constructs within the primary pathway. Results report a three-factor model with significant pathways between impairments, functional limitations and disability in samples of patients with musculoskeletal problems, rheumatoid arthritis, multiple sclerosis and fibromyalgia (Escalante, et al., 2005; Lawrence & Jette, 1996; Phillips & Stuifbergen, 2010). However, some studies have reported a two-factor model in representing the primary pathway (Bai, et al., 2009; Phillips & Stuifbergen, 2009; Phillips & Stuifbergen, 2010). Further, the terms of the three constructs (impairments, functional limitations and disability) and the measured variables that are used as indicators for these constructs are defined using several different variables, leading to concern over construct validity. Thus, the purpose of aim 1 was to test the basic theory of the DPM and its claim that the primary pathway consists of three factors (i.e., impairments, functional limitations and disability). The Disablement Process literature has not empirically demonstrated the rationale behind having a three-factor versus a two-factor model representing the primary pathway. As such, this will be the first study to empirically evaluate the structure of the primary pathway of disablement. Based on the DPM literature, it was predicted that a three-factor solution would be extracted from an EFA as posited by the original theory of the DPM (Verbrugge & Jette, 1994; see Figure 2). The EFA results were followed by the CFA procedure to confirm the structure and composition of constructs within the primary pathway using SEM. Here the CFA played a crucial role in confirming the factor structure for the primary pathway.

Aim 2: EFA and CFA of the Psychosocial Explanatory Factors.
Similar to the first aim, an EFA was also employed but this time to examine the factor structure of the psychosocial explanatory factors (i.e., mediators on the primary pathway). The EFA was employed to determine the structure and composition of the common factors underlying the measured variables of the explanatory factors. The associations between psychosocial variables (e.g., depression, anxiety, catastrophizing, social support) and pain-related outcomes have been widely reported in the general pain literature (Adams, et al., 2008; Hirsh, et al., 2006; Jensen, et al., 2011; Kerns, et al., 2002; Sullivan, et al., 2001; Sullivan, et al., 2004), as well within samples of women suffering from IC/PBS (Ginting, et al., 2010; Nickel, et al., 2010; Rothrock, et al., 2003; Tripp, et al., 2009; Tripp, et al., 2006). However, no study has examined all of the previously mentioned measured variables in regard to factor structure within an IC/PBS sample. In particular, there has been some discussion as to whether catastrophizing is a distinct construct from depression (Davidson, et al., 2008; Sullivan, et al., 2001). It was predicted a three-factor solution would be extracted from an EFA, including negative affect (which would include depression and anxiety), catastrophizing and social support. The CFA was to provide confirmation of the psychosocial explanatory factors as specified in the first part of this aim as stated above.

General Hypothesis: Model Fit, Modifications and Mediation Analyses.

Another procedure of the Mulaik and Millsap (2000) model building process, necessary before a full model test of mediation of disability by the explanatory factors, was to examine the overall structural model fit. This involved placing the primary pathway and the explanatory factors in a unified model, as specified from the EFAs and CFAs from aims one and two. The initial hypotheses consisted of analyses of the
measurement model in which the hypothesized pattern of relations were between the latent constructs and the measured variables. This next procedure examined the structural portion of the model, in which the primary pathway and the explanatory factors’ pattern of relations among the latent constructs were examined. Once the structural model was constructed according to the previous steps, model fit was evaluated and modifications to the model were executed if deemed necessary.

Following the full model estimation step above, the final step of the Mulaik and Millsap (2000) procedure was to evaluate specific hypotheses regarding the parameters estimates of the comprehensive multi-variable mediation model. More specifically, in this step the effects of the psychosocial mediators (i.e., the explanatory factors) were tested for their effect on the relationships within the primary pathway of disablement. The next series of analyses were based on Baron and Kenny’s steps of mediation (Baron & Kenny, 1986), which will further be described in the data analysis section. What follows below is a description of the unique effects of mediation of each of the potential explanatory factors, the multi-variable mediation analysis as well as potential follow-up analyses in order to determine which unique mediators were the most significant in explaining the relationships within the primary pathway of disablement. This procedure may be best conceptualized as a series of tests, explained below in a step like manner:

Step 1) The first step of this mediation analysis was to determine which, if any, of the psychosocial explanatory factors were significant mediators according to Baron and Kenny’s steps of mediation (Baron & Kenny, 1986). More specifically, this step was used to determine if a unique mediator was significant before adding it to the comprehensive multi-variable model. If any of the explanatory factors were not significant as a mediator
on their own, it would be excluded in the subsequent analyses. It was predicted that all three of the explanatory factors (negative affect, catastrophizing and social support) would act as significant mediators when assessed for their unique indirect effects on the relationships within the primary pathway of disablement. More specifically, it was hypothesized that impairments increase negative affect, which will increase functional disability. Similarly, it was hypothesized that impairments will increase catastrophizing, which will increase functional disability. Lastly, it was hypothesized that impairments will decrease social support, which will increase functional disability. Indeed, the existing literature supports the use of psychosocial factors such as negative affect, catastrophizing and social support in association with pain and disability (Adams, et al., 2008; Ginting, et al., 2010; Hirsh, et al., 2006; Jensen, et al., 2011; Kerns, et al., 2002; Nickel, et al., 2010; Rothrock, et al., 2003; Sullivan, et al., 2001; Sullivan, et al., 2004; Tripp, et al., 2009; Tripp, et al., 2006).

Step 2) The second step of this procedure was to evaluate the indirect mediation effect of the combination of all of the psychosocial explanatory factors on the primary pathway of disablement. It was hypothesized that the combination of the three explanatory factors as mediators would produce an indirect effect that was larger than of any of the mediators on their own, and produce a model with significantly better fit to the data. The criterion of executing the next subcomponent of analyses was that there must be at least two out of three unique mediators that were significant.

Step 3) Further follow-up analyses would be employed if two or more of the unique mediators were significant. The purpose of these follow-up analyses would be to determine which of the unique mediators were more significant in accounting for the
variance between the relationships within the primary pathway of disablement. In these follow-up analyses, specific pathways within the model would be constrained (Preacher & Hayes, 2008). In other words, the model would be specified such that certain pathways were forced to have the same variance. A chi-squared difference test between the constrained model and the original full model developed in initial stages of this hypothesis, would then determine if the models were significantly different. Evaluation of the standardized regression coefficients could then establish which of the unique psychosocial mediators were the most significant. There is no empirical rationale to suggest that all three mediators (i.e., the explanatory factors) could not provide an approximately equal contribution to the indirect effect. Thus, it was hypothesized that all explanatory factors would significantly contribute to the mediation model.
Chapter 2: Methods

Participants

A total of 196 women diagnosed with IC/PBS by a urologist in a tertiary care hospital setting participated in this study. There were 69 women recruited from Canada, 61 from the US and 66 from Germany. All Canadian and US women completed the questionnaires in English, and the German women completed the questionnaires in German. For specific demographic information of the women according to country (i.e., Canada, US or Germany), see Table 1. Overall, the mean age of all of the women was 52.58 ± 14.14 years (range: 21 - 83 years). The majority of the women were Caucasian (93.4%), with 6.1% of the women reporting being Hispanic, Asian, African or Other. In regards to education, 8.7% of the sample reported finishing less than high school, 26.5% completed high school, 19.4% completed some university, 27.6% completed university or college and 17.9% completed a graduate or professional degree. The majority of the women in the sample reported having a spouse (77.0%). In terms of employment, 41.3% reported being employed, 10.7% unemployed, 33.2% retired and 13.8% disabled. Lastly, the average time since diagnosis was 6.80 ± 5.60 years (range: 0 - 30 years).
Measures

Measures of the Primary Pathway of Disablement.

Pain. The Short Form - McGill Pain Questionnaire (SF-MPQ) (Melzack, 1987) was used to assess the experience of pain (see Appendix A). The SF-MPQ consists of 15 descriptors (11 sensory and 4 affective) of pain experiences in which participant are asked to rate the severity of each of the descriptors on a 4-point Likert scale from 0 (None) to 3 (Severe). Sensory descriptors include words such as “stabbing” and “throbbing”, and affective descriptors include words such as “fearful” and “punishing-cruel”. The total score is calculated by summing all 15 items and ranges from 0 - 45. In the present study, this total score was used as an indicator for pain. Further, the Cronbach’s alpha for all 15 items in this study was 0.914, which is in the excellent range (George & Mallery, 2003).

IC/PBS Symptoms and Problems. To evaluate disease-specific symptoms and problems, the Interstitial Cystitis Symptom Index (ICSI) and the Interstitial Cystitis Problem Index (ICPI) were used (O'Leary, Sant, Fowler, Whitmore, & Spolarich-Kroll, 1997) (see Appendix B). The ICSI assesses the severity of IC/PBS symptoms experienced with 4 items that are rated on a six point Likert scale from 0 (Not at All) to 5 (Almost Always). Similarly, the ICPI assesses the degree of bother that patients experience due to IC/PBS symptoms with 4 items on a 5-point Likert scale from 0 (No Problem) to 4 (Big Problem). In the present study, the ICSI and ICSI total scores were used as indicators for IC symptoms and IC problems, respectively. The ICSI total score was calculated by totaling all of the four items and ranged from 0 - 20. Similarly, the
ICPI total score was calculated by totaling all 4 items and ranged from 0 - 16. In this study the Cronbach’s alpha for the ICSI was 0.74, which is in the acceptable range and the Cronbach’s alpha for the ICPI was 0.81, which is in the good range (George & Mallery, 2003).

Physical Health Functioning. To measure general physical health functioning, the physical-health component score (PHCS) from the Short-Form 12 - Medical Outcomes Survey (SF12) was calculated (Ware, Kosinski, & Keller, 1996) (see Appendix C). The SF-12 is a brief and reliable measure of overall health status. The questionnaire consists of 12 items including 2 questions concerning physical functioning, 2 questions on role limitations because of physical health problems; 1 question on bodily pain; 1 question on general health perceptions; 1 question on vitality (i.e., energy and fatigue); 1 question on social functioning; 2 questions on role limitations because of emotional problems; and 2 questions on general mental health (psychological distress and psychological well-being). These items are used to compute an overall QoL score, a physical health component score and a mental health component score. These three component scores are computed with scoring algorithms and range from 0 - 100, with higher scores indicating a better QoL. The physical health component score from the SF12 was used as an indicator for general physical functionality.

Pain-Related Disability. To determine status of functional disability, the items from the Pain Disability Index (PDI) were assessed (Pollard, 1984) (see Appendix D). The PDI consists of seven items in which participants are asked to rate the overall impact of pain in their life on an 11-point scale from 0 (No Disability) to 10 (Total Disability). The seven items relate to home and family responsibilities, social activities, recreational
activities, occupation, sexual behavior, self-care and life support. For the present study, all seven items were used as indicators for disability. Further, the Cronbach’s alpha for all seven items within this study was in the good range ($\alpha = 0.864$) (George & Mallery, 2003).

