A Factor Analytic Study of Existing Pain Catastrophizing Items

by

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Abstract

Pain catastrophizing refers to an exaggerated negative mental set during the actual or anticipated experience of pain (Sullivan, Bishop, & Pivik, 1995). Interest in this construct, promising research findings, and greater attention to the role of psychological mechanisms in pain perception has led to a proliferation of self-report measures for assessing pain catastrophizing. Sullivan and colleagues' (1995) three-factor Pain Catastrophizing Scale (PCS) is the most widely employed today. However, currently the construct is somewhat vaguely defined, different measures utilize different conceptual models, and many similar constructs exist. Similar to Brenan, Clark, and Shaver (1998) we gathered all available measures tapping pain catastrophizing and similar constructs, eliminated a small number of clearly redundant items, and had a sample of respondents (who regularly experience pain) complete a questionnaire containing the items. Items reflecting resilience were also included in the final questionnaire. This 70-item questionnaire was administered via the crowdsourcing platform: Mechanical Turk. This approach allowed us to assess the stability of the three-factor solution proposed by the PCS, to explore alternative models, and to develop a new measure based on these findings.

Exploratory factor analyses (EFA) of just the items from the PCS did not yield a replication of the three-factor structure and instead found support for a one-factor model which accounted for 46.42% of the overall variance. EFA of the full item pool found support for a 45-item, five-factor model which accounted for 52.98% of the total variance and had no commonalities lower than 0.30. The following subscales were derived from this model: Catastrophizing, Disability, Resilience, Low Self-Efficacy, and Self-Directed Negative Affect.

Confirmatory factor analysis removed an additional seven redundant items. The five-factor model had adequate fit as the subscale and full model levels. The subscales were highly correlated with each other and had strong internal consistency. The seven-item Resilience subscale was dropped in favor of a four-factor model. The 31-item Negative Pain Cognitions Questionnaire (NPCQ) was derived from the four-factor model. The subscales of the NPCQ were sufficiently different to support a one-factor model of pain catastrophizing.

Keywords: Chronic Pain, Pain Catastrophizing, Negative Affect, Factor Analysis

Chapter I

Introduction

Pain is a subjective unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage (International Association for the Study of Pain [IASP], 2017). Acute instances of pain have adaptive significance. They warn of actual, potential, or perceived damage or harm. Chronic pain, however, is maladaptive. It continues excessively following the removal of the noxious stimulus. It generally lasts more than three to six months, and adversely affects the individual's well-being (Institute of Medicine (US) Committee on Advancing Pain Research, Care, and Education [IOM], 2011). The 2016 version of the National Health Interview Survey (NHIS) estimated that over 50 million adults within the United States experienced chronic pain (Dahlhamer, et al., 2018). Chronic pain has been estimated to have a collective economic strain of at least $500 billion dollars in annual medical costs and an unknown amount from indirect costs such as lack of productivity (Gaskin, & Richard, 2012). These numbers are expected to grow as the population of the United States increases and ages in the coming decades (IOM, 2011).

Chronic pain does not refer to one specific type of long-term pain. It is an umbrella term that encompasses different medical conditions and etiologies. Chronic pain can occur as a standalone condition or it can develop secondary to another condition or injury (including recovery from planned surgery). Given this diversity in manifestations, there is no standard treatment for chronic pain. Additionally, the condition can be challenging to diagnosis, especially for physicians who do not specialize in pain treatments. Two of the most common ports of entry into the nation's healthcare system are the emergency department and primary care, neither of which is ideally equipped for assessing and managing recurring pain (Marcus, & Venkat, 2015; Owen, et al., 2018). These obstacles alongside a scarcity of specialty care contribute to chronic pain being a major public health crisis.

Our understanding of chronic pain, and the obstacles involved in diagnosing and treating the condition, has grown considerably in the past 50 years. This has led to a more robust understanding of some of the physiological mechanisms involves in the development and maintenance of chronic pain. Nonetheless, much research is still needed to better understand the condition. One area receiving growing attention pertains to the psychological mechanisms involved in the pain experience (Edwards, Dworkin, Sullivan, Turk, & Wasan, 2016). Psychological researchers are becoming increasingly aware that the subjective experience of pain involves an interaction between physiology and psychology. Our perception of pain is, in part, constructed (Gatchel, Peng, Peters, Fuchs, & Turk, 2007). Thus, some individuals may internally represent various pain experiences different from others. For example, some individuals are known to ruminate on and catastrophize anticipated pain experiences and current pain experiences (Edwards, et al., 2016). The role of psychological mindset in the construction of the pain experience has clear implications for the treatment of pain (Gatchel, et al, 2007), and may be useful in highlighting individuals more and less at risk for developing problematic pain reactions.

The Pain Experience: Biological & Psychological Factors

Pain is not experienced or perceived in a universal manner; instead each individual experiences pain in a highly subjective fashion. The biopsychosocial model of pain postulates that pain is an illness that is shaped by biological, psychological, and social factors (Gatchel, et al., 2007). The biological contributions to pain are reasonably well known. The sensation of pain is known as “nociception.” It involves specialized afferent neurons (e.g. nociceptors, low-threshold mechanoreceptors) that are activated by a harmful stimulus. This activation initiates a cascade of neural activity within the central nervous system (Kuner, & Flor, 2017). Ascending neural pathways from the spinal cord enter the brain and branch off, synapsing with multiple neural structures, and ultimately forming a neural matrix that constructs pain perception (Kuner, & Flor, 2017). These structures process sensory-discriminative (e.g. location, intensity) and cognitive-affective (e.g. appraisal of harm, perceived control) qualities of pain (Wiech, 2016). Additionally, descending pathways from the brain have been linked to the modulation of nociception and pain relief (Wiech, 2016).

This neural network for perceiving pain include synapsing with a number of other networks that are not directly involved in the processing of pain signals; however, several of these networks are involved in shaping how pain is experienced. Today, there are several studies highlighting the role of social and psychological factors in pain experiences (Edwards, Dworkin, Sullivan, Turk, & Wasan, 2016). For example, major depressive disorder often manifests alongside somatic complaints (many of which are pain related), is predictive of future painful episodes, and is associated with higher rates of treatment failure in pain patients (Bair, Robinson, Katon, & Kroenke, 2003). Traumatic experiences in childhood place one at greater risk of developing chronic pain (Edwards, et al., 2016). For those disabled by their pain, perceptions of limited social support or receiving solicitous responses from others in response to pain is associated with worse physical functioning and greater pain intensity (Jensen, Moore, Bockow, Ehde, & Engel, 2011). Cognitive factors, including beliefs about pain, beliefs about one’s ability to manage pain experience, and a number of memory and attentional processes, also influence how one subjectively perceives pain. One important cognitive factor linked directly to pain experiences is pain catastrophizing.

Pain Catastrophizing

Pain catastrophizing is a commonly researched construct within the pain literature; however, it has been defined in various ways. Generally, it refers to an exaggerated negative mental set during the actual or anticipated experience of pain (Sullivan, Bishop, & Pivik, 1995). Specifically, it involves an overestimation of the intensity of the pain experience, an underestimation of one's capacity to tolerate and manage pain, lower thresholds for experiencing pain, greater sensitivity and attentional bias toward physiological indicators of pain, greater rumination about pain, heightened tension, or any combination of the aforementioned factors. In short, pain catastrophizing refers to a broad range of mechanisms that contribute to heightened pain sensitivity and more intense subjective pain experiences (Quartana, Campbell, & Edwards, 2009).

Accounts of the experience of pain catastrophizing date back as far back as the year 200 with the publication of Zhang Ji's medical book: *Jin Gui Yao Lue* which described a patient experiencing distressful thoughts, helplessness, and magnified responses in response to pain or stress (this condition was labeled "Zhong Zao") (as cited in Lueng, 2012). Investigation of catastrophic thought was popularized by Albert Ellis and Aaron Beck in their study of maladaptive cognitive styles in depressive and anxiety disorders (Quartana, Campbell, & Edwards, 2009). Ellis (1962) viewed the construct as an irrational idea involving excessive worry over things that are out of one's control which ultimately contributes to the manifestation of neurosis and should be combated by accepting one's situation and readjusting one's expectations. Beck described patient's tendency to catastrophize (i.e. excessive worry) as a type of negative cognitive distortion which characterize depressive schema (Beck, 1979; Flink, Boersma, & Linton, 2013). The construct began to popularize itself in the pain literature during the late 20th century and has since grown.

Pain catastrophizing has been linked with worse pain-related outcomes in individuals suffering from acute and/or chronic pain conditions. For example, *pain catastrophizers* (we use this term to refer to individuals who score high in this construct) are at greater risk for developing functional disability, ruminate more about pain, subjectively experience more intense pain, and report greater emotional distress about pain, compared to non-catastrophizers (Turk, Fillingim, Ohrbach, & Patel, 2016).