**Measures of the Explanatory Factors.**

*Depression.* Depression was assessed using the Centre for Epidemiological Studies – Depression scale (CES-D) (Radloff, 1977) (see Appendix E). The CES-D is a 20-item measure designed to assess depressive symptoms in the past week in the general population. This scale asks participants to evaluate their feelings and behaviours based on the past week from when they completed the questionnaire and assesses physical and cognitive symptoms of depression. An example of an item that assesses physical symptoms is: “I had crying spells”. An example of an item that assess cognitive symptoms: “I thought my life had been a failure”. Each item is rated on a 4-point scale, ranging from 0 (Rarely or none of the time) to 3 (Most or all of the time). There are four subscales that can be calculated with a higher score indicating greater depressive symptoms. The four subscales include items related to Depressed Affect, Positive Affect, Somatic symptoms and Interpersonal issues. The Depressed Affect subscale relates to feeling blue, sad and lonely. Conversely, the Positive Affect subscale evaluates respondents feelings of happiness, joy and hopefulness. Retarded activity is assessed by the Somatic Subscale and includes items related to changes in appetite, sleep and getting going as well as feelings of bother. Lastly, the Interpersonal subscale includes items relating to the perception that others dislike you and are unfriendly. The factor structure of these four subscales has been demonstrated in a number of studies showing good
validity and reliability (Knight, Williams, McGee, & Olaman, 1997) (Radloff, 1977). For this present study, the four subscales of the CES-D were used as indicators for depression. As such, the Cronbach’s alpha was 0.85 for the Depressed Affect subscale (good range), 0.79 for the Positive Affect subscale (acceptable range), 0.72 for the Somatic subscale (acceptable range), and 0.60 for the Interpersonal subscale (questionable range) (George & Mallery, 2003).

Anxiety. The State Trait Anxiety Index (STAI) is an instrument for measuring anxiety in adults (Speilberger, Gorusch, & Lushene, 1983) (see Appendix F). The STAI includes 20 items in which participants are asked how they would rate themselves according to statements. Each item is self-report rated on a 4-point Likert scale from 1 (Not At All) to 4 (Very Much So). The items evaluate how respondents felt at a particular time in the recent past and how they anticipate they will feel either in a specific situation that is likely to be encountered in the future or in a variety of hypothetical situations. In sum, these items assess general feelings of apprehension, tension, nervousness, and worry. The total score can be calculated by adding up all of the items and ranges from 0 to 80. For the present study, the total STAI score was used as an indicator for anxiety. Further, the Cronbach’s alpha for the STAI items in this study was 0.942, which is in the excellent range.

Mental Health Functioning. To measure general mental health functioning, the mental-health component score (MHCS) from the Short-Form 12 - Medical Outcomes Survey (SF12) was calculated (Ware, et al., 1996) (see Appendix C). As described above, the MHCS was calculated as a component score and ranged from 0-100 with higher
scores indicating a better mental QoL. The MHCS was used as an indicator for general mental health functioning.

**Pain Catastrophizing.** Catastrophizing was assessed with the three subscales from the Pain Catastrophizing Scale (PCS) (Sullivan, et al., 1995) (see Appendix G). The PCS is a measure that contains 13 self-report items used to assess three different components of catastrophizing: magnification, rumination and helplessness. The PCS asks participants to rate 13 statements describing different thoughts and feelings that may be associated with pain, with all items beginning with the phrase, “When I'm in pain...”.

Examples of items include “I worry all the time about whether the pain will end”, “I think of other painful experiences”, and “I keep thinking about how much it hurts”. Each item is scored on a Likert scale ranging from 0 (Not at all) to 4 (All the time), with higher scores indicating higher levels of pain catastrophizing. The Helplessness subscale assesses individual’s perceived inability to deal with painful situation. The magnification of the unpleasantness of painful situations and expectancies for negative outcomes was assessed with the Magnification subscale, and the Rumination subscale evaluated ruminative thoughts, worry, and the inability to inhibit pain-related thoughts (Sullivan, et al., 1995). For the present study, the subscales for the three components of catastrophizing were used as indicators for catastrophizing. In relation to the analysis of item reliability, the Cronbach’s alpha for the Rumination subscale was 0.90 (excellent range), 0.91 for the Helplessness scale (excellent range), and 0.67 for the Magnification subscale (questionable range).

**Social Support.** Lastly, social support was assessed using the three subscales from the Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet, Dahlem,
Zimet, & Farley, 1988) (see Appendix H). This measure includes 12 items that assess one’s perceptions of social support from friends, family and significant others. Each item is rated on a Likert scale from 1 (very strongly disagree) to 7 (very strongly agree). The three subscales (perceived social support from friends, family and significant others) will be used as indicators for the construct of social support. For the present study, the Cronbach’s alpha for the Support from Significant Other subscale was 0.92 (excellent range) and 0.94 for both the Support from Family and Support from Friends subscales (excellent range).

**Procedure**

This study utilized data from a larger ongoing IC/PBS project which consisted of women from Canada, the US and Germany. The Canadian site of recruitment was the IC/PBS clinic at The Kingston General Hospital. Participants in the US were recruited from IC/PBS clinics at the University of Rochester Medical Center (Rochester, NY) and at the Loyola University Medical Center (Maywood, IL). The German participants were recruited from the IC/PBS clinic at the University Hospital of Bochum (Herne, Germany). All study centers received REB ethics clearances. All women were physician-diagnosed with IC/PBS by a staff urologist at an IC/PBS clinic in a tertiary care setting. Potential participants were approached and briefed about the study following their IC/PBS clinic appointment and upon verbal consent they were given a questionnaire package containing a letter of information and a consent form as well as a postage-paid
return envelope. Informed consent was considered upon return of the questionnaire package as well as the signed letter of information.

The women from the Canadian and US centers completed the questionnaires in English, and the women from the German center completed the questionnaires in German, in which the procedure of back-translation was used. First, the questionnaires were translated into German by several bilingual German research assistants. Next, back-translation, a procedure widely used in cross-cultural psychological research (Brislin, 1970; Heine, 2010; Peng & Nisbett, 1999) was used to check consistency of meaning, which was done by a professional translator. Finally the translations were checked once again by the two bilingual German research assistants to ensure they were free of error. This procedure is used to improve the reliability and validity of research in different languages by requiring that an independent translator translating back into the original language verify the quality of translation.

**Data Analysis**

The basic rationale for the series of analyses in this research was communicated in the aims and hypothesis section. This section adds details to those procedures (i.e., Mulaik & Millsap, 2000) in relation to the two aim and general hypothesis by providing information on the specific analyses conducted within each of the steps and subcomponents.

For the EFA’s conducted under aims one and two, the first step of the Mulaik and Millsap (2000) procedure was to determine the structure and composition of the common
factors underlying the measured variables. To accomplish these tasks for the primary pathway and explanatory factors models, an iterative maximum likelihood EFA was run in SPSS 19 (IBM, 2010). The cutoff criteria for determining the number of factors within the model was an eigenvalue of one or greater. The scree plot was also inspected for the interpretation of the number of factors. In order to improve the interpretation of the factor loadings, an oblique rotation was applied. Rather than applying an orthogonal rotation, an oblique rotation accounts for the constructs being somewhat correlated. The extracted and rotated factor loadings were then interpreted and the constructs were given appropriate names. The CFA procedure was employed to provide confirmation of the constructs that resulted from the EFA models for both the primary pathway and the explanatory models. A maximum likelihood CFA was employed using SEM in AMOS 19 (Arbuckle, 2010). The structure and composition of the constructs to be confirmed was specified by the results from the EFAs of aims one and two.

For the second component of aims one and two, a maximum likelihood CFA was employed using SEM in AMOS 19 (Arbuckle, 2010). The structure and composition of the constructs within the primary pathway and explanatory models were combined into a representative model of the DPM. The latent constructs were correlated to determine their relations amongst each other. Further, the model’s performance was evaluated according to model fit indices as well as the parameter estimates. When evaluating model fit, the chi-square index is commonly reported. However, with sample sizes with approximately 200 cases or more, the chi-square statistic will almost always be significant thereby indicating an inadequate fitting model and not providing valid information regarding model fit. For this reason, numerous alternative measures of model fit have been
developed (Byrne, 2010; Kenny, 2010). It is important to evaluate several different indices as many of these indices define fit in different ways and it can be instructive to compare the performance of a model across these indices. Thus, it has been suggested that researchers rely on small set of indices of fit and these indices should be selected on the basis of their performance in detecting errors in model specification and in terms of their conceptual properties (L. Fabrigar, personal communication, November 8, 2010). As such, to determine the performance of the model in terms of model fit, the Chi-square index, as well as one absolute fit index and one incremental fit index will be evaluated. Absolute fit indices attempt to quantify discrepancy between the model and the data without any reference to a comparison point. Conversely, incremental fit indices quantify the discrepancy between a proposed model and the data relative to a comparison model. The comparison model is the null model in which all of the measured variables have variances but there are no covariances amongst these measured variables, indicating no structure underlying the data (L. Fabrigar, personal communication, November 8, 2010).

The absolute fit index can be assessed by the Root Mean Square Error of Approximation (RMSEA), including it’s Confidence Intervals (CI) and significance value, and the Comparative Fit Index (CFI). The RMSEA index has been recognized as one of the most informative criteria in SEM as it is sensitive to model misspecifications and can yield appropriate conclusions regarding model quality (Hu & Bentler, 1998; MacCallum & Austin, 2000). More specifically, the RMSEA index ranges from zero to one with values less than 0.050 indicating close fit, from 0.051 to 0.080 indicating acceptable fit, from 0.081 to 0.100 indicating mediocre fit and values greater than 0.100 indicating unacceptable fit. These defined ranges will be used to describe model fit
throughout this thesis. Furthermore, the 90% confidence intervals will be reported along with the RMSEA significance value. The null hypothesis is that the RMSEA value will be 0.05 indicating a close-fitting model, thus if the significance value is greater than 0.05, it is concluded that the fit of the model is close (Byrne, 2010; Kenny, 2010). The other index was the Comparative Fit Index (CFI). While there are numerous incremental fit indices that have been developed, some argue that the CFI should be the index of choice as it takes sample size into account (Bentler, 1990). The CFI ranges from zero to one, with a value between 0.90 and 0.95 indicating acceptable fit, while a value above 0.95 is indicative of a good fitting model (Byrne, 2010; Kenny, 2010). After the model fit indices had been evaluated, modification indices could then be reviewed and any changes that were made to the model were based on a theoretical rationale. After these modifications, the model fit indices were once again evaluated. This procedure was employed to confirm the structure and composition of the latent constructs within the primary pathway of disablement as well as the psychosocial explanatory factors.

Once the structure and composition of the latent constructs within the model were specified and confirmed in accordance with the first two aims, the multi-variable mediation model was constructed and model fit could be assessed as specified in the general hypothesis (e.g., Mulaik & Millsap, 2000). This set of procedures examined the specific parameters of the model in relation to specified hypotheses, or in other words, the major parameters to be tested were in determining if the psychosocial explanatory factors were significant as primary pathway mediators (Baron & Kenny, 1986). Step one was to ensure that the initial variable was significantly associated with the outcome variable (i.e., that the pathways within the primary pathway of disablement were
significant). Step two was to ensure that the initial variable was significantly associated with the mediator (i.e., that the pathway from impairments to the explanatory factors was significant). Steps one and two were assessed for significance using the standardized regression coefficient estimates as produced by the structural equation model using maximum likelihood estimation in AMOS 19 (Arbuckle, 2010). In order to continue with this analysis, steps one and two must demonstrate significant pathways. If this criterion was met, steps three and four were to determine if the indirect effects accounted for a full or partial mediation (i.e., if the explanatory factors had a significant full or partial mediation effect on the primary pathway of disablement).