Pain catastrophizing does not stay in one's head. By altering individuals' experiences of pain, it affects their day-to-day emotional experiences (e.g., rumination), influences their treatment (e.g., longer hospitalizations), affects their behavior, alters risk for other medical conditions, and lowers overall levels of functioning. Pain catastrophizing has also been associated with the transition from acute to chronic pain following injury (one of most common precipitating factors of chronic pain), longer periods of hospitalization, and comorbid mood and anxiety disorders (Sullivan, 2009). Thus, pain catastrophizing appears to increase risk for chronic pain and to complicate pain treatment. Given these broad impacts, adjunctive treatments targeting the pain catastrophizing component of chronic pain have been developed and utilized conjointly with more traditional pain management approaches (IOM, 2011).

Interdisciplinary treatment regimens which involve addressing psychological factors (e.g. cognitive-behavioral therapies) alongside other therapies (e.g. opioid analgesia, physical therapy) have been demonstrated to reduce pain, functional disability, and medication use in chronic pain patients (Turk, Wilson, & Cahana, 2011; IOM, 2011). Effects of psychotherapy are not consistent across providers or patients, and sometimes degrade over time (Turk, et al., 2011).

Interest in the construct, promising research findings, and greater attention to the role of psychological mechanisms in pain perception has led to a proliferation of self-report measures for assessing pain catastrophizing. While advances have clearly been made through the utilization of these instruments, challenges to the field have also emerged. Currently, the construct is somewhat vaguely defined and it has been defined differently by different experts. Different definitions have led to differences to the content and structure of various self-report pain catastrophizing instruments. At present, different instruments suggest different models for understanding what pain catastrophizing phenomena is and how it works. Further, a number of closely related constructs have also emerged in the literature (e.g., pain avoidance, pain neuroticism, and pain anxiety). At this time, it is unclear if these are separate constructs from pain catastrophizing, overlapping or related, or if they are simply the same thing. One way to refine our understanding of pain catastrophizing would be to critically examine our current tools for measuring it. This approach has proved useful in other areas of psychology, such as in the field of intelligence (Keith, & Reynolds, 2010), personality (Norman, 1963), and adult attachment (Brennan, Clark, & Shaver, 1998).

Measuring Pain Catastrophizing

While several measures for assessing pain catastrophizing are available, Sullivan and colleagues' (1995) Pain Catastrophizing Scale (PCS) is the most widely employed today. Its use in research has persisted over two decades. It has been translated into multiple languages and has been adapted for use in multiple, specific respondent populations. The PCS is a 13-item, self-report scale which instructs participants to reflect on past painful experience and then rate thoughts and feelings for how frequently they occurred on a 5-point Likert scale. It is scored by summing item responses together and deriving a total score ranging from zero to 52 (Sullivan, 2009). The validity of the PCS has been demonstrated in several ways. For example, those experiencing pain who score between the 50^{th} and 75^{th} percentiles on the PCS are at moderate risk of developing chronicity and those who score higher have an even greater risk (Sullivan, 2009). The predictive validity of the PCS likely flows from the rigorous approach the authors took to developing the measures items.

The items for the PCS were developed based on key studies within the pain experience literature. When constructing the PCS, Sullivan, et al. (1995) incorporated key cognitive themes during item creation. These themes have been accepted by later researchers as the primary factors underlying the pain catastrophizing construct. While studying hypnotic analgesia, Spanos, Radtke-Bodorik, Ferguson, and Jones (1979) recognized that catastrophizers tended to have difficulty removing pain from their minds and expressed excessive fear and worry towards pain which, all together, led to no significant analgesia relative to non-catastrophizers. Thus, items tapping rumination and difficulty controlling pain-related worries were generated. Rosenstiel and Keefe (1983) recognized catastrophizing as an ineffective coping strategy associated with helplessness and negative thoughts. Thus, items assessing beliefs about pain tolerance, capacity to manage pain, and exacerbation (i.e., catastrophizing) of pain outcomes were generated. Finally, Chaves and Brown (1987) conceptualized catastrophizing as a negative thinking pattern associated with failure to identify situational anxiety, general apprehensiveness, helplessness, and an external locus of control. Thus, items designed to assess subjective sense of control over pain and pain-specific anxiety were generated. In sum, the PCS conceptualizes pain catastrophizing in excessive worry about pain (rumination), exaggeration of pain intensity and anticipation of “worst case” pain-related outcomes (magnification), and a perceived lack of efficacy for adaptively managing pain and related outcomes (helplessness).

Beyond the use of experts, Sullivan and colleagues subjected their measure to significant psychometric scrutiny, including principal component analysis (PCA). The initial PCA of the PCS preliminary item pool revealed a three-factor structure (i.e. Rumination, Magnification, Helplessness) (Sullivan, et al, 1995). Rumination referred to ruminative thoughts, worry, and an inability to inhibit pain-related thoughts; Magnification reflected magnification of the unpleasantness of pain situations and expectancies for negative outcomes; and Helplessness reflected the inability to deal with painful situations (Sullivan, et al., 1995). This solution mapped neatly onto Sullivan and colleagues’ theoretical model described in the paragraph above. While not uncommon in psychological studies, PCA, however, is not a true form of factor analysis, is limited for supporting theoretical models, and can have the disadvantage of being sample specific (Osborne, 2014). Further, PCA is known to reward scales for having overlapping, redundant items. Thus, while providing initial validation for the model and measure, these results alone were not sufficient to truly promote the three-factor model of pain catastrophizing.

Osman, et al. (1997) sought to replicate and extend Sullivan and colleagues’ initial study. This study made use of confirmatory factor analysis (CFA). Unlike PCA, CFA has the advantage of testing a pre-specified theory. It also provides a better estimation of scale and sub-scale unidimensionality. CFA is also better suited for studying a range of models to determine if items produce independent scales, inter-dependent subscales, and/or if factors load onto a higher-order (also referred to as second-order) factor (in which subfactors are assumed to contribute to an overarching higher-order factor). A final advantage of CFA is that it does not reward scales and subscales for redundant items. In fact, highly redundant items contribute to lower fit score estimates. Using a sample of 220 healthy undergraduates, Osman's CFA findings largely replicated the three-factor structure (with secondary loadings occurring in the strongest model fit) of the PCS.

The PCS is not the sole measure of pain catastrophizing available today. Other measures exist which measure pain catastrophizing or negative orientations towards pain. These measures have factor structures which differ from the three-dimensional PCS and include: the Pain Anxiety Symptoms Scale, the Illness Cognition Questionnaire, the Somatosensory Catastrophizing Scale, the Cognitive Evaluation Questionnaire, the Pain-Related Self-Statements Scale, and the Inventory of Negative Thoughts in Response to Pain. Furthermore, no single underlying theory of pain catastrophizing is supported within the literature. Hence, the conceptualization of these scales all differ, if only slightly.

Scale proliferation, and the resulting conceptual confusion that follows is not specific to pain catastrophizing. In 1987, Hazar and Shaver developed a groundbreaking three-factor self-report measure of adolescent and adult romantic attachment orientations (Brennan, Clark, & Shaver, 1998). The following years of the late 20^{th} century witnessed the production of *many* variant adult attachment scales. These scales all claimed to be measuring the same things but differed considerably in their content and ultimately created confusion in the field (Kurdek, 2002). Brennan, Clark, and Shaver (1998) addressed these inconsistencies by gathering all of the attachment measures, eliminating redundant items, gathering a large sample of respondents, and subjecting these responses to a factor analysis. They ultimately found evidence for a two-factor, four-cluster model, and selected items that best tapped those two factors. In this way, they both refined the theory and built a "gold standard" measure that became widely used.

In a similar fashion, the purpose of the following study was to explore the factor structure of pain catastrophizing. Similar to Brenan, Clark, and Shaver (1998) we gathered all available measures tapping pain catastrophizing, eliminated a small number of clearly redundant items, and had a sample of respondents (who regularly experience pain) complete all of the items. This approach allows us to assess the stability of the three-factor solution proposed by the PCS, to explore alternative models, and to develop a new measure based on these findings. Such a measure will aid in the development of a new model of pain catastrophizing for the future.

Chapter II

Methods

Scale Retrieval Procedure

To identify scales assessing pain catastrophizing and closely related constructs, a systematic search was done via the PsycTests database (circa January 2019). The search terms utilized were: “pain catastrophizing”, “catastrophizing”, “pain anxiety”, “fear of pain”, “pain avoidance”, “pain helplessness”, “pain magnification”, and “pain rumination”. Other search terms were utilized but failed to yield any unique scales for consideration. “Pain catastrophizing”, “catastrophizing”, and “pain anxiety” were used because they reflect catastrophizing directly. “Fear of pain” and “pain avoidance” reflect Lethem, Slade, Troup, and Bentley’s (1983) Fear-Avoidance Model of exaggerated pain perception in which pain catastrophizing plays a key role in. The final three terms represented one of the three factors found in Sullivan, Bishop, and Pivik’s (1995) Pain Catastrophizing Scale. These searches yielded a total of 367 non-unique scales (meaning that several scales appeared multiple times).