To determine the overall significance of the mediation effects, a bootstrapping procedure was employed. Bootstrapping is the preferred method over the Sobel’s test as it requires no assumptions of the data (Preacher & Hayes, 2008). This procedure involves three steps: 1) the sample is treated as a population and from this population a large number of samples are drawn randomly with replacement (i.e., 10,000), 2) for each “resample” the statistic of interest is calculated, and 3) the frequency distribution of this statistic is used as an empirical estimate of its sampling distribution (Mooney & Duval, 1993). This bootstrapped sampling distribution can then be used generate confidence intervals for significance testing and to make inferences about population parameters. In these analyses, bootstrapping capabilities were employed to construct confidence intervals and significance tests to assess for the total, direct and indirect effects of mediation. In particular, the values and significance of the indirect is of interest as this quantifies the amount of mediation. As defined mathematically, the indirect effect
quantifies the amount of reduction of the direct effect of the initial variable on the outcome variable (Kenny, 2009a).

The final hypothesis provides three testable statements. The first component of this analysis was to determine which, if any, of the psychosocial explanatory factors were significant mediators as described by the procedures above. If any of the explanatory factors were not significant as a mediator, it would be excluded from the next subcomponent of the analysis.

The second component of this analysis was to evaluate the indirect effect of all of the mediators together within the comprehensive multi-variable mediation model, as described by the procedures above. All of the psychosocial explanatory factors that demonstrated to be significant mediators in the first subcomponent of this hypothesis were included in this analysis. Finally, if there are any differences in the structural portion in the model, a chi-square difference test will determine which model has a better fit to the data.

Finally, the last evaluation remained dependent on whether or not there were at least two significant mediators and is detailed as follows. This final step determined which of the psychosocial explanatory factors was the most significant mediator of the primary pathway model. In order to directly compare the effects of the potential mediators, the items that were used as indicators for the composition of the constructs needed to be standardized to each other. As such, each of the items was linearly transformed to range from zero to one. A linear transformation was employed instead of the computation of z-scores as this method conserves the degree of variance amongst
scores and does not rely on any assumptions. After this transformation was completed, the pathways of the potential mediators could be directly compared to each other. The next step in the process of comparing the significance of mediators was to constrain certain pathways to force equality in variance between two constructs. In SEM, contrasts can be conducted by imposing equality constraints on pathways and then examining whether those constraints produce a better or worse fitting model (Preacher & Hayes, 2008). For example, in order to compare which pathway is more significant between the independent variable and the mediator (i.e., impairments and negative affect versus impairments and catastrophizing), these two pathways would be constrained to have the same variance within the model. A chi-squared difference test would then be employed to determine if the constrained model had a significantly better or worse model fit than the original unconstrained model. If the constrained model was significant, the two pathways would be evaluated and the bigger pathway (i.e., the larger regression coefficient) would represent the more significant mediator.

This procedure would also be employed for the pathways from the mediator to the outcome variable. In relation to the example above, this comparison would be run for the pathways from negative affect to disability versus catastrophizing versus disability. If the pathways to and from one particular mediator are consistently greater than the other potential mediators, this mediator would be assumed to be the most significant. However, if there is no clear pattern as to which mediator has the largest pathway, it can be inferred that all of the potential mediators have similar mediating effects. The next sections will review the initial data analyses (i.e., data cleaning procedures and data checks) as well as the results that were discussed in this data analysis section.
Chapter 3: Results

Data Cleaning.

The data were cleaned with attention to missing data as well as univariate and multivariate outliers. Missing values in questionnaires with completion of 85% or more data were randomly imputed. All other data (N=4) was considered missing and the cases were deleted from the dataset. Boxplots were evaluated in order to assess univariate normality. Two cases of statistical outliers were found, both of which were from the interpersonal subscale of the CES-D. Upon deletion of these two cases the data was considered to have statistically univariate normality (Tabachnick & Fidell, 2007). Multivariate normality was also assessed using Mahalonobis Distance, in which no statistical multivariate outliers were found.

Data manipulation check.

Table 1 includes sample demographics of the women in the total sample as well as broken down by country. A series of ANOVAs were employed in order to ensure that there were no statistically significant differences in the questionnaire data in the women between the countries (i.e., Canada, the US and Germany). The women in Canada, US and Germany did not differ in terms of age, partner status, employment, IC symptoms, IC problems, total disability, mental-health related QoL, catastrophizing, anxiety, social support or depression (See Table 2). Of all of the comparisons, the only difference was noted between the German and Canadian women with the German women reported significantly better physical-health related QoL in comparison to the Canadian women only ($F = 5.410, p = 0.003$).
Table 1

**Sample Demographics (N=196)**

<table>
<thead>
<tr>
<th></th>
<th>Total Sample n=196</th>
<th>Canada n=69</th>
<th>US n=61</th>
<th>Germany n=66</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>52.58 ± 14.14</td>
<td>53.33 ± 14.67</td>
<td>49.75 ± 12.69</td>
<td>54.21 ± 14.67</td>
</tr>
<tr>
<td>Range</td>
<td>21 - 83</td>
<td>21 - 83</td>
<td>22 - 75</td>
<td>28 - 80</td>
</tr>
<tr>
<td><strong>Ethnicity N (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>183 (93.4%)</td>
<td>68 (98.6%)</td>
<td>56 (91.8%)</td>
<td>59 (89.4%)</td>
</tr>
<tr>
<td>Other</td>
<td>12 (6.1%)</td>
<td>1 (1.4%)</td>
<td>5 (8.2%)</td>
<td>6 (9.1%)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>17 (8.7%)</td>
<td>3 (4.3%)</td>
<td>0</td>
<td>14 (21.2%)</td>
</tr>
<tr>
<td>High school</td>
<td>52 (26.5%)</td>
<td>20 (29.0%)</td>
<td>7 (11.5%)</td>
<td>25 (37.9%)</td>
</tr>
<tr>
<td>University / College</td>
<td>92 (47.0%)</td>
<td>40 (57.9%)</td>
<td>37 (60.7%)</td>
<td>15 (22.7%)</td>
</tr>
<tr>
<td>Graduate / Professional</td>
<td>35 (17.9%)</td>
<td>6 (8.7%)</td>
<td>17 (27.9%)</td>
<td>12 (18.2%)</td>
</tr>
<tr>
<td><strong>Married N (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>151 (77.0%)</td>
<td>49 (71.0%)</td>
<td>48 (78.8%)</td>
<td>55 (83.3%)</td>
</tr>
<tr>
<td><strong>Employment N (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>81 (41.3%)</td>
<td>28 (40.6%)</td>
<td>30 (49.2%)</td>
<td>23 (84.8%)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>21 (10.7%)</td>
<td>6 (8.7%)</td>
<td>12 (19.7%)</td>
<td>3 (4.5%)</td>
</tr>
<tr>
<td>Retired</td>
<td>65 (33.2%)</td>
<td>24 (30.8%)</td>
<td>7 (11.5%)</td>
<td>34 (51.5%)</td>
</tr>
<tr>
<td>Disabled</td>
<td>27 (13.8%)</td>
<td>11 (15.9%)</td>
<td>12 (19.7%)</td>
<td>4 (6.1%)</td>
</tr>
<tr>
<td>Time since diagnosis</td>
<td>6.0 ± 5.60</td>
<td>7.09 ± 6.06</td>
<td>5.18 ± 4.89</td>
<td>8.12 ± 5.42</td>
</tr>
</tbody>
</table>
Table 2

*Differences in Characteristics Among Women from Canada, the US and Germany*

<table>
<thead>
<tr>
<th></th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.828</td>
<td>0.164</td>
</tr>
<tr>
<td>Partner status</td>
<td>1.536</td>
<td>0.218</td>
</tr>
<tr>
<td>Employment</td>
<td>1.14</td>
<td>0.322</td>
</tr>
<tr>
<td>IC Symptoms</td>
<td>0.239</td>
<td>0.787</td>
</tr>
<tr>
<td>IC Problems</td>
<td>0.958</td>
<td>0.386</td>
</tr>
<tr>
<td>Disability</td>
<td>0.601</td>
<td>0.549</td>
</tr>
<tr>
<td>Physical health related QoL</td>
<td>5.410</td>
<td>0.005 **</td>
</tr>
<tr>
<td>Mental health related QoL</td>
<td>2.334</td>
<td>0.100</td>
</tr>
<tr>
<td>Catastrophizing</td>
<td>2.186</td>
<td>0.115</td>
</tr>
<tr>
<td>Anxiety</td>
<td>2.731</td>
<td>0.068</td>
</tr>
<tr>
<td>Social Support</td>
<td>1.478</td>
<td>0.231</td>
</tr>
<tr>
<td>Depression</td>
<td>0.312</td>
<td>0.732</td>
</tr>
</tbody>
</table>

*Note.* ** $p < .01$

_Aim 1: EFA and CFA on the Primary Pathway of Disablement._

The EFA to determine the structure and composition of the primary pathway of disablement yielded a two-factor model explaining 56% of the total variance [$\chi^2 (34, N = 196) = 59.559, p = 0.004$]. The factor loadings in factor 1 ranged from 0.949 to 0.345 and the indicators associated with this factor were family/home responsibilities, social activities, recreation, occupation, sexual behavior, life-support, self-care, pain and general physical-health functioning. As all of these variables were related to the ability to
functional in every day activities, factor 1 was thus named functional disability (Verbrugge & Jette, 1994). For the second factor, the factor loadings ranged from 0.943 to 0.913 and the indicators associated with this Factor were IC symptoms and IC problems. These two variables were related to abnormalities due to disease related pathology, and this factor was thus named impairments (Verbrugge & Jette, 1994). The estimated factor loadings for the indicators associated with impairments and functional disability are listed in Table 3. Further, the two factors were moderately correlated \( r = -0.51 \). One interesting finding in this analysis was that pain had a similar factor loading on to both impairments and functional disability.

The first aim also sought to confirm the structure and composition of the constructs within the primary pathway of disablement as demonstrated by the EFA procedure. This step was executed using CFA with SEM in AMOS 19 (Arbuckle, 2010). Results from this analysis revealed that all of the pathways were significant (as below the \( p = 0.001 \) level) and these pathways (as represented by standardized regression coefficients) ranged from 0.94 to 0.42. In addition, impairments and functional disability were significantly correlated \( r = 0.51, p < 0.001 \). Initially, the two-factor model (as specified from the EFA in hypothesis 1a) had acceptable fit to the data according to the CFI value and mediocre fit according to the RMSEA value \( [\chi^2(43, N = 196) = 120.790, p < .001, \text{CFI} = 0.935; \text{RMSEA} = .096 (90\% \text{ CI: } 0.076, 0.117, p < 0.001)] \). As pain had similar factor loading values on to both impairments and functional disability in the EFA from hypothesis 1a, it was allowed to freely vary between the two latent constructs. This modification resulted in standardized regression coefficients from impairments to pain \( (\lambda = 0.41) \) and from functional disability to pain \( (\lambda = 0.41) \) to be quite similar. With this
modification, the model displayed good model fit according to the CFI value and acceptable model fit according to the RMSEA value \[\chi^2(42, N = 196) = 84.448, p < 0.001, \text{CFI} = 0.964 \text{ and } \text{RMSEA} = 0.072 \text{ (90\% CI: } 0.049, 0.094, p = 0.054)\].