Scale Selection Criteria

In selecting scales for inclusion and exclusion, we considered several factors. Each scale was required to assess either a past painful experience or one’s general attitude towards pain. Given the interest in pain within a chronic pain population, scales were excluded if they were validated solely for use with acute pain populations or if their use with a chronic pain population would be inappropriate. Adaptations of scales that were tailored to fit a specific population (e.g., cluster headache) were also excluded. To be included, scales must have been validated for adults of any age. Scales validated solely for children or elderly were excluded. Scales were required to focus on the respondent's personal experience and were excluded if they assessed pain via proxy (e.g. an individual assessing their spouse's pain experience). In some cases, a scale contained subscale that reflected a component of pain catastrophizing, as defined by the Pain Catastrophizing Scale (Sullivan, Bishop, & Pivik, 1995). In these cases, we included the pain catastrophizing subscale only. Finally, a Likert or Likert-like scale for measurement was required for inclusion. Utilizing these selection criteria, the initial pool of scales was trimmed down to seven scales.

The seven scales yielded 198 items. Some items across scales were virtually identical in wording. Thus, to reduce redundancy, we selected one item and omitted the others. Some items were worded to be reverse-coded. Higher ratings on these reverse-coded items reflect some component of hopefulness, perseverance, self-efficacy, or active coping with regard to pain. We included these items as they were written. From the initial pool of 198 items, 62 were retained. An additional eight reverse-coded items were also included for a total of 70 items. To create the item pool, items were adjusted as needed into statements and for appropriate use in the evaluation of a past experience of pain not inherently associated with a specific condition (e.g. "symptoms" or "illness" replaced with "pain"). To see all of the items included, please see Appendix A.

Participant Recruitment

Participants were crowdsourced from Amazon's Mechanical Turk (MTurk) Marketplace with the Turk Prime service. Crowdsourcing allows for the quick recruitment of large samples from across the world. MTurk has not been used to directly explore the pain catastrophizing construct. It has, however, been used in studies evaluating the psychometric properties of scales

(Kamalou, Shaughnessy, Moscovitch, 2019; Rochefort, Baldwin, & Chmielewski, 2018). Additionally, MTurk has been used in the past to measure both pain and clinical populations (Tompkins, et al., 2017; Bartek, et al., 2017).

To qualify for the study all participants must have had an ongoing chronic pain condition that had lasted at least three months and have experienced more days than not during their present manifestation of chronic pain. Additionally, all participants were required to be over the age of 21, have the capability to provide informed consent without legal proxy, be fluent in English, and have been permanent citizens or residents of the United States of America for at least the past five years. A MTurk account was required to access the survey link and receive compensation. To recruit directly from MTurk a "human intelligence task" (HIT; MTurk's term for a study) advertised the study on the MTurk Marketplace. Recruitment began June 21st and closed July 22nd.

Participants

A total of 2,288 MTurk workers completed the screening questionnaire. Of this total, 576 (25.17%) successfully screened into the study; however, 108 participants had their data rejected for failure to accurately complete attention checks, because their responses were not aligned with the inclusion criteria (e.g., providing an age which did not fall within the previously selected age range) or failure to follow instructions (e.g., rating their average chronic pain intensity greater than their most intense flare-up of chronic pain). The final sample consisted of 459 participants (249 men, 209 women, and 1 intersex individual). The mean age was 38.31 years (*SD* = 11.84, range 21-73). Average chronic pain intensity was 5.55 (*SD* = 1.60) on a ten-point scale (10 = the worst pain). The average score for the most intense flareup was 7.86 (*SD* = 1.89, range: 3-10). With regard to ethnicity, 373 participants were White or Caucasian, 33 were

Black or African-American, 17 were Asian, 5 were American Indian or an Alaskan Native, 23 were mixed race, 4 were of Hispanic or Latin decent, and 4 participants did not identify their race. Regarding relational status, 151 participants were single, 101 were single, but in a long-term committed relationship, 167 were married, 38 had divorced and never remarried, and 2 had divorced and remarried. For a breakdown of the sample's demographic and health history distribution see Table 1.

Table 1.

Sample Demographic and Health History Distribution

	Total (*n* = 459)
Gender	
Male	249 (54.2%)
Female	209 (45.5%)
Intersex	1 (0.2%)
Race	
American Indian or Alaskan Native	5 (1.1%)
Asian	17 (3.7%)
Black or African American	33 (7.2%)
Hispanic or of Latin Decent	4 (0.9%)
White or Caucasian	373 (81.3%)
Mixed Race	23 (5.0%)
Not Reported	4 (0.9%)
Relationship Status	
Single	151 (32.9%)
Single, but in a committed long-term relationship	101 (22.0%)
Married	167 (36.4%)
Divorced, never remarried	38 (8.3%)
Divorced, remarried	2 (0.4%)
Employment Status	
Yes	370 (80.6%)
No	89 (19.4%)
Language Fluency	
English Only	425 (92.6%)
Multilingual	34 (7.4%)
Proximity to a Hospital	
Within 25 miles	447 (97.4%)
Not within 25 miles	12 (2.6%)
Exercise	

At least 30 minutes a day	283 (61.7%)
Less than 30 minutes a day	176 (38.3%)
Cardiovascular Disease	
Yes	52 (11.3%)
No	407 (88.7%)
Cancer	
Yes	6 (1.3%)
No	453 (98.7%)

Procedure

Participants with an MTurk worker account learned about the HIT's via the Mturk Marketplace. After reading a brief, IRB-approved study description, they could opt to click the "Accept & Work" button to begin the study. Once entering the study, participants were routed to a Qualtrics survey. All participants first reviewed a brief consent form informing them that they are going to complete some screening questions to determine if they are eligible for the study. Participants were advised that the questions were about their general health history and demographic information, required roughly four minutes to complete, that they may not screen in as eligible for the study, that there is no compensation for completing the screening measures, and that those who screen in for the study would be immediately routed to the formal study electronic consent form and survey. Participants who agreed to complete the online screening questions clicked on the button on the lower-left hand corner of their screen to continue to the questions. Those who did not consent to proceed further were asked to simply close their web browser. Participants who completed the screening questions, but did not screen in for the study were routed to a study screen thanking them for their time and informing them that they were not eligible for the study. Participants who screened out were asked to then close their web browser and received no compensation.

Participants who were eligible to participate were informed that they were eligible to continue and were taken to the full study electronic consent form. The electronic informed consent document explained the nature of the study, potential risks they may incur as a result of their participation, compensation to be received, limits of confidentiality, clarification that participation was optional and emphasized that no penalty would be given by the researchers. Participants were informed that they could stop the survey at any time; however, they were also informed that they must reach the end of the survey in order to obtain the study code to enter into MTurk for payment. Participants who were willing to consent to volunteer for the study were instructed to click the button located on the lower-left hand side of the screen and those who did not wish to continue were instructed to simply close their web browser.

Participants who consented then completed a demographic questionnaire. Following this, they were then administered an electronic version of the item pool. Item location was randomized across participants. The item pool instructed participants to reflect on a time they were in pain and then rate on a 5-point Likert scale to what frequency they made the self-statement when in pain. The scale ranged from "Strongly disagree" to "Strongly agree”. The item pool also contained three attention check questions. Participants were given one hour to complete the study.

Upon completion of the item pool, participants were provided with a code to submit to MTurk for the purpose of being compensated two United States dollars. Participants were informed that those who withdraw before reaching the end of the study, whose data is expected to be fraudulent, who do not complete at least 80% of the questions, who do not complete the study within one hour, or who do not qualify for the study will not be eligible for compensation. Upon reaching the end of the survey, participants were given a unique study completion code, randomly generated by Turk Prime, and were instructed to copy this study completion code and paste it into MTurk.

Amazon's Mechanical Turk (MTurk) and Turk Prime. MTurk is a crowdsourcing platform that has been growing in popularity over the years thanks to its large subject pool whose data is similar to those found in traditional setting (e.g. undergraduate samples), the convenience that online recruitment provides, and the relatively low cost for recruitment of large samples (Shapiro, Chandler, & Mueller, 2013). Its use in the behavioral and social sciences in particular is on the rise and it has been used to recruit thousands of pain patients (Bartek, et al., 2017). Participants who complete tasks on the platform are known as workers and they are typically compensated for completing Human Intelligence Tasks (HIT) (e.g. surveys) from requesters (e.g. experimenters).

Relative to the general United States population, MTurk workers are younger, more educated, more likely to be unemployed, more likely to be Caucasian and more likely to be in the middle class (Shapiro, Chandler, & Mueller, 2013). MTurk workers are also more likely to report levels of distress that are uncommon in the general population, as well as, greater rates of substance abuse, depression, trauma, and general anxiety (Shapiro, Chandler, & Mueller, 2013). The potential for false data is difficult to control for in general chronic pain research given the heterogeneity with which the condition may manifest and its vulnerability towards interpretation. The inability to ensure the accuracy of the data represents a major limitation of the study.

Turk Prime is a survey hosting platform which allows for recruitment from the MTurk Marketplace. This service provides extra protection for participants through the anonymizing of Worker ID's (the personal identifier of MTurk Workers) and blocking of IP address collection.