A final modification was made in correlating two error terms. The error terms between the indicators of self-care and life-support (i.e., from the obligatory disability subscale on the PDI) were allowed to covary. The procedure of allowing error terms to covary is a common practice in SEM. More specifically, two measured variables of the same construct may share variance because they are measured by the same method (Kenny, 2009b). This final model, including the specified modifications, displayed good model fit according to the CFI value and acceptable model fit according to the RMSEA value \[\chi^2(41, N = 196) = 69.097, p = 0.004, \text{CFI} = 0.976 \text{ and } \text{RMSEA} = 0.059 \text{ (90\% CI: } 0.034, 0.083, p = 0.249)\]. This final model is displayed in Figure 3.

Figure 3. Confirmatory Factor Analysis of the Primary Pathway of Disablement.
Table 3

Estimated Factor Loadings for the Measured Variables Associate with Functional Disability and Impairments from the Exploratory Factor Analysis

<table>
<thead>
<tr>
<th>Factors</th>
<th>Functional Disability</th>
<th>Impairments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family/home (PDI)</td>
<td>.949</td>
<td>.138</td>
</tr>
<tr>
<td>Occupation (PDI)</td>
<td>.903</td>
<td>.010</td>
</tr>
<tr>
<td>Recreation (PDI)</td>
<td>.856</td>
<td>.112</td>
</tr>
<tr>
<td>Social Activity (PDI)</td>
<td>.741</td>
<td>-.093</td>
</tr>
<tr>
<td>Self-Care (PDI)</td>
<td>.553</td>
<td>.038</td>
</tr>
<tr>
<td>Physical Health QoL (PHCS-SF12)</td>
<td>-.531</td>
<td>.119</td>
</tr>
<tr>
<td>Sexual Behavior (PDI)</td>
<td>.474</td>
<td>-.044</td>
</tr>
<tr>
<td>Pain (MPQ)</td>
<td>.413</td>
<td>-.385</td>
</tr>
<tr>
<td>Life-support activity (PDI)</td>
<td>.345</td>
<td>-.150</td>
</tr>
<tr>
<td>IC problem index (ICPI)</td>
<td>-.007</td>
<td>-.943</td>
</tr>
<tr>
<td>IC symptom index (ICSI)</td>
<td>.016</td>
<td>-.913</td>
</tr>
</tbody>
</table>

Aim 2: EFA and CFA on the Explanatory Factors.

Similar to the first aim, the second aim was to determine the structure and composition of the psychosocial explanatory factors using EFA and to confirm using CFA. The EFA procedure yielded a three-factor model explaining 62% of the total
variance $[\chi^2 (33, N = 196) = 75.746, p < 0.001]$. The factor loadings in factor 1 ranged from 0.930 to 0.428 and the indicators associated with this factor were depressed affect (CES-D), somatic symptoms (CES-D), positive affect (CES-D), interpersonal difficulties (CES-D), general mental health functioning (MHCS - SF12) and anxiety (STAI). As this factor incorporated the constructs of depression, anxiety and psychological distress, this factor was thus named negative affect.

In the assessment of the second factor, the factor loadings ranged from 0.948 to 0.470. The measured variables that were indicated in this factor were social support from a significant other (MSPSS), social support from family (MSPSS) and social support from friends (MSPSS). As these are the three subscales from the MSPSS, factor 2 was given the name social support.

Lastly, the factor loadings in factor 3 ranged from 0.896 to 0.802 and measured variables that were indicated in this factor were magnification (PCS), rumination (PCS) and helplessness (PCS). As these are the three components of catastrophizing from the PCS, factor 3 was thus named catastrophizing. In assessment of the correlations between the factors, negative affect was moderately correlated with social support and catastrophizing ($r = -0.460$, $r = -0.548$, respectively) and social support and catastrophizing were weakly correlated with each other ($r = 0.109$). The estimated factor loadings of these three factors and their indicators are listed in Table 4.
Table 4

*Estimated Factor Loadings for the Measured Variables Associate with Negative Affect, Social Support and Catastrophizing from the Exploratory Factor Analysis*

<table>
<thead>
<tr>
<th>Factors</th>
<th>Negative Affect</th>
<th>Social Support</th>
<th>Catastrophizing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental Health QoL (MHCS-SF12)</td>
<td>-0.930</td>
<td>-0.040</td>
<td>-0.081</td>
</tr>
<tr>
<td>Depressive Affect (CES-D)</td>
<td>0.807</td>
<td>-0.039</td>
<td>-0.045</td>
</tr>
<tr>
<td>Anxiety (STAI)</td>
<td>0.794</td>
<td>-0.036</td>
<td>-0.039</td>
</tr>
<tr>
<td>Somatic Symptoms (CES-D)</td>
<td>0.729</td>
<td>0.092</td>
<td>-0.132</td>
</tr>
<tr>
<td>Positive Affect (CES-D)</td>
<td>0.625</td>
<td>-0.010</td>
<td>-0.038</td>
</tr>
<tr>
<td>Interpersonal Relations (CES-D)</td>
<td>0.428</td>
<td>-0.090</td>
<td>0.009</td>
</tr>
<tr>
<td>Significant Other Support (MSPSS)</td>
<td>0.127</td>
<td>0.948</td>
<td>0.117</td>
</tr>
<tr>
<td>Family Support (MSPSS)</td>
<td>-0.058</td>
<td>0.764</td>
<td>-0.060</td>
</tr>
<tr>
<td>Friend Support (MSPSS)</td>
<td>-0.185</td>
<td>0.470</td>
<td>-0.041</td>
</tr>
<tr>
<td>Rumination (PCS)</td>
<td>0.051</td>
<td>0.073</td>
<td>-0.896</td>
</tr>
<tr>
<td>Helplessness (PCS)</td>
<td>0.073</td>
<td>-0.013</td>
<td>-0.860</td>
</tr>
<tr>
<td>Magnification (PCS)</td>
<td>-0.026</td>
<td>-0.067</td>
<td>-0.802</td>
</tr>
</tbody>
</table>

Results from the explanatory factors EFA were followed up using the CFA approach. The CFA analysis showed that all of the pathways were significant and the standardized regression coefficients ranged from 0.91 to 0.47. Additionally, there was a significant correlation between catastrophizing and negative affect ($r = 0.60, p < 0.001$) and negative affect and social support ($r = -0.46, p < 0.001$) but not between social
support and catastrophizing \((r = -0.144, p = 0.082)\). The three-factor model from the EFA had good fit according to the CFI value and acceptable fit according to the RMSEA value, with no necessary modifications \([\chi^2 (51, N = 196) = 110.007, p < 0.001, CFI = 0.956 \text{ and } RMSEA = 0.077 (90\% CI: 0.057, 0.097, p = 0.014)]\). This final model is displayed in Figure 4.

Figure 4. Confirmatory Factor Analysis of the Explanatory Factors.

Note. ** p < .05
General Hypothesis: Model Fit, Modifications and Mediation Analyses.

The objective of the general hypothesis, in accordance with the Mulaik and Millsap (2000) procedure, was to specify and evaluate the structural component of the model in terms of model fit and the parameter estimates and then to follow a mediation analyses process. In the SEM specification of this multi-variable mediation model, negative affect was allowed to correlate with catastrophizing and social support. The standardized residuals were then examined. Standardized residuals represent an estimate of the distance from a zero residual that would exist if the specified model fit the data perfectly (Byrne, 2010). It is suggested that standardized residual values greater than 2.58 are large and the model should thus be respecified (Joreskog & Sorbom, 1993). There were no standardized residuals that were above the critical value of 2.58 and thus the model did not need to be further respecified.

The following modifications were also made to the final model. Variance that is not explained by latent constructs may also vary across measures. This unexplained variance is not necessarily random and may in fact be meaningful when accompanied with a specified rationale (Kenny, 1998). The residual of Catastrophizing was allowed to covary with pain’s error term. This has a conceptual rationale as the construct of Catastrophizing was measured using the Pain Catastrophizing Scale, which assesses individual’s thoughts and feelings that are associated with pain (Sullivan, et al., 1995). Thus, it is justifiable that the variance of pain and catastrophizing should covary. Similarly, as two indicators from the same construct may share variance due to being measured by the same method, the error terms from the physical health and mental health
related QoL component scores (from the SF12) were allowed to covary as well (Kenny, 2009b).

After re-specifying the model according to the previously mentioned modifications, the final model showed acceptable fit to the data according to both the CFI and RMSEA values, \( \chi^2 (217, N = 196) = 420.281, p < 0.001, \text{CFI} = 0.925 \) and RMSEA = 0.069 (90% CI: 0.059, 0.079, \( p = 0.001 \)). As expected, negative affect was significantly correlated with catastrophizing (\( r = 0.52, p < 0.001 \)) and social support (\( r = -0.39, p < 0.001 \)). The correlation between negative affect and social support was denoted by an arrow that runs behind catastrophizing. As the correlation between catastrophizing was not significantly correlated with social support in previous relationships, that correlation was not specified within the final model. Table 5 displays the standardized regression coefficients of the latent constructs and their respective indicators. The next section to follow will evaluate the specific parameters of the structural portion of the model.
### Table 5

**Standardized Factor Loadings in the Measurement Model**

<table>
<thead>
<tr>
<th>Measured Variables</th>
<th>Impairments</th>
<th>Functional Disability</th>
<th>Negative Affect</th>
<th>Catastrophizing</th>
<th>Social Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC Symptoms (ICSI)</td>
<td>0.930 **</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC Problems (ICPI)</td>
<td>0.930 **</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain (MPQ)</td>
<td>0.413 **</td>
<td>0.388 **</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social (PDI)</td>
<td>0.792 **</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recreation (PDI)</td>
<td>0.794 **</td>
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<tr>
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<tr>
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<tr>
<td>Rumination (PCS)</td>
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<td>0.895 **</td>
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<td>0.922 **</td>
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<td>Magnification (PCS)</td>
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<td>Support from significant other (MSPSS)</td>
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<td>0.848 **</td>
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<tr>
<td>Support from family (MSPSS)</td>
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<td>Support from friends (MSPSS)</td>
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<td>0.568 **</td>
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*Note.* *p < .05; **p < .01.*
Figure 5. Structural Model of the IC/PBS Psychosocial Model of Disability.

Note. * p < .05, ** p < .01

The final step of the Mulaik and Millsap (2000) procedure was to evaluate specific hypotheses regarding the parameters of the mediation model. Each of the mediators was first examined for its unique mediation effect between impairments and functional disability as well as in combination with each other. The first mediator to be evaluated was negative affect. The standardized regression coefficients between impairments and negative affect ($\lambda = 0.28, p < .001$) and negative affect and functional
disability ($\lambda = 0.42, p < 0.001$) were both significant. The bootstrapping technique produced estimates such that both the standardized direct $[0.368, p < 0.001 \text{ (CI: } 0.231, 0.489)]$ and indirect $[0.117, p < 0.001 \text{ (CI: } 0.050 – 0.201)]$ effects of negative affect were significant in the model. This was consistent with a partial mediation effect (Baron & Kenny, 1986). Furthermore, this model had close fit to the data $[\chi^2(113, N = 196) = 219.608, p < 0.001, \text{CFI} = 0.945 \text{ and RMSEA} = 0.070 \text{ (90\% CI: } 0.056, 0.083), p = 0.011]$. Thus, negative affect was a significant partial mediator on the relationship between impairments and functional disability.