Measures

Screening Questionnaire. Participants were asked screening items to determine their eligibility for the study. Screening items requested participants disclose if they are fluent in English, how long they have been residing in the United States, if they have an ongoing chronic pain condition, and how long they how long they have had chronic pain. Masking questions were also included. The purpose of these questions is to keep eligibility requirements for the study reasonably disguised. These masking questions inquire about the presence of a cardiovascular disease, presence of cancer, proximity to a hospital, employment status, and engagement in daily exercise.

All participants were ruled ineligible for the study if they were not fluent in English, not an American citizen or permanent resident, have not been residing in the United States for the past five years, or were unable to legally consent for themselves. Participants were also ruled ineligible if they do not have a chronic pain condition, have had chronic pain for less than three months, or have not experienced pain more days than not during their current bout of chronic pain. For the purpose of this study, chronic pain was defined as pain that lasts for at least three months (IOM, 2011).

Demographic Questionnaire. This questionnaire asked participants to self-report both demographic and health-related information for the purposes of categorization. Demographic information collected included: biological sex, age, race, and current relationship status. Biological sex will be categorized as male, female, non-binary and other. Race options included: American Indian or Alaska Native, Asian, Black or African American, Middle-Eastern or Arab-American, Native Hawaiian or Other Pacific Islander, White or Caucasian, and other. A selection of "other" was accompanied by participants reporting any category they feel best describes their race or biological sex. Current relationship status fell into one of these categories:

single; single, but in a committed long-term relationship; married; divorced, never remarried; and divorced, remarried. Other health history included: location of chronic pain, type of chronic pain, adjectives used to describe the pain, average pain intensity since the onset of chronic pain, and worst chronic pain intensity experienced. Other health history for the nonchronic group included if they have experienced chronic pain before, when the most recent episode of chronic pain entered remission, the location of the past chronic pain, the type of chronic pain, adjectives used to describe the past pain, and the worst pain intensity ever experienced. Pain adjectives were categorized as: sharp, shooting pain; dull, aching pain; neuropathic pain; and muscular-skeletal pain. Pain intensity was assessed with a self-report, 11-point Likert scale wherein higher values are associated with more intense pain. A rating of '5' constitutes moderately intense pain, '0' constitutes no pain, and '10' constitutes one's worst imaginable pain.

Pain Catastrophizing Scale (PCS; Sullivan, Bishop, & Pivik, 1995). The PCS contains 13 items tapping pain catastrophizing. For the PCS, catastrophizing was defined as an exaggerated negative orientation toward noxious stimuli. The PCS instructs participants to reflect on past painful experiences and indicate the degree to which they experienced each of the 13 thoughts or feelings when experiencing pain on a 5-point scale from '0' ("not at all") to '4' ("all the time"). In addition to an overall score, it generates scores for three subscales: rumination (4 items), magnification (3 items), and helplessness (6 items). Rumination items described ruminative thoughts, worry, and an inability to inhibit pain-related thoughts. Magnification items reflected magnification of the unpleasantness of pain situations and expectancies for negative outcomes. Helplessness items reflected the inability to deal with painful situations. The PCS was validated as a self-report measure assessing catastrophizing in both clinical and nonclinical populations. All 13 items of the PCS were included in this study's questionnaire.

Using data obtained from an undergraduate sample ($n = 425$), principal components analysis with oblique rotation yielded a 3-factor solution with eigenvalues greater than 1. Scale items loaded negatively on helplessness, wherein higher items on the scale indicated lower levels of helplessness. Rumination was highly correlated to helplessness ($r = -0.50$) and moderately correlated to magnification ($r = 0.32$). Helplessness was moderately correlated with magnification ($r = -0.30$). Internal consistency analysis revealed coefficient alphas of 0.87, 0.60, and 0.79 for the rumination, magnification, and helplessness subscales, respectively. Coefficient alpha for the PCS as a whole was 0.87. Test-retest correlations for the PCS on a chronic pain population ($n = 40$) indicated a high degree of stability across a 6-week period, $r = .75$, $p < .001$. Assessment of construct discriminative validity was done via correlations with the Beck Depression Inventory ($r = .26$, $p < .05$), the State-Trait Anxiety Inventory ($r = .32$, $p < .05$), the Positive Affect-Negative Affect Scale (r - .32, $p < .05$), and the Fear of Pain Questionnaire ($r = .80$, $p < .001$). A significant multiple correlation was obtained, $r = .47$, $p < .001$. Examination of the semi-partial correlations revealed that only the PCS contributed unique variance to the prediction of pain, F (1, 56) = 5.4, $p <.001$.

The Pain Anxiety Symptoms Scale (PASS; McCracken, Zayfert, & Gross, 1992). The PASS is a 53-item self-report measure of the fear of pain. It was developed to better categorize patients' pain-related anxiety and understand how anxiety responses influence the experience of pain. It is comprised of these four subscales: Somatic Anxiety (14 items), Cognitive Anxiety (10 items), Fear of Pain (14 items), and Escape and Avoidance (15 items). Each item of the measure is comprised of a behavior related to pain. PASS' scale instructs participants to rate the frequency of occurrence of each behavior on a six-point scale wherein a '0' indicates the behavior never occurs and a '5' indicates the behavior always occurs. Eight items from the PASS were included in the item pool. Four items from the Cognitive Anxiety and four items from the Fear of Pain subscales were included in the item pool.

A sample of 104 outpatients from a multidisciplinary pain management center was used to validate PASS. Validity was assessed as part of a comprehensive pain assessment procedure in which other measures relevant to the experience of pain were administered. All four subscales showed good internal consistencies with Cronbach's alpha values of 0.89 for Somatic Anxiety, 0.87 for Cognitive Anxiety, 0.85 for Fear of Pain, and 0.81 for Escape and Avoidance. The internal consistency analysis for the scale as a while yielded an alpha value of 0.94.

The Illness Cognition Questionnaire (ICQ; Evers, Kraaimaat, Lankveld, Jongen, Jacobs, & Bijlsma 2001). The ICQ is a self-report measure meant to assess three different cognitions related to appraisals of one's illness. It was developed to better understand how cognitions impact adjustment outcomes in individuals with chronic diseases. ICQ is comprised of these three subscales: Helplessness, Acceptance, and Perceived Benefits. Each subscale is comprised of six items that tap one's cognitions. ICQ's scale instructs participants to rate how much they agree the cognition accurately represents their long-term illness experience on a four-point scale wherein a '1' indicates the cognition is "not at all" accurate and a '4' indicates the cognition is "completely" accurate. Four of the 18 total items were chosen for this study's item pool; all four of these items were from the helplessness subscale.

A sample of 263 outpatients with rheumatoid arthritis (RA) and 167 patients with multiple sclerosis was used to validate ICQ. A principal components factor analysis with oblique rotation was done in the RA sample. A three-factor solution with eigenvalues that exceeded 1 accounted for 62% of the total variance. All of the items showed good internal consistency with Cronbach's alphas ranging from 0.84 to 0.91 in the samples. A three-factor confirmatory factor analysis with the MS population was done. The oblique model showed good internal consistency: χ^2 (132, N = 167) = 230.91, p < .001. The fit indices values were: comparative fit index = 0.94; Tucker-Lewis Index = 0.93; incremental goodness-of-fit index = 0.94.

The Somatosensory Catastrophizing Scale (SSCS; Seto, & Nakao, 2017). In light of somatosensory amplification (i.e. tendency to adversely experience and ruminate on strong bodily sensations) being understudied in the domain of catastrophizing, the SSCS was developed to assess the relationship between somatosensory catastrophizing and general physical symptoms. It consists of five factors: attention to bodily symptoms (attention), obstacles in daily life (obstacles), concern about serious disease (concern), feeling helpless to do anything about the symptoms (helpless), and hopelessness. The SSCS utilizes a 5-point Likert scale ranging from '1' "Strongly disagree" to '5' "Strongly agree.". It instructs participants to rate a series of statements for how accurate the statement depicts their cognitions regarding their thoughts and feelings about subjective body sensations and physical symptoms. Seven out of a total of 27 items were chosen for this study's item pool.

A sample of 158 university students were used to test the validity of the SSCS. Attention, obstacles, and concern had Cronbach's alphas greater than 0.90 and helpless, and hopelessness had Cronbach's alphas greater than 0.85. Concurrent validity was demonstrated with strong correlations with the PCS (r = 0.76, p < 0.01) and the Short Health Anxiety Inventory (r = 0.61, p < 0.01). Four items from the helpless factor, two from the attention, and one from the concern factor were chosen for the item pool. No items were chosen from the obstacle factor because intrusion on one's daily life were represented with items from other scales. No items were chosen from the hopelessness scale for ethical considerations.

The Cognitive Evaluation Questionnaire (CEQ; Philips, 1989). The CEQ was developed to better understand different types of cognitions related to the experience of chronic pain. The questionnaire consists of 48 statements that were adapted from Bakal's (1982) Bakal Headache Questionnaire for use with a general chronic pain population. Each statement requires reflection of one's thoughts, feelings, and/or attitudes that result from the experience of pain. The CEQ utilizes a four-point Likert-like scale wherein a response of "0" indicates that the cognition was not at all likely to occur during a period of severe pain and a response of "3" indicates that the cognition was very much likely to occur. Sixteen out of a total of 48 items were chosen for the item pool.