The next unique mediator to be examined was catastrophizing. The path coefficients between impairments and catastrophizing ($\lambda = 0.34, p < 0.001$) and catastrophizing and functional disability ($\lambda = 0.33, p < 0.001$) were both significant. The bootstrapping technique produced estimates such that the standardized direct $[0.373, p < 0.001 \text{ (CI: } 0.215, 0.513)]$ and indirect $[0.113, p < 0.001 \text{ (CI: } 0.051 – 0.208)]$ effects of catastrophizing were significant. This was also consistent with a partial mediation effect (Baron & Kenny, 1986). Furthermore, this model had close fit to the data $[\chi^2(71, N = 196) = 131.773, p < 0.001, \text{CFI} = 0.964 \text{ and RMSEA} = 0.066 \text{ (90\% CI: } 0.048, 0.084), p = 0.066]$. Thus, catastrophizing was also found to be a significant partial mediator on the relationship between impairments and functional disability.

Lastly, the unique mediation effect of social support on the relationships between impairments and functional disability was evaluated. The standardized regression coefficients from impairments to social support ($\lambda = -0.12, p = 0.141$) and from social support to functional disability ($\lambda = -0.08, p = 0.264$) were both non-significant. Thus, social support did not satisfy the first two steps of Baron and Kenny’s model of
mediation (Baron & Kenny, 1986), and the indirect mediational effect of social support was thus non-significant [0.010, \( p = 0.188 \) (CI: -0.005, 0.005)]. Therefore, social support was not a significant mediator on the relationship between impairments and functional disability and was excluded for the remainder of the analyses.

Due to the fact that catastrophizing and negative affect were significant mediators, evaluation of the comprehensive multi-variable mediation model with the significant mediators proceeded. The combination of these two mediators was found to have a significant mediation effect on the primary pathway that was consistent with a partial mediation according to Baron and Kenny’s model (Baron & Kenny, 1986). The bootstrapping technique produced estimates such that the standardized direct \([0.342, p < 0.001 \) (CI: 0.194, 0.474)] and indirect \([0.144, p = 0.001 \) (CI: 0.069 – 0.238)] effects were significant both significant, thus indicating a partial mediation effect. This final model including the mediators of negative affect and catastrophizing, but no social support, showed reasonable fit to the data \([\chi^2 (160, N = 196) = 317.233, p < 0.001, CFI = 0.936 \) and \( RMSEA = 0.071 \) (90% CI: 0.059, 0.082), \( p = 0.002 \)]. In comparison to the original proposed model that may have included social support as a mediator, the model with catastrophizing and negative affect only had significantly better fit to the data once social support was removed \([\Delta \chi^2 (57, N = 196) = 103.048, p = 0.001] \).

As at least two out of three significant mediators were significant, this allowed for the continuation of follow-up analyses to determine which mediator was accounted for the most variance on the relationship between impairments and functional disability. The contributions of negative affect and catastrophizing were assessed to determine which mediator was the most significant in the SEM Disablement model. This consisted of
imposing equality constraints on the pathways and then examining whether those constraints produce a better or worse fitting model (Preacher & Hayes, 2008). The first constrained model was as follows. The variance of the pathways from impairments to negative affect and impairments to catastrophizing were forced to be equal. This produced a significantly different model fit from the original unconstrained model \[ \Delta \chi^2 (1, N = 196) = 13.467, p < 0.001 \]. Further examination of the standardized regression coefficients demonstrated that the pathway from impairments to negative affect (\( \lambda = 0.26 \), \( p < 0.001 \)) was larger than the pathway from impairments to catastrophizing (\( \lambda = 0.11 \), \( p < 0.001 \)).

The next process was to constrain the other half of the model. As such, the pathways from negative affect to functional disability and catastrophizing to functional disability were forced to have equal variance. This also produced a significantly different model fit from the original unconstrained model \[ \Delta \chi^2 (1, N = 196) = 7.867, p < 0.005 \]. However, evaluation of the standardized regression coefficients demonstrated that the pathway from catastrophizing to functional disability (\( \lambda = 0.31 \), \( p < 0.001 \)) was larger than the pathway from negative affect to functional disability (\( \lambda = 0.13 \), \( p < 0.001 \)).

In sum, both negative affect and catastrophizing had similar mediating effects on the relationship between impairments and functional disability. More specifically, it can be concluded that while impairments had more of an association with negative affect (than with catastrophizing), functional disability was more associated with catastrophizing (than negative affect). These results will be further discussed in the next section along with limitations, clinical implications and guides for future research.
Chapter 4: Discussion

To our knowledge, this was the first study to apply a theoretical conceptualization of the factors contributing to disability in women suffering from IC/PBS. More specifically, this study was aimed at evaluating how psychosocial factors might mediate the relationships within the primary pathway of disablement. The general results of this study indicate that issues of construct measurement and specific disease-based analyses of the primary pathway of the DPM are warranted concerns. Researchers should be aware that there are no specific constructs used as standards across this research area. The results also indicate that negative affect and catastrophizing act as significant mediators between impairments and functional disability in women suffering from IC/PBS. This is the first study to examine this particular set of associations and in doing so provides new perspectives on the impact of psychosocial variables on patient reported disability. Support for the hypotheses of this thesis are discussed below with current and future research implications. These sections are then followed by the study limitations, clinical implications, and the general conclusion.

Aim 1: EFA and CFA on the Primary Pathway of Disablement.

The original Disablement Process Model (Verbrugge & Jette, 1994) posited that the primary pathway consisted of four factors: pathology, impairments, functional limitation and disability, which was based on the Nagi Scheme (Nagi, 1965, 1979, 1991). As the presence of pathology (i.e., a chronic illness) is a prerequisite for the majority of studies evaluating the DPM, the three factors that are evaluated in the literature are impairments, functional limitations and disability. However, there has been some
confusion in the literature in conceptually differentiating between the constructs of impairments (dysfunctions and structural abnormalities in specific bodily symptoms due to pathology), functional limitations (the restrictions in performing fundamental actions that are used in everyday life that develop due to one’s disease or condition) and disability (experiencing difficulty in doing activities in various life domains). Various studies report a two-factor structure for the primary pathway of disablement, with many of the studies using varied indicators to represent these constructs (Bai, et al., 2009; Phillips & Stuifbergen, 2009; Phillips & Stuifbergen, 2010). A review of the Disablement Process literature leads to questioning the construct validity of the factors within the primary pathway of disablement. Furthermore, no study has empirically evaluated the construct and composition of the factors within the primary pathway of disablement, which could be a particularly interesting finding across various samples of patient-reported disability. As such, an empirical evaluation of the constructs within the primary pathway of disablement was an aim of this thesis.

The results of an EFA on the indictors of the primary pathway of disablement provided a two-factor solution most appropriately fit the current data. A follow-up CFA analysis also supported this two-factor solution. This finding is concomitant with the Disablement Process literature (Bai, et al., 2009; Phillips & Stuifbergen, 2009; Phillips & Stuifbergen, 2010). The first factor included the variables that assessed disease-specific symptoms, such as IC/PBS symptoms and pain, and was thus named impairments. The second factor was found to be a combination of both functional limitations and disability and was thus named functional disability. In the construction of the measurement model of the primary pathway of disablement, pain was allowed to covary between the two
factors of impairments and functional disability for the following rationale. In women suffering from IC/PBS, pain is the cardinal symptom and can be considered a primary source of impairments (Rosamilia, 2005). Furthermore, within the Disablement Process literature, other studies have indicated pain as part of impairments. However, pain also interferes with the ability to carry out every day activities and as such is additionally a source of functional limitations and disability (Koziol, et al., 1993). By allowing pain to covary between the constructs of impairments and functional disability, the structural model of the primary pathway of disablement was significantly improved.

The results of this study provided confirmation of the existing literature such that a two-solution is the most appropriate in representing the primary pathway of disablement. Caution needs to be exercised in delineating constructs in any theoretical model, unless an empirically validated measurement model supports them. In order to adequately evaluate a measurement model, both the procedures of EFA and CFA are necessary. The added value as suggested by the results from this procedure is the ability to separate the distinct constructs that are associated with impairments and disability in a clinically meaningful way, specific to our sample of women suffering from IC/PBS. Furthermore, these results provided some clarity as to which distinct variables are appropriate to use as indicators for the constructs within the primary pathway of disablement. Future research should expand and replicate this line of work in other pain and medical patient samples. For example, using a construct reductionistic approach (i.e., EFA and CFA), future research could evaluate if similar constructs are produced with their respective indicators in other samples of chronic pain patients. This line of study could help illustrate differences or similarities of patient reported disability pathways and
appropriate measures for use in various samples. The results of this aim have the capability of generalization of impairments and pain-related outcomes across various pain and medical samples.

**Aim 2: EFA and CFA of the Psychosocial Explanatory Factors.**

The second aim was to determine the factor structure of the psychosocial explanatory factors. In particular, clarification on whether catastrophizing was independent from the constructs of depression and anxiety was of interest. While some research has found catastrophizing to be redundant in relation to depression and anxiety (Davidson, et al., 2007), others have maintained that catastrophizing is a unique construct (Sullivan, et al., 2001). The results from this study support the originally hypothesized factor structure and composition of the explanatory factors and a three-factor solution was found to fit the data the most appropriately with no modifications. The three factors included negative affect, catastrophizing and social support. As expected, the measured variables used to indicate depression and anxiety loaded together to comprise a single construct that was given the name negative affect. In support of Sullivan et al., (2001) this study also found catastrophizing to be a unique construct in relation to negative affect using the techniques of both EFA and CFA within our sample (Sullivan, et al., 2001). Perhaps there are potential sample differences between our sample and the sample from the Davidson et al. paper. It is also possible for some samples of patient pain catastrophizing to be correlated with factors associated with negative affect. For example, Edwards et al. (2011), noted that depression and catastrophizing do not influence pain outcomes in isolation, but interact with a variety of other factors (Edwards, Cahalan, Mensing, Smith & Haythornthwaite, 2011). Furthermore, a study on patients with back
pain demonstrated that subgroups of patients could be high on either catastrophizing or depression but not the other (Linton et al., 2010). The results of the hypothesis within this thesis suggest that negative affect and catastrophizing are conceptually distinct within this sample, yet it is likely that the two concepts are interactive with other factors that are not collected in the present data. Future research should expand this line of work in evaluating what other potential psychosocial, demographic and disease-specific factors influence the impact of negative affect and catastrophizing on pain-related outcomes. Lastly, social support was the third factor that was extracted and confirmed by the data reduction procedures that was indicated by the variables measuring perceived social support from a significant other, from family and from friends.

In sum, these findings add to the DPM literature by empirically evaluating the measurement models of the proposed explanatory factors in using the procedures of EFA and CFA along with novel variables (i.e., pain catastrophizing). Furthermore, the results suggest that catastrophizing is conceptually distinct from a negative affect. Future research in this area should expand list of factors that may be pertinent as explanatory factors within the DPM literature such as attachment style or pain sensitivity, both with moderate to high associations with pain catastrophizing.

Attachment style research has examined the associations between adult attachment and fear-avoidance of pain. In a sample of pain free university students, correlations and multiple regression analyses supported the hypotheses that insecure attachment was positively associated with reports of pain-related fear, hypervigilance and catastrophizing (McWilliams & Asmundson, 2007). The results of this study are novel and that pain-catastrophizing, or in general pain-related fears, may be a developmental
feature of earlier behavioral learning. Future disability research could model the effects of attachment style in the DPM with catastrophizing and other mediators like negative affect.

High pain sensitivity (i.e., reduced pain threshold and tolerance compared to others) is associated with depression and pain catastrophizing (Campbell et al., 2010). Assessing pain sensitivity in patients with fibromyalgia, pain catastrophizing during the assessment of pain reporting was more predictive of pain sensitivity rather than general recall of catastrophizing in day-to-day life (Campbell et al., 2010). This study exemplifies the complex relationship between pain, catastrophizing and pain sensitivity that needs to be further elucidated in future studies as discussed further below. As with the procedures in this thesis, these additional potential factors of interest should be evaluated in a reductionistic and empirical approach in order to qualify them into the appropriate model and evaluate their impact on pain-related outcomes.

General Hypothesis: Model Fit, Modifications and Mediation Analyses.

In keeping with the adopted model building methodology (Mulaik & Millsap, 2000), the structural model was constructed from the appropriately specified measurement models as suggested by the results in hypotheses one and two. This model included the constructs of impairments and functional disability to represent the primary pathway of disablement, as well as negative affect, catastrophizing and social support to represent the psychosocial explanatory factors. This specified model demonstrated acceptable fit to the data according to both the CFI and RMSEA values and represented the first study within the DPM literature to use an empirical model building procedure.
This application expands the existing literature as it shows a parsimonious pathway model that exemplifies how to empirically evaluate the explanatory factors.

Within a biopsychosocial conceptualization, psychosocial factors exert their complex effects via multiple overlapping pathways. As such, it is necessary to evaluate these relationships using reductionistic techniques and model-building methodologies as described within this thesis. Future research should expand and replicate this existing model based on other samples of chronic pain and health conditions as well as the evaluation of novel explanatory factors, such as attachment style and pain sensitivity as potential mediators. Further, psychosocial variables have been shown to have profound and long-term influences on pain-related outcomes and disability in patients with rheumatoid arthritis (Edwards et al., 2011). As such, future research could expand upon the current study by evaluating the long-term effects (i.e., longitudinal research design) of various psychosocial mediators on pain-related outcomes in patients with IC/PBS.

The final hypothesis also examined the unique and combined contributions of the explanatory factors in a mediation model. The findings suggested that negative affect and catastrophizing, but not social support, acted as unique partial mediators between impairments and functional disability. The negative affect finding is consistent with finding within both the general pain literature as well as the Disablement process literature. Within the DPM literature, depression has been found to a significant explanatory factor on the primary pathway of disablement (Phillips & Stuifbergen, 2010). Further, research on women with various pain conditions (i.e., low back, myofascial, neck, arthritis and fibromyalgia) demonstrates that negative mood fully mediates the relationship between pain and disability (Hirsh, et al., 2006). Similarly, depression was
found to augment pain-related disability in a sample of women, but not men, with musculoskeletal pain conditions (Adams, et al., 2008). This study expands the general pain literature by demonstrating that another sample of patients with a distinct symptom profile (i.e., women with IC/PBS) produced similar effects of mediation, thus increasing the generalizability of this finding.

The present results also suggest that in women with chronic pelvic pain conditions (i.e., IC/PBS), symptoms may become disabling through the cognitive mechanisms of negative affect. It is possible that patients reporting greater negative affect are more likely to show a bias towards negative rumination about pain. Such patients are more likely to anticipate a broader range of pain experiences, interpret ambiguous signals as being related to pain, and to attend to pain-related cues and experience interference of pain during cognitive tasks (Edwards et al., 2011). Adams et al. also suggested that women are more likely to become internally focused and ruminate when depressed, thus increasing attention to painful symptoms. This attentional focus may then lead patients to experience more severe pain (Adams et al., 2008).

As with negative affect within the general pain literature, catastrophizing is a prominent psychological predictor of pain and pain-related outcome but in some several studies it acts so over and above the impact of depression (Sullivan, et al., 2001; Sullivan, et al., 2004; Tripp, et al., 2009; Tripp, et al., 2006). Recent research with women suffering from IC/PBS, also show a strong positive correlation between catastrophizing and pain (Nickel, et al., 2010). However, this study is the first to examine catastrophizing within the context of a disability model (i.e., the Disablement Process Model). Catastrophizing was included in the current model as an explanatory factor to further
expand the current DPM literature, showing itself to be a partial mediator between impairments and functional disability. Alongside negative affect, the current finding identifies catastrophizing as a key risk factor in relation to pain and disability.

As is the case with negative affect, the catastrophizing mediation effect suggests that in women with chronic pain conditions, symptoms may become disabling through the cognitive mechanisms. Studies have suggested that pain catastrophizing is associated with a heightened attentional bias to pain-relevant stimuli and an inability to disengage from pain or pain cues (Quartana, Campbell, & Edwards, 2009). The cognitive mechanisms of catastrophizing have also been evaluated context of Lazarus and Folkman's transactional model of stress and coping. According to Severijns and colleagues, magnification and rumination may reflect one’s focus on painful stimulus as extremely threatening (e.g., primary appraisal), whereas helplessness may reflect secondary appraisals of one’s inability to cope (Severeijns, Vlaylen, & van den Hout, 2004). Furthermore, some evidence suggests that catastrophizing is associated with other appraisal processes, such as self-efficacy (Sullivan et al., 2001).

Future research should examine if the mediation effects of negative affect and catastrophizing would be similar in other samples of patients with chronic pain, for example in men with chronic pelvic pain (i.e., Chronic Prostatitis). Research has demonstrated that the cognitive mechanisms associated with negative affect and catastrophizing may operate differently in women and men (e.g., Edwards et al., 2010; Adams et al., 2008; Hirsh et al., 2006). For example, in women, negative mood fully mediated the relationship between pain and disability and depression was found to augment activity related pain. However, the impact of negative affect on pain and
disability was not found in men within these samples (Adams et al., 2008; Hirsh et al., 2006). Thus, these relationships need to be further elucidated to determine what other factors may be acting to impact pain-related disability in men versus women, and within other chronic pain samples. By elucidating these relationships, generalized biopsychosocial models of disability can constructed that capture a more comprehensive evaluation of the mechanisms behind the experience of disability.

The social context in which an individual experiences chronic pain has a significant influence on pain and disability and the effects of social support on pain and pain-related outcomes are complex (Jensen, et al., 2011; Kerns, et al., 2002). Generally, greater levels of perceived social support are associated with less pain and disability (Jensen, et al., 2011), but people with disabilities and pain who report living in an environment where spouses or family members are solicitous in response to pain behaviors, tend to do more poorly (Jensen, et al., 2011). These results have also been shown in women suffering from IC/PBS. A recent study evaluated the effects of social support in a sample of women suffering from IC/PBS (Ginting, et al., 2010). The negative spousal responses to pain behavior were found to be associated with greater disability.

In this study, social support was not found to be a significant mediator on the relationship between impairments and functional disability. The construct of social support within this study was indicated with the measured variables of perceived social support from a significant other, family and friends. As demonstrated by the literature, social support has a complex relationship with pain and disability. This study did not assess for various “types” of behavioral social support for pain, such as negative spousal
support or solicitous behaviors. Recent research suggests that social support such as spousal reactions to pain is significant in evaluating cross-gender modeling of pelvic pain conditions (Ginting, Tripp, Nickel, FitzGerald, & Mayer, 2010). More specifically, distracting spousal responses were found to act as buffers on the deleterious effects of pain on mental health-related QoL for women suffering from IC/PBS. Further, negative spousal responses to pain behavior were associated with greater disability. However, the beneficial effects of social support are complex and difficult to conceptualize (Bolger & Amarel, 2007). It has been shown that the perception of the availability of social support has a greater impact on adjustment in comparison to the actual social support that was received (Helgeson, 1993). As such, we had chosen to include a measure of perceived social support within this study.

These results have the potential to guide future research that could evaluate how various types of social support function as mediators within the DPM. In particular, pain coping strategies such as distracting spousal responses may act as superordinate factors in disability prediction because they are specific to the adjustment of patients in regard to pain and pain acts to decrease mobility in many. For example, distracting someone expressing pain may lessen the psychological distress via cognitive mechanisms, such as preventing them from attending to and ruminating about pain (Ginting et al., 2011).

Although social support was not found to be a significant mediator and was subsequently removed from the final multi-variable mediation model for the final series of analyses, this does not suggest that social support is an unimportant factor in pain and disability. It does suggest that in the present data at least, catastrophizing and negative affect provide a stronger model. It was unexpected to find that the model fit of this final
model was significantly improved when the construct of social support excluded from analyses. The combined effect of negative affect and catastrophizing were significant in partially mediating the relationship between impairments and functional disability. These results are similar to the findings in a sample of patients with back pain, in which the combined effects of catastrophizing and depression were found to create a synergistic increase in pain-related disability (Linton et al., 2010). As with the report that both catastrophizing and negative affect are cognitive variables that may promote greater functional disability, it may be that social support has less proximal effects in the association between impairments and functional disability.

Subsequent mediation model follow-up analyses were employed to determine which mediator was the most significant. After constraining the variance of pathways in the first analysis, the pathway from impairments to negative affect was larger than the pathway from impairments to catastrophizing. However, in the second analysis the pathway from catastrophizing to functional disability was larger than the pathway from negative affect to functional disability. Thus, the pattern of findings is unclear and suggested that both negative affect and catastrophizing contribute similar mediation effects on to the relationships between impairments and functional disability. More specifically, from the results of this study, impairments (i.e., pain and disease-specific symptoms) is more strongly related to negative affect, while catastrophizing is more strongly related to functional disability (i.e., difficulty in participating in everyday roles). While the previous literature has evaluated how psychosocial variables influence pain-related outcomes individually, this is the first study to assess the combined effects of psychosocial variables on pain and disability.
This is the first study within the Disablement Process Literature to compare the mediation effects of the psychosocial explanatory factors in order to determine which mediator is the most significant. As such, the results of this study provide a novel methodology as to how to compare and contrast multiple mediators within a model using SEM. Furthermore, this study indicates that both catastrophizing and negative affect provide unique contribution as mediators within the DPM. These results also confirm the importance of negative affect and catastrophizing as variables associated with patient disability within the IC/PBS literature. These results have provided novel staging for the other significant research on disability in IC/PBS. Disability is a major concern due to the large economic and social impact of chronic pelvic pain (i.e., IC/PBS). Identifying potential psychosocial variables and the manner in which they function in the promotion of functional disability is an important step in for clinical targeting and treatment to be advanced for these patients.

**Study Limitations.**

There are several limitations to be discussed in the current research. Primarily, the use of self-report data is almost always viewed as a limitation. Indeed, survey data collected using self-reported data from respondents is by its very nature a lower quality type of research compared to the randomized intervention study or studies that employ direct observation. The greatest limitation of a self-report methodology is that the patient who is self-reporting, as in this study, has answers recorded as fact without being independently verified. Self-report data has the possibility of containing biases such as selective memory, attribution errors and exaggeration. However, this is also a necessary feature of much research because of time and support costs to completing large-scale
observational studies. Future research could extend the applicability of this model by collecting both subjective self-report data as well as objective behavioral data. This could be informative in the measurement of constructs such as impairments. For example, impairments could additionally be assessed using evaluations of performance. One such performance task is the timed sit-stand task. In a sit-stand task, participants are asked to perform a sit-to-stand movement from a chair without arms five times as fast as possible. Generally, the task is performed several times and the average time in seconds needed to perform the task is calculated. In a study evaluating the validity and reliability of performance tasks of disability in patients with low back pain, the sit-stand task demonstrated to have good test-retest reliability and was found to be clinically meaningful in changes in reported pain scores (Smeets, Hijdra, Kester, Hitters, & Knotternerus, 2006). This sit-stand procedure could be incorporated into the Disablement Process Model as an additional indicator for impairments and would expand on the current literature.