Using a sample of 127 chronic pain patients, an exploratory cluster analysis yielded a seven-cluster solution. These clusters were labeled: positive coping, desire to withdraw, disappointment with self, causal rumination, helplessness, concern, and emotional reactivity. Unlike the other six clusters, the positive coping cluster contains statements which involve therapeutic reactions to pain. The positive coping cluster is weekly correlated with the other clusters which all involve maladaptive reactions to pain. The six maladaptive clusters are all moderately to strongly intercorrelated (*r* values ranging from 0.38 to 0.62). The disappointment with self and helplessness clusters, however, were only moderately related ($r = 0.28$). Regarding the item pool, items from the desire to withdraw (1), disappointment with self (5), helplessness (3), and concern (7) clusters were included.

The Pain-Related Self-Statements Scale (PRSS; Flor, Behle, & Birbaumer. 1993). PRSS is an 18 item self-report measure of cognitions that either attempt to promote or hinder attempts of coping with one's pain. PRSS was developed to better further our understanding of how self-statements guide behavior (e.g. negative self-statements lead to more pain and interference). The measure consists of two, nine-item subscales: Catastrophizing and Coping. PRSS's scale instructs participants to rate on a 6-point scale, how often a statement entered their minds when they experienced severe pain ('0' = "almost never", '5' = "almost always"). Seven items from the PRSS were included in this study's item pool. With the exception of two item (which were redundant with items from others scales), all items from the PRSS Catastrophizing scale were included in the item pool.

120 chronic pain patients validated the PRSS. Exploratory factor analysis yielded the two subscales. Factor loading exceeded 0.50 for all scale items. The Catastrophizing subscale explained 45% of the total variance and the Coping subscale explained 30%. The subscales had strong internal consistency: $\alpha = 0.92$ for Catastrophizing and $\alpha = 0.88$ for Coping.

Inventory of Negative Thoughts in Response to Pain (INTRP; Gil, Williams, Keefe, & Beckham, 1990). The INTPR is a 21-item self-report measure of the frequency of one's negative thoughts during a flareup of pain. It was developed to provide a better understanding of how negative cognitions lead to worse health-related outcomes in patients with recurrent pain (e.g. greater pain and psychological distress). It is composed of these three subscales: Negative Self-Statements (11 items), Negative Social Cognitions (7 items), and Self-Blame (4 items). Each item of the INTRP is a negative self-statement that reflected statements obtained during clinical interviews of pain patients. The INTRP instructs participants to indicate how frequently they have each negative thought during a flare-up of pain on a 5-point Likert-like scale wherein a '1' indicates "Never" and a '5' indicates "Always". Eight items from the INTPR were included in the item pool; all were from the Negative Self-Statements subscale.

185 chronic pain patients were used to validate the INTPR. The INTPR was administered as part of a comprehensive pain assessment. Factor analysis of INTPR items yielded factor loadings as low as 0.39 and as high as 0.85. Negative Self-Statements accounted for 50% of the common variance, Negative Social Cognitions accounted for 30% of the common variance, and Self-Blame accounted for 20% of the common variance. The three scales showed good internal consistency with Cronbach's alphas of 0.91 for Negative Self-Statements, 0.82 for Negative Social Cognitions, and 0.72 for Self-Blame.

Pain Resilience Scale (PRS; Slepian, Ankawi, Himawan, & France, 2016). The PRS is a 14-item self-report measure of one's resilience to pain (i.e. their ability to maintain functioning during pain). It was developed in light of recent research which demonstrate that resilience is protective of worse pain outcomes and a lack of pain-specific resilience measures. It is composed of two subscales: Behavioral Perseverance (5 items) and Cognitive/Affective Positivity (9 items). The PRS instructs participants to read a series of statements and rate how well a statement described how they would respond to intense or prolonged pain a 5-point Likert-like scale wherein a '0' indicates "not at all" and a '4' indicates "to a great degree". Two items from the Behavioral Perseverance and four from the Cognitive/Affective Positivity subscales from included in the item pool.

936 undergraduate students were used to validate the PRS. Using principal components analysis, a 2-factor solution was retained for the final version of the PRS. Behavioral Perseverance accounted for 5.17% of the variance and Cognitive/Affective Positivity accounted for 43.69% of the variance. The correlation between the two factors was $r = 0.68$. The internal consistencies of the Behavioral Perseverance and Cognitive/Affective Positivity subscales were $\alpha = 0.88$ and $\alpha = 0.91$, respectively.

The Pain Self-Efficacy Questionnaire-2 (PSEQ-2; Bot, Nota, & Ring, 2013). The PSEQ-2 is an abbreviated version of the Pain Self-Efficacy Questionnaire (PSEQ). It is comprised of 2 self-report items which measure the influence pain has on one's confidence to perform tasks. The original PSEQ was comprised of 10 items and displayed strong internal consistency ($\alpha = 0.92$). However, its length in combination with other measures can lead to lengthy intakes for patients. The PSEQ-2 instructs participants to rate how confident they feel two statements reflect their resilience towards pain on a 10-point scale. Both items of the PSEQ-2 were chosen for the item pool.

316 English-speaking adults were used to validate the PSEQ-2. All participants were administered the PSEQ. The two items chosen had strong inter-item correlations and their inclusion did not result in a decrease in overall variation. The PSEQ-2 showed good internal consistency with a Cronbach's alpha of 0.90.

Chapter III

Results

Exploratory Factor Analysis - Assumptions

Data analysis was conducted with IBM's Statistical Software Package for the Social Sciences (SPSS; IBM Corp., 2017). Exploratory factor analysis (EFA) with primary axis factoring (PAF) and an oblique rotation (i.e. Direct Oblimin) was the method used examine the underlying factor structure of the item pool and the PCS. The data met the basic assumptions of EFA. Bartlett's Test of Sphericity yielded a significant value: χ^2 (2415) = 19645.875, p < .001. The Kaiser-Maier-Olkin Measure of Sampling Adequacy value was 0.963. The diagonal of the anti-image coefficient correlations ranged from 0.808 to 0.978. Every item had a correlation of 0.30 or higher with at least one other item and no item had a correlation with another variable that was higher than 0.70. The data were multicollinear (determinant = 1.025×10^{-20}). This was, however, to be expected because, as items were selected from scales of similar constructs and thus were expected to be highly correlated with one another. PAF was chosen as the factor extraction technique because of its acceptability for data which has does not have multivariate normality (Yong, & Pearce, 2013). An oblique rotation method was chosen because the factors are expected to be correlated with one another. In fact, we anticipated that factors would be inter-dependent (as opposed to orthogonal [i.e. independent]).

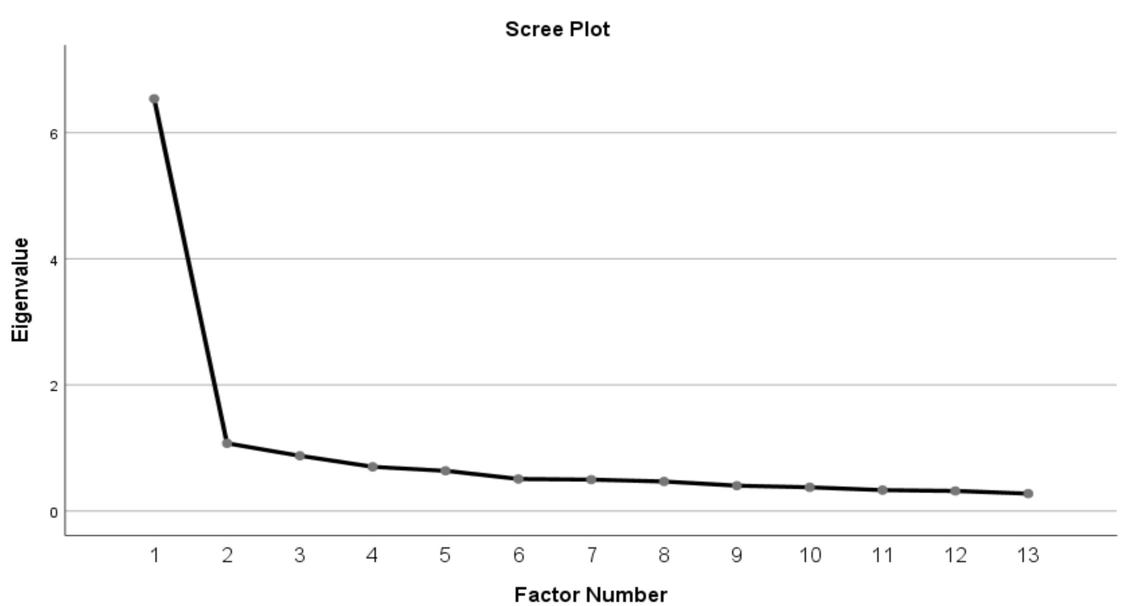
Exploratory Factor Analysis - PCS

Using the "process" scripts provided by O'Connor (2000) for SPSS, Horn's parallel analysis (PA) and Velicer's minimum average partial (MAP) test were conducted. The PA suggested that the data contained 4 factors and the MAP test suggested the data contained 1 factor. These results suggested that the PCS is unidimensional. Consistent with recommendations provided by Osborne (2014), who recommends using PA and the MAP test as an initial starting point but ultimately exploring models within plus three and minus three of the number suggested, we explored seven models ranging from a one-factor model to a seven-factor model.