Another potential limitation of this study was that the women were recruited from centers in Canada, the US and Germany. This may have resulted in various culture-based differences in the primary variables of interest in the present study. However, a series of analyses revealed that the women across these countries did not differ on a variety of demographic variables including age, partner status, employment, IC/PBS symptoms, IC/PBS problems, disability, mental-health related QoL, catastrophizing, anxiety, social support or depression. The lone significant difference was found in between the German and Canadian women, where the German women reported significantly better physical-health related QoL. According to norms developed by Ware et al., a 5-point or greater
reduction in any of the SF-12 subscales is described as clinically and socially relevant in North American samples (Ware, Snow, Kosinski, & Gandek, 1993). The German women reported a better physical QoL in comparison to the Canadian women at a mean difference score of 5.5 points. This difference, just above the cutoff criteria, may simply be seen as random error (where chance occurrences of differences between samples are experienced) or could be a point of caution. However, given that the constructs in this study were empirically developed through an exploratory and confirmatory process, it is unlikely that the elevation in only one indicator of a construct has a worrisome impact upon the final model and outcomes. Furthermore, throughout the data reduction techniques and model building procedures, various checkpoints are involved in order to determine if the model requires respecification at each particular step. For example, the values of the communalities, factor loading scores, error terms and standardized residuals are evaluated to determine if any of the indicators or constructs are presenting a problem within the measurement or structural models. As such, physical health QoL did not present with any complications throughout these procedures when evaluating the previously mentioned values indicating that the model did not need to be respecified due to the variable. Nonetheless, women diagnosed with IC/PBS in Canada, the US and Germany were found to have similar demographic information and experience similar levels of disease-specific symptoms, disability, catastrophizing, anxiety, social support and depression. This speaks to the generalizability of the experiences of women suffering from IC/PBS internationally and by proxy makes the current findings of concern to women suffering from IC/PBS outside of North America.
Another limitation of this study is in relation to the generalizability of the sample. Caution should be exercised when applying the results of this study to women of other ethnicity as the majority of this sample identified as Caucasian. However, Clemens et al. (2007) evaluated the prevalence of IC/PBS and effects on QoL in Black, Hispanic and Caucasian patients in which analyses revealed that there were no variations by race or ethnicity (Clemens et al., 2007). Moreover, this present sample consisted of women with a wide range of ages and education with similar experiences of pain and urinary symptoms.

Another limitation of this study is associated with the statistical methodologies within this thesis. Although SEM is a valuable methodology of data analysis, it also has its limitations. One major limitation in the use of SEM is the assumption of causality amongst pathways. The only true method of inferring causation is through study design features (e.g., longitudinal studies with experimentation of key variables). Yet SEM has some advantages over other statistical methods for establishing the conditions necessary to infer causality and is a useful procedure in model construction. For one, it has the ability to account for random and systematic measurement error. It also allows for flexibility in assessing for numerous and complex hypotheses. Furthermore, it has the ability to simultaneously assess multiple relationships amongst variables (L. Fabrigar, personal communication, November 8, 2010). Moreover, the use of SEM within cross-sectional datasets is a necessary feature of research due to the time and support costs of completing large-scale projective studies with the manipulation of variables.

A final limitation relates to this study’s cross-sectional design. This project captures a snapshot of the experience of disability in women suffering from IC/PBS at
one point in time. As such, caution should be taken when generalizing the results of this thesis. More specifically, these findings summarize an average effect of the process of disablement and the various factors that may impact on these relationships. Disability is a process that affects individual’s abilities to act in the necessary, usual, expected and personally desired ways in their society. Moreover, the term “process” reflects that disability is dynamic in terms of the course of functional consequences over time, the directionality of the factors and the patterns of change (Verbrugge & Jette, 1994). As such, it is essential to conceptualize disability within a holistic perspective as in the methodologies of this thesis.

Clinical Application of a Disability Model to Women with IC/PBS.

The application of a psychosocial disability model for women suffering from IC/PBS is significant for several reasons. For one, there is no sufficient etiology to explain the onset of IC/PBS, as such medical research has been unable to provide an efficacious form of treatment (Whitmore, 1994). Thus, treatment requires a trial-and-error approach and relies on symptom and pain management rather than a cure. For this reason, IC/PBS can have a devastating effect on individual’s life as it can be physically and psychologically debilitating (Rabin, et al., 2000). Thus, a study that has evaluated a conceptual framework as to how pain and disability are impacted by psychosocial factors may be an important starting point for psychosocial therapies that target disability management.

This line of work has already shown some success in patients with musculoskeletal pain. Within this literature, psychosocial risk factors have been shown to
increase the probability that pain-related disability will persist over time, and as such research highlighting the important role of psychosocial factors in pain and disability has prompted the development of intervention approaches designed to target psychosocial risk factors associated (Sullivan, Feuerstein, Gatchel, Linton, & Pransky, 2005). Moreover, reviews of the literature indicate that multidisciplinary programs that include psychosocial pain management interventions are more effective in reducing work disability than programs that do not include psychosocial interventions (Guzman et al., 2004).

One such psychosocial intervention that has shown success in decreasing catastrophizing and increasing return to work in patients with musculoskeletal injuries is the Pain-Disability Prevention (PDP) Program. The PDP was developed to specifically target certain psychosocial risk factors (Sullivan & Stanish, 2003). More specifically, the PDP Program is a standardized 10-week intervention that targets risk factors such as fear of movements and re-injury, and perceived disability. Moreover, the cognitive mechanisms associated with pain-related disability and outcomes, such as depression and catastrophizing are treated using thought monitoring and cognitive restructuring strategies. A preliminary study yielded encouraging results with 60 percent of PDP patients returning to work, in comparison to an 18 percent base rate of return. Furthermore, in a sample of injured workers who completed the PDP Program, treatment-related reductions in pain catastrophizing significantly predicted RTW (Sullivan et al., 2005).

The multi-variable mediation model as presented in this thesis has significant potential clinical implications. The results from this study exemplify the process of
disablement in which an individual may progress from disease-specific symptoms, such as pain, to functional disability in which an individual has difficulty performing the essential roles of their every day life. Furthermore, the final model as presented by this thesis emphasizes how the effects of psychosocial factors can act to mediate the relationships between pain and disability. Thus, a significant application of the results from this study can be used to develop a psychosocial intervention aimed at reducing pain-related patient disability in women suffering from IC/PBS. This intervention should emphasize the reduction of patient’s negative affect as well as catastrophizing in order to improve their functionality in everyday roles and general physical functioning. As with the PDP Program, this intervention could include cognitive behavioral strategies such as thought monitoring and cognitive restructuring in order to achieve these goals.

A recent study has evaluated the feasibility of a psycho-educational program aimed at reducing psychosocial risk factors in men suffering from Chronic Prostatitis / Chronic Pelvic Pain Syndrome (CP/CPPS; Tripp, Nickel, & Katz, 2011). The program consisted of eight weekly psycho-educational sessions aimed at getting patients to identify and dispute catastrophic and pessimistic thinking with health-focused thinking and behavior. Following the training program, patients reported significantly less pain catastrophizing, pain and disability. This study demonstrates how such programs can reduce psychosocial risk factors and make headway into improving patient outcomes such as pain and disability in men with CP/CPPS. However, no study has applied or evaluated this type of intervention in women suffering from chronic pelvic pain (i.e., IC/PBS). As such, future research should adapt this program to evaluate the efficacy of improving patient pain and disability by reducing levels of negative affect and
catastrophizing in women suffering from IC/PBS. It is suggested that such an effort would be successful due to the overlapping symptom profiles in urogenital pain between IC/PBS and CP/CPPS (Pontari, 2006).

*General Conclusions.*

The goal of this study was to evaluate the impact of psychosocial mediators on pain-related outcomes such as disability. This was the first study to empirically evaluate a psychosocial model of disability in women suffering from IC/PBS using model building methodologies. Overall, the results from this thesis supported the hypotheses such that psychosocial factors, such as negative affect and catastrophizing, were found to be significant partial mediators on the relationship between impairments and functional limitations. The findings from this thesis contribute to the Disablement Process literature, as this was the first study to employ empirical and systematic model building methodologies in order to evaluate the measurement and structural models within the DPM. The results from this study also contribute to the pain and urology literature by identified key psychosocial variables of interest that may influence symptoms to become disabling in women through the cognitive mechanisms of negative affect and catastrophizing. As such, potential psychosocial clinical interventions should focus on decreasing levels of negative affect and catastrophizing through cognitive behavioral strategies in order to decrease pain-related disability in women suffering from IC/PBS.
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**Appendix A: Short Form - McGill Pain Questionnaire (SF-MPQ)**

Rate how much the following words describe your pain. Indicate the severity of each pain experience word by shading the circle under “None”, “Mild”, “Moderate”, “Severe”.

<table>
<thead>
<tr>
<th>Word</th>
<th>None</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throbbing</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Shooting</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Stabbing</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Sharp</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Cramping</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Gnawing</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Hot-Burning</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Aching</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Heavy</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Tender</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Splitting</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Tiring-Exhausting</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Sickening</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Fearful</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
<tr>
<td>Punishing-Cruel</td>
<td>O₀</td>
<td>O₁</td>
<td>O₂</td>
<td>O₃</td>
</tr>
</tbody>
</table>
Appendix B

Interstitial Cystitis Symptom Index:

Q1. During the past month, how often have you felt the strong need to urinate with little or no warning?

0. ___ not at all
1. ___ less than 1 time in 5
2. ___ less than half the time
3. ___ about half the time
4. ___ more than half the time
5. ___ almost always

Q2. During the past month, have you had to urinate less than 2 hours after you finished urinating?

0. ___ not at all
1. ___ less than 1 time in 5
2. ___ less than half the time
3. ___ about half the time
4. ___ more than half the time
5. ___ almost always

Q3. During the past month, how often did you most typically get up at night to urinate?

0. ___ none
1. ___ once
2. ___ 2 times
3. ___ 3 times
4. ___ 4 times
5. ___ 5 or more times

Q4. During the past month, have you experienced pain or burning in your bladder?

0. ___ not at all
1. ___ a few times
2. ___ fairly often
3. ___ usually
4. ___ almost always

Add the numerical values of the checked entries;

Total Score: ______

Interstitial Cystitis Problem Index:

During the past month, how much has each of the following been a problem for you?

Q1. Frequent Urination during the day?

0. ___ no problem
1. ___ very small problem
2. ___ small problem
3. ___ medium problem
4. ___ big problem

Q2. Getting up at night to urinate?

0. ___ no problem
1. ___ very small problem
2. ___ small problem
3. ___ medium problem
4. ___ big problem

Q3. Need to urinate with little warning?

0. ___ no problem
1. ___ very small problem
2. ___ small problem
3. ___ medium problem
4. ___ big problem

Q4. Burning, pain, discomfort, or pressure in your bladder?

0. ___ no problem
1. ___ very small problem
2. ___ small problem
3. ___ medium problem
4. ___ big problem

Add the numerical values of the checked entries;

Total Score: ______

Interstitial Cystitis Symptom Index and Problem Index
(O’Leary, Sant, Fowler, Whitmore, Spolarich-Kroil, 1997)
Appendix C: Medical Outcomes Survey - Short Form 12 (SF-12)

Instructions: This survey asks for your views about your health. Answer every question by marking the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can.