Models were rejected if they failed to achieve simple structure. The criteria for determining simple structure is 1) every item should show a primary loading equal to or greater than 0.40 and 2) no items should have cross-loadings within an absolute value of 0.20 of the item's primary loading. The only model which achieved simple structure was the one-factor model. This model accounted for 46.42% of the total variance. The one-factor model is supported by the scree plot found in Figure 1.

Figure 1.

Eigenvalue Scree Plot for the One-Factor Model



Exploratory Factor Analysis - Full Item Pool

Using the "process" scripts provided by O'Connor (2000) for SPSS, PA and MAP test were conducted. The original PA suggested that the data contained 9 factors and the MAP test suggested the data contained 7 factors. These results suggested that pain catastrophizing is more complex than the three-factor solution the PCS proposes or (more likely), with multiple constructs being assessed within the scale. Consistent with recommendations provided by Osborne (2014), who recommends using PA and the MAP test as an initial starting point but ultimately exploring models within plus three and minus three of the number suggested, we explored multiple models. We also explored a three factor model, given the PCS's original theory.

The three-factor model clearly did not fit the data well. It accounted for an insufficient amount of variance (i.e. < 50%), resulted in many items have poor communalities, and produced a pattern matrix with numerous cross-loading and poorly loading items. As such, we abandoned this model.

While exploring a four-factor model, an additional hypothesized factor beyond that suggested by the PCS's original theory emerged. This factor was composed almost entirely of the reverse-coded items. An analysis of this model's commonalities found that six items had a loading less than 0.30. We quickly examined additional models and found that these items continued to have poor communalities even at higher factor numbers. Thus, these items were eliminated bringing the scale down from 70 items to 64.

Next, we re-ran the four models in ascending order. The three-factor, four-factor, five-factor, and seven-factor models accounted for 45.90%, 48.30%, 50.44%, and 53.55% of the total variance, respectively (though not reported, we later examined models containing six factors, eight factors, and a nine factors, but these all produced a pattern matrix that was far from simple in composition [these models are available from the author upon request]). We then looked across all models to further reduce the item pool. Items were eliminated if they prevented each of the four tested models from achieving simple structure. The criteria for determining simple structure is 1) every item should show a primary loading equal to or greater than 0.40 and 2) no items should have cross-loadings within an absolute value of 0.20 of the item's primary loading. Using this method, 16 items were eliminated bringing the scale down to 48 total items.

With this reduced item total, the four-factor model was revisited. Item reduction resulted in a model which accounted for 49.55% of the total variance. However, a simple structure was not obtained. Multiple variables had commonalities with a loading less than 0.30. The eigenvalue scree plot produced by the four-factor model also suggested the presence of six factors. Hence, a six-factor model was tested. This model explained 51.12% of the variance and contained no commonalities with a loading less than 0.30. Using the same simple structure exclusion criteria mentioned previously, two items was eliminated from the scale bringing the scale down to 46 items.

Now, both the four-factor and the six-factor models were retested. They explained 47.28% and 52.27% of the total variance, respectively. The six-factor model had no commonalities lower than 0.30 and the four-factor model had three commonalities lower than 0.30. However, analysis of the pattern matrix of both models yielded inconsistent results. With the exception of two items who had problematic cross-loadings for both models, six items achieved a sufficient primary loading with no problematic cross-loadings in one model, but not the other.

A five-factor model resolved these inconsistencies. The model generated a simple structure. Additionally, one of the two items which had shown problematic cross-loadings in other models, did not have any problematic cross-loadings in the five-factor model. The remaining item still had problematic cross-loadings and was subsequently eliminated. This elimination brought the scale down to 45 items.

The model was then re-examined with 45-items. The 45-item five factor model accounted for 52.98% of the total variance and had no commonalities lower than 0.30. The model achieved a simple structure. The scree plot supported the presence of five factors within this model. In light of this, the five-factor model was retained and can be viewed within Table 2. The factors were labeled as follows: Catastrophizing, Disability, Resilience, Low Efficacy, and Self-Directed Negative Affect. Catastrophizing contained the most items with a total of 21. Disability and Resilience contained seven items each. Finally, Low Efficacy and Self-Directed Negative Affect contained five items each. Of note, the Resilience items are reverse coded. In other words, these items are all worded to indicate that a person feels confident in their ability to manage pain and resulting complications adaptively.

Table 2.

Five-Factor Model Pattern Matrix

		Factor				
#	Question	Catastrophizing	Disability	Resilience	Low Self-Efficacy	Self-Directed Negativ e Affect
1	When I'm in pain, I keep thinking about how badly I want the pain to stop.	0.776				

2	When I'm in pain, I anxiously want the pain to go away.	0.714			
3	When I'm in pain, I can't seem to keep it out of my mind.	0.715			
4	When I'm in pain, I keep thinking about how much it hurts.	0.797			
6	When I'm in pain, I become afraid that the pain may get worse.	0.625			
9	When I'm in pain, it's terrible and I think it's never going to get any better.	0.553			
10	When I'm in pain, I worry all the time about whether the pain will end.	0.672			
11	When I'm in pain, it's awful and I feel that it overwhelms me.	0.737			
12	When I'm in pain, I feel I can't stand it anymore.	0.720			
15	I am bothered by unwanted	0.512			-0.223

	thoughts when I'm in pain.				
16	My thoughts are agitated and keyed up as pain approaches.	0.638			
17	I worry when I am in pain.	0.569			-0.247
19	I dread feeling pain.	0.613			
27	I repeatedly confirm the degree of pain I am experiencing.	0.516			
31	My pain makes me feel useless at times.	0.450			
39	I am thinking, Why me. Why do I always feel pain?	0.541			
43	How am I going to concentrate with this awful pain?	0.582			
44	It's so hard to work with pain.	0.586			
48	I cannot stand pain.	0.572			
53	The pain gets to me.	0.616			
54	The pain drives me crazy.	0.658			
29	My pain limits me in everything that is		-0.447		

	important to me.		
55	Because of my pain, other people will have to do everything for me.	-0.789	
56	Because of my pain, I won't be able to do anything.	-0.584	
58	Because of my pain, my family will have to take over all of my responsibilities.	-0.836	
59	Because of my pain, I am going to become an invalid.	-0.586	
60	Because of my pain, I won't be able to do anything for others.	-0.636	
61	Because of my pain, I will become a burden on my family.	-0.589	
63	I believe I can push through my pain.		0.587
64	I believe I will accomplish my goals in spite of my pain		0.817
65	I can focus on positive		0.516

	thoughts to manage pain.				
66	My pain will not affect my happiness.		0.538		
67	I will be able to keep a hopeful attitude despite my pain.		0.733		
69	I will still accomplish most of my goals in life, despite the pain.		0.804		
70	I will live a normal lifestyle, despite the pain.		0.652		
13	When I'm in pain, there is nothing I can do to reduce the intensity of the pain.			0.581	
22	I feel that I can not control the pain.			0.536	
24	I feel that the pain will not get better no matter what I do.			0.605	
49	I cannot change the pain.			0.766	
51	My pain will never stop.			0.484	
35	I am afraid of what people think about my pain.	-0.245			-0.435

37	I feel guilty about having pain episodes.		-0.692
38	I am angry with myself for being in pain.		-0.729
39	I am disappointed with myself for having another bout of pain.		-0.692
58	My pain makes me think "I am worthless."	-0.205	-0.524

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

Confirmatory Factor Analysis – Item Reduction for the Catastrophizing Subscale

Data analysis was conducted with IBM's SPSS - Analysis of Moment Structures (AMOS 22; IBM Corp., 2017). Confirmatory factor analysis (CFA) was initially used to identify any possible redundant item pairs within the catastrophizing factor so that the number of items for this subscale could be reduced.

CFA was conducted using maximum likelihood estimation was used to identify item pairs with highly correlated error terms and remove redundancy from the factors. As suggested by Byrne (2016), modification indices (MI) exceeding 10 are typically indicative of items with highly correlated error terms. In most cases, this can indicate item content redundancy. We initially ran the CFA using all of the items from the Catastrophizing subscale, and examined MIs for the items. We then examined the highest MI (that was above 10), examined the item content for this pair. When item content was redundant, we opted to remove one of the redundant items and then we repeated the procedure again. We only removed items when both the MI was >10 and the item content was clearly redundant (which was the case in seven of the eight comparisons). This approach resulted in the removal of seven items from this subscale.

Confirmatory Factor Analysis – Model Fit at the Subscale level.

We next used CFA to examine model fit. We first examined each individual factor (i.e. subscale) by assigning all items from that subscale to load on a single factor. We used the following indicators to evaluate model fit: Comparative Fit Index (CFI), the Tucker Lewis index (TLI), the Root mean square error of approximation (RMSEA), and the 90 confidence interval for RMSEA. Scores of < .90 for CFI indicate a poorly fitting model, while those between .90 and .95 indicate adequate fit, and those > .95 indicate good fit (Siefert, et al., 2018). TLI values greater than or equal to .95 suggest good fit (Byrne, 2016). Regarding RMSEA, values greater than .10 indicate poor fit, those between .09 and .05 suggest adequate fit, and those less than .05 suggest good fit (Byrne, 2016). Narrow RMSEA confidence intervals indicate better precision and upper bound values less than .06 indicate good fit for the 90% interval (Byrne, 2016). We also report the overall Chi-Square value for the models, noting that in psychological research with larger samples it is quite common for these to be statistically significant. This is why preference was shown to CFI, NNFI, and RMSEA, as these indicators are the ones most routinely used in psychological research and test development to determine model fit (Byrne, 2016; Siefert et al., 2018).

Fit statistics for the 14-item Catastrophizing subscale suggested good fit, χ^2 (77) = 180.444, p < .001; CFI = 0.968; TLI = 0.962; RMSEA = 0.054 [90% CI = 0.044, 0.065]. Thus, this model was retained "as is," with no revisions.

Examination of the CFA for the Disability subscale produced one pair of items with an MI of 19.519. However, after examining the item content of these items we did not feel it was appropriate to allow their error terms to correlate because the contents of the items were determined to be sufficiently different (i.e. "Because of my pain, I won't be able to do anything.", and "Because of my pain, I won't be able to do anything for others."). Additionally, fit statistics for the Disability scale were quite strong: χ^2 (13) = 29.032, p = .006; CFI = 0.991; TLI = 0.986; RMSEA = 0.052 [90% CI = 0.026, 0.078].

The CFAs for the Low Efficacy and Self-Directed Negative Affect subscales produced no highly correlated pairs. Fit statistics for the Low Self-Efficacy subscale ranged from adequate to good: χ^2 (5) = 20.653, p = .001; CFI = 0.976; TLI = 0.951; RMSEA = 0.083 [90% CI = 0.048, 0.122]. Fit statistics for the Self-Directed Negative Affect subscale yielded ranged from adequate to good: χ^2 (5) = 17.936, p = .003; CFI = 0.988; TLI = 0.975; RMSEA = 0.075 [90% CI = 0.040, 0.115].

Confirmatory Factor Analysis – Model Fit at the Full Model level.

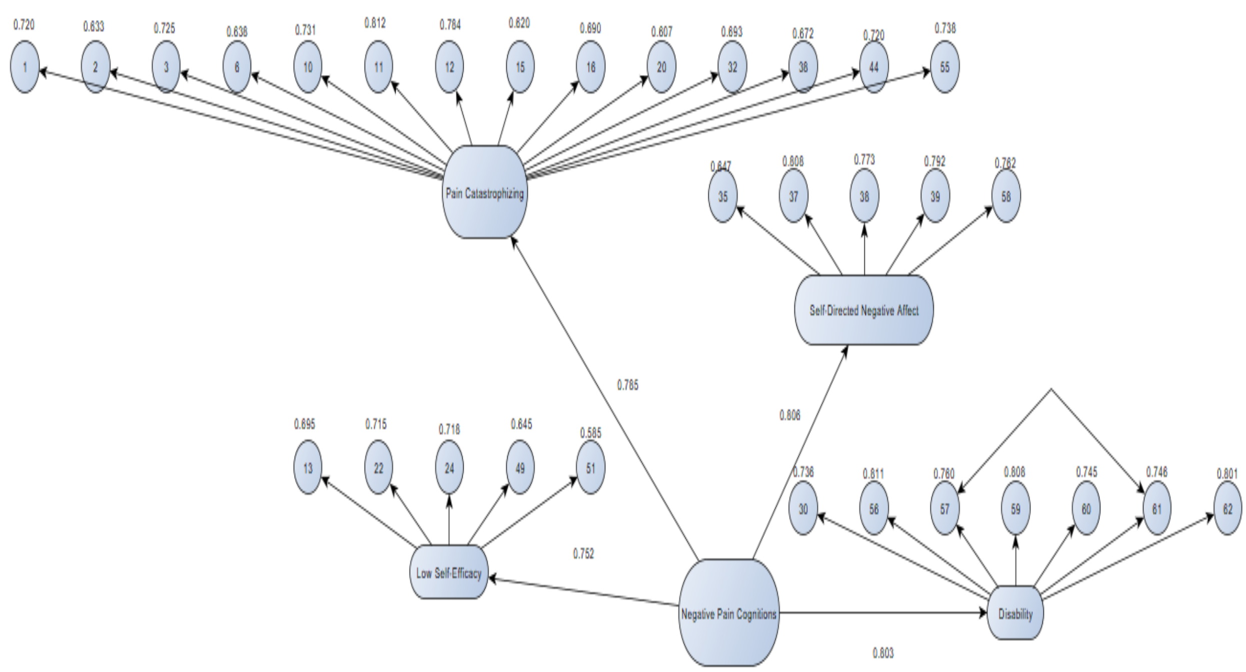
Because it is possible for each subscale to produce a good model fit without the entire model producing adequate fit, we conducted a series of CFAs at the full model level. We compared two models: a four factor model (in which all items were assigned to their respective factor and each factor was allowed to correlate with the other three factors) and a second-order factor model (in which all items were assigned to their respective factor and each factor was assigned to a global factor). In both models, we used the version of the disability factor in which one pair of items was specified to have correlating error terms.

Of note, neither model included the Resiliency subscale. There were two reasons for this. First, at this time, it was unclear if this factor "breaks out" solely due to the fact that items are reverse coded or because it actually represents a different construct. Second, while there may be benefits to including a subscale in a measure intended to capture psychological processes related to the exacerbation of pain and pain-related complications, it seemed unlikely a scale tapping resiliency would be useful to this end. While items could be reverse coded, they could also be re-written to capture the opposing end of the spectrum (rather than capturing resiliency as they do now).

Taken all together, the fully correlated model yielded an adequate fit: χ^2 (427) = 929.495, p < .001; CFI = 0.935; TLI = 0.930; RMSEA = 0.051 [90% CI = 0.046, 0.055]. Analysis of the second-order factor also yielded an adequate fit χ^2 (5) = 942.344, p < .001; CFI = 0.934; TLI = 0.928; RMSEA = 0.051 [90% CI = 0.047, 0.056]. For a visual of this model, see Figure 2. These results failed to indicate that one model was significantly better at explaining the data than the other. Both, however, supported a 31-item, four-factor model in which subscales are all centered on a negative mental set directed towards the anticipation of or actual experience of pain.

Figure 2.

Visual Representation of the Second-Order Factor Model



Fixed Factor Analysis

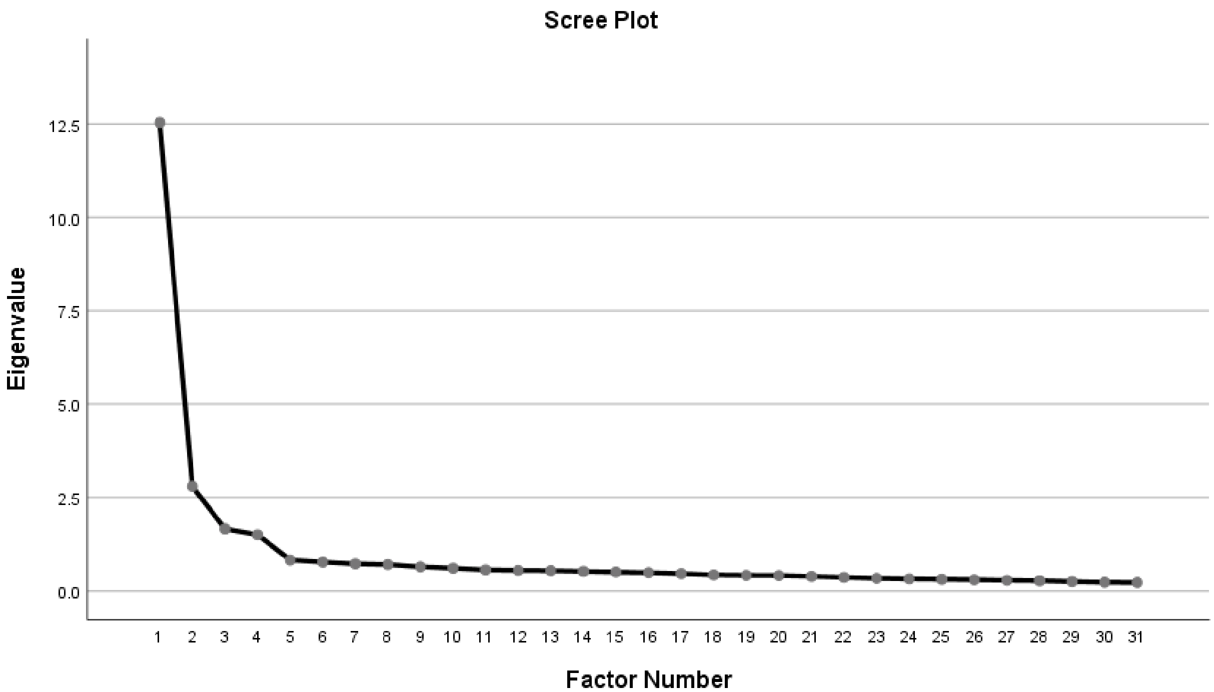
Finally, a fixed factor analysis (with the final item pool and using the same EFA approach as described above) was conducted on the final four-factor model. Commonalities ranged from 0.341 to 0.691. A simple factor structure was achieved. The four-factor model is supported by the scree plot found in Figure 3.