1. In general, would you say your health is:  
   □: Excellent  
   □: Very Good  
   □: Good  
   □: Fair  
   □: Poor

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

2. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf  
   □: Yes, limited a lot  
   □: Yes, limited a little  
   □: No, not limited at all

3. Climbing several flights of stairs  
   □: Yes, limited a lot  
   □: Yes, limited a little  
   □: No, not limited at all

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

4. Accomplished less than you would like  
   □: Yes  
   □: No

5. Were limited in the kind of work or other Activities  
   □: Yes  
   □: No

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

6. Accomplished less than you would like  
   □: Yes  
   □: No

7. Didn’t do work or other activities as carefully as usual  
   □: Yes  
   □: No

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?  
   □: Not at all  
   □: A little bit  
   □: Moderately  
   □: Quite a bit  
   □: Extremely
These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks:

9. Have you felt calm and peaceful?  
   - All of the time
   - Most of the time
   - A good bit of the time
   - Some of the time
   - A little of the time
   - None of the time

10. Did you have a lot of energy?  
    - All of the time
    - Most of the time
    - A good bit of the time
    - Some of the time
    - A little of the time
    - None of the time

11. Have you felt downhearted and blue?  
    - All of the time
    - Most of the time
    - A good bit of the time
    - Some of the time
    - A little of the time
    - None of the time

12. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?  
    - All of the time
    - Most of the time
    - Some of the time
    - A little of the time
    - None of the time
Appendix D: Pain Disability Index (PDI)

**Directions:** The scales below indicate how much your pain is preventing you from doing what you would normally do, or from doing it as well as you normally would. Respond to each category by indicating the *overall impact* of pain in your life, not just pain at its worst. Please fill in the circle of the number on the scale that describes the level of disability you typically experience. A score of 0 “no disability at all”, and a score of 10 “all of the activities in which you would normally be involved have been totally disrupted or prevented by your pain”.

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

   \[
   \begin{array}{cccccccccc}
   0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
   \end{array}
   \]

   NO Disability                     TOTAL Disability

2. **Recreation**
   This category includes hobbies, sports, and other similar leisure time activities (e.g., tennis, playing cards).

   \[
   \begin{array}{cccccccccc}
   0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
   \end{array}
   \]

   NO Disability                     TOTAL Disability

3. **Social Activity**
   This category refers to activities that involve participation with friends and acquaintances other than family members. It includes parties, theatre, concerts, dining out, and other social functions.

   \[
   \begin{array}{cccccccccc}
   0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
   \end{array}
   \]

   NO Disability                     TOTAL Disability

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

   \[
   \begin{array}{cccccccccc}
   0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
   \end{array}
   \]

   NO Disability                     TOTAL Disability

5. **Sexual Behaviour**
   This category refers to the frequency and quality of one’s sex life.

   \[
   \begin{array}{cccccccccc}
   0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
   \end{array}
   \]

   NO Disability                     TOTAL Disability

6. **Self-care**
   This category includes activities that involve personal maintenance and independent daily living (e.g., taking a shower, driving, getting dressed, etc.)

   \[
   \begin{array}{cccccccccc}
   0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
   \end{array}
   \]

   NO Disability                     TOTAL Disability
7. **Life-support activity**

This category refers to basic life-supporting behaviours such as eating, sleeping, and breathing

\[ q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9, q_{10} \]

<table>
<thead>
<tr>
<th>NO Disability</th>
<th>TOTAL Disability</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>( q_0 )</th>
<th>( q_1 )</th>
<th>( q_2 )</th>
<th>( q_3 )</th>
<th>( q_4 )</th>
<th>( q_5 )</th>
<th>( q_6 )</th>
<th>( q_7 )</th>
<th>( q_8 )</th>
<th>( q_9 )</th>
<th>( q_{10} )</th>
</tr>
</thead>
</table>

100
**Instructions:** Check the statement that best describes how often you felt or behaved this way, *during the past week.*

<table>
<thead>
<tr>
<th></th>
<th>Rarely or none of the time (Less than 1 day)</th>
<th>Some or a little of the time (1-2 days)</th>
<th>Occasionally or a moderate amount of the time (3-4 days)</th>
<th>Most or all of the time (5-7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I was bothered by things that usually don’t bother me.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>2.</td>
<td>I did not feel like eating; my appetite was poor.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>3.</td>
<td>I felt that I could not shake off the blues even with help from my family or friends.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>4.</td>
<td>I felt that I was just as good as other people.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>5.</td>
<td>I had trouble keeping my mind on what I was doing.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>6.</td>
<td>I felt depressed.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>7.</td>
<td>I felt that everything I did was an effort.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>8.</td>
<td>I felt hopeful about the future.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>9.</td>
<td>I thought my life had been a failure.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>10.</td>
<td>I felt fearful.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>11.</td>
<td>My sleep was restless.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>12.</td>
<td>I was happy.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>13.</td>
<td>I talked less than usual.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>15.</td>
<td>People were unfriendly.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>16.</td>
<td>I enjoyed life.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>17.</td>
<td>I had crying spells.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>18.</td>
<td>I felt sad.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>19.</td>
<td>I felt that people disliked me.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>20.</td>
<td>I could not get “going”.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
</tbody>
</table>
Appendix F: State Trait Anxiety Index (STAI)

Instructions: A number of statements which people have used to describe themselves are given below. Read each statement and then check the appropriate number to the right of the statement to indicate how you feel right now, that is, at this moment. There are no right or wrong answers. Do not spend much time on any one statement but give the answer which seems to describe your present feelings best.

Right now, at this moment:

1. I feel calm.  
   □ 1. Not at all  
   □ 2. Somewhat  
   □ 3. Moderately so  
   □ 4. Very much so

2. I feel secure.  
   □ 1. Not at all  
   □ 2. Somewhat  
   □ 3. Moderately so  
   □ 4. Very much so

3. I am tense.  
   □ 1. Not at all  
   □ 2. Somewhat  
   □ 3. Moderately so  
   □ 4. Very much so

4. I feel strained.  
   □ 1. Not at all  
   □ 2. Somewhat  
   □ 3. Moderately so  
   □ 4. Very much so

5. I am at ease.  
   □ 1. Not at all  
   □ 2. Somewhat  
   □ 3. Moderately so  
   □ 4. Very much so

6. I feel upset.  
   □ 1. Not at all  
   □ 2. Somewhat  
   □ 3. Moderately so  
   □ 4. Very much so

7. I am presently worrying over possible misfortunes.  
   □ 1. Not at all  
   □ 2. Somewhat  
   □ 3. Moderately so  
   □ 4. Very much so

8. I feel satisfied.  
   □ 1. Not at all  
   □ 2. Somewhat  
   □ 3. Moderately so  
   □ 4. Very much so
9. I feel frightened.
   □ Not at all
   □ Somewhat
   □ Moderately so
   □ Very much so

10. I feel comfortable.
    □ Not at all
    □ Somewhat
    □ Moderately so
    □ Very much so

11. I feel self-confident.
    □ Not at all
    □ Somewhat
    □ Moderately so
    □ Very much so

12. I feel nervous.
    □ Not at all
    □ Somewhat
    □ Moderately so
    □ Very much so

13. I am jittery.
    □ Not at all
    □ Somewhat
    □ Moderately so
    □ Very much so

    □ Not at all
    □ Somewhat
    □ Moderately so
    □ Very much so

15. I am relaxed.
    □ Not at all
    □ Somewhat
    □ Moderately so
    □ Very much so

16. I feel confident.
    □ Not at all
    □ Somewhat
    □ Moderately so
    □ Very much so

17. I am worried.
    □ Not at all
    □ Somewhat
    □ Moderately so
    □ Very much so
18. I feel confused.

☐ Not at all  
☐ Somewhat  
☐ Moderately so  
☐ Very much so

19. I feel steady.

☐ Not at all  
☐ Somewhat  
☐ Moderately so  
☐ Very much so

20. I feel pleasant.

☐ Not at all  
☐ Somewhat  
☐ Moderately so  
☐ Very much so
### Appendix G: Pain Catastrophizing Scale (PCS)

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures or surgery.

**Instructions:** We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

**When I’m in Pain,...**

1. I worry all the time about whether the pain will end.
   - Not at all
   - To a slight degree
   - To a moderate degree
   - To a great degree
   - All the time

2. I feel I can’t go on.
   - Not at all
   - To a slight degree
   - To a moderate degree
   - To a great degree
   - All the time

3. It’s terrible and I think it’s never going to get any better.
   - Not at all
   - To a slight degree
   - To a moderate degree
   - To a great degree
   - All the time

4. It’s awful and I feel that it overwhelms me.
   - Not at all
   - To a slight degree
   - To a moderate degree
   - To a great degree
   - All the time

5. I feel I can’t stand it anymore.
   - Not at all
   - To a slight degree
   - To a moderate degree
   - To a great degree
   - All the time

6. I become afraid that the pain will get worse.
   - Not at all
   - To a slight degree
   - To a moderate degree
   - To a great degree
   - All the time
When I’m in Pain,...

7. I keep thinking of other painful events.
   - Not at all
   - To a slight degree
   - To a moderate degree
   - To a great degree
   - All the time

8. I anxiously want the pain to go away.
   - Not at all
   - To a slight degree
   - To a moderate degree
   - To a great degree
   - All the time

9. I can’t seem to keep it out of my mind.
   - Not at all
   - To a slight degree
   - To a moderate degree
   - To a great degree
   - All the time

10. I keep thinking about how much it hurts.
    - Not at all
    - To a slight degree
    - To a moderate degree
    - To a great degree
    - All the time

11. I keep thinking about how badly I want the pain to stop.
    - Not at all
    - To a slight degree
    - To a moderate degree
    - To a great degree
    - All the time

12. There’s nothing I can do to reduce the intensity of the pain.
    - Not at all
    - To a slight degree
    - To a moderate degree
    - To a great degree
    - All the time

13. I wonder whether something serious may happen.
    - Not at all
    - To a slight degree
    - To a moderate degree
    - To a great degree
    - All the time
Appendix H: Multidimensional Scale of Perceived Social Support (MSPSS)

Instructions: Below are a list of statements that address issues of relationships with family, friends, and a significant other. Please read each statement carefully and decide how strongly that item describes your relationships. “1” indicates that you “very strongly disagree” and “7” indicates that you “very strongly agree” with each statement. This is not a test and there are no right or wrong answers.

1. There is a special person who is around when I am in need.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vary Strongly Disagree</td>
<td>Very Strongly Agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. There is a special person with whom I can share my joys and sorrows.

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<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
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</tbody>
</table>

3. My family really tries to help me.

<table>
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<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
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<td>Very Strongly Agree</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

4. I get the emotional help and support I need from my family.

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<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
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</tbody>
</table>

5. I have a special person who is a real source of comfort to me.

<table>
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<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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</tr>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

6. My friends really try to help me.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
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<td>Very Strongly Agree</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

7. I can count on my friends when things go wrong.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
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<td></td>
<td></td>
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</tbody>
</table>

8. I can talk about my problems with my family.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9. I have friends with whom I can share my joys and sorrows.

```
1  2  3  4  5  6  7
Very Strongly Disagree  Very Strongly Agree
```

10. There is a special person in my life who cares about my feelings.

```
1  2  3  4  5  6  7
Very Strongly Disagree  Very Strongly Agree
```

11. My family is willing to help me make decisions.

```
1  2  3  4  5  6  7
Very Strongly Disagree  Very Strongly Agree
```

12. I can talk about my problems with my friends.

```
1  2  3  4  5  6  7
Very Strongly Disagree  Very Strongly Agree
```