Correlations among the four subscales were examined by generating scores for each subscale by averaging all items loading onto that subscale. Overall, the subscales were correlated to a fairly large degree, but not to a degree that would suggest that they measure precisely the same thing. Catastrophizing was correlated with Disability ($r = 0.578$, Low Self-Efficacy ($r = 0.608$) and Self-Directed Negative Affect ($r = 0.570$) scales. Disability was correlated with Low Self-Efficacy ($r = 0.643$) and Self-Directed Negative Affect (r = 0.0.631). Finally, Low Self-Efficacy was correlated with the Self-Directed Negative Affect ($r = 0.554$) factor.

Each subscale proved internally consistent. Coefficient alphas for Catastrophizing ($\alpha = 0.93$), Disability ($\alpha = 0.90$), Low Self-Efficacy ($\alpha = 0.80$), and Self-Directed Negative Affect ($\alpha = 0.87$) were all in the acceptable range. Additionally, alpha for the global score (based on the average of all items) was also internally consistent ($\alpha = 0.95$) with corrected item-to-scale correlations ranging from 0.41 to 0.71.

Figure 3.

Eigenvalue Scree Plot for the Four-Factor Model



Chapter IV

Discussion

Pain catastrophizing is defined as an exaggerated negative mental set in response to actual or anticipated experiences of pain (Sullivan, et al., 1995). The most widely used measure of pain catastrophizing is the PCS. The PCS conceptualizes the construct through a three-factor model consisting of: Rumination - ruminative thoughts, worry, and an inability to inhibit pain-related thoughts; Magnification - magnification of the unpleasantness of pain situations and expectancies for negative outcomes; and Helplessness - the inability to deal with painful situations (Sullivan, et al., 1995).

Some prior studies using PCA have provided soft support for this model (Osman, et al., 1997; Sullivan, 2009). The present study, which employed a larger sample than most of these studies, included items from several validated scales, and utilized a more rigorous EFA approach, however, did not support this precise model. Instead a four-factor model emerged with the following subscales: Catastrophizing, Disability, Self-Directed Negative Affect, and Low Self-Efficacy was supported. The Catastrophizing subscale measures the extent one is likely to exaggerate the negative consequences of actual or anticipated pain. In many ways it represents the narrowest conceptualization of pain catastrophizing; specifically, the rumination on and anticipation of "worst-case" scenarios related to the experience of pain and pain-related consequences. The Disability subscale measures the extent one is likely to view themselves as disabled. The Self-Directed Negative Affect subscale measure the extent on is likely to direct negative affect towards themselves. Finally, the Low Self-Efficacy subscale measure the extent one is likely to view their pain as being out of their control. In addition, a fifth factor emerged, Resilience, composed entirely of reverse coded items involving beliefs that one can overcome and manage pain.

These four subscales all correlated strongly with each other, suggesting the presence of an underlying factor. CFA largely confirmed this, with a second-order factor model adequately representing the data. Reflecting this pattern of findings, we named our final scale *the Negative Pain Cognitions Questionnaire* (NPCQ). For a complete list of all items included in the NPCQ, their scale and subscale of origin, and their item numbers, refer to Appendix B. For a list of all items included in the Resilience subscale, their subscale of origin, and their item numbers, refer to Appendix C.

While all of the aforementioned subscales clearly tap a construct involved in a negative mental set towards pain, the management of pain, the consequences of pain, and the ability to control pain, a fifth factor also emerged. Specifically, a Resilience factor was found, but not included within the final model. This factor was not included because it is unclear how reverse-scored construct would fit within the model. The Resilience subscale is made up of items relating to self-efficacy or positivity. A case can be made that one's belief in their ability to persevere serves as a foil to the pessimistic attitude presented by the other subscales. However, the focus of this investigation was on negative cognitive factors. Given the limited number (i.e. eight) of included items relating to positive cognitive factors and the duality of the subscale, it is possible the inclusion of more positive items would have broken up the subscale into multiple, distinct factors.

The Catastrophizing subscale consisted of 14 items, half of which came from the PCS. In spite of the three-factor model not being retained, the subscale was still named "Catastrophizing". This is because each item abides by Sullivan and colleagues' (1995) definition of: an exaggerated mental set to actual or anticipated experiences of pain. All of the items also reflect some component of Sullivan and colleagues' (1995) definition of rumination, magnification, or helplessness. This is also reflected in the represented subscales of the original scales (i.e. Rumination, Magnification, Helplessness, Cognitive Anxiety, Fear of Pain, Concern, and Catastrophizing). Cognitive Anxiety resembles rumination as it was focuses on pervasive, racing thoughts, worry, and impaired concentration (McCracken, Zayfert, & Gross, 1992). Fear of Pain resembles magnification and rumination with its focus on fearful thoughts (i.e. dread) or expectations of negative consequences (e.g. more pain, disability, or damage) (McCracken, Zayfert, & Gross, 1992). The ICQ's and CEQ's definition of helplessness is consistent with the PCS's definition. Concern resembles rumination with an emphasis on fulfilling one's responsibilities and seeking social support (Philips, 1989). The PRSS's Catastrophizing subscale's item content resembles helplessness and the included items in the Catastrophizing subscale all involve poor pain tolerance (Flor, Behle, & Birbaumer 1993).

No single-factor pain catastrophizing measure has gained traction within the literature. Those which do exist (i.e. the PRSS's Catastrophizing subscale) bear strong resemblances to content present within the PCS. Regardless, while the three-factor solution was not supported, the item content of the PCS has been demonstrated to be valid with none of its subscales being superfluous.

The Disability subscale consisted of seven items. No items from the PCS loaded onto this subscale. Its name was derived from its contents focusing on functional disability and dependency on others. Six of its items were derived from the INTPR's Negative Self-Statements subscale. All retained items from the INTPR reflected expressions of functional disability and dependency on others. Eliminated items resembled the PCS's Helplessness subscale and were deemed redundant. The final item was pulled from the ICQ's Helplessness subscale but emphasizes functional disability (i.e. "My pain limits me in everything that is important to me").

Unlike the catastrophizing scale, the Disability subscale taps into an important component of chronic pain not represented by pain catastrophizing. Chronic musculoskeletal pain is one of the leading causes for functional disability and missed workplace hours (IOM, 2011). This loss of motility may create anxiety which drives maladaptive responses to pain (e.g. pain catastrophizing). Examining this scenario under Lazarus and Folkman's (1984) Transactional Model of Stress, the loss of resources created by limited motility results in negative appraisals and consequently, passive coping methods which serve to promote continued disengagement with daily activities.

The Low Self-Efficacy subscale consisted of five items. One item from the PCS loaded onto this subscale. This subscale emphasized a lack of control over one's pain. The PCS' Helplessness subscale, the SSCS' Helplessness subscale, and the PRSS' Catastrophizing subscale were all represented. This subscale shows strong overlap in content with the PCS' conceptualization of helplessness and may represent a subcomponent of catastrophizing. However, in light of our findings, the subscales seem sufficiently discriminant to form a conceptually distinct factor. While most individuals high in pain catastrophizing would be expected to score highly on this subscale as well, at least some individuals may score high in one and low in the other.

The Self-Directed Negative Affect subscale was composed of five items. No items from the PCS loaded onto this subscale. This subscale focused on negative self-directed emotions experienced during pain and the perceived consequences of chronic pain. Three items from the CEQ's Disappointment with Self subscale, one item from the CEQ's Helplessness subscale, and one item the INTPR's Negative Self-Statements subscale all loaded onto the Self-Directed Negative Affect subscale. The items of the CEQ's Disappointment with Self subscale directly map onto the subscales definition (Philips, 1989). Unlike the item on the Catastrophizing subscale, the CEQ Helplessness item which loaded onto the Self-Directed Negative Affect subscale involved situational feelings of disappointment instead of a dispositional character trait. Similarly, the one item from the INTPR's Negative Self-Statements subscale that did not load onto the Disability subscale may have loaded onto this subscale because the item represents situational feelings of worthlessness instead of a dispositional character trait (e.g. "… I won't be able to do anything").

Ultimately, a three-factor model of pain catastrophizing was not supported. Given the broad definition present within the literature, pain catastrophizing is likely unidimensional.

Future Research

Mood and anxiety disorders have been strongly linked to the presence of pain catastrophizing (Leung, 2012). Furthermore, the literature surrounding negative pain schema shows that these constructs are notably convergent with one another (Quartana, et al., 2009). The results of this study support this notion with the discovery of four highly correlated factors. Future research investigating the presence of a latent factor underlying negative schema (e.g. pain and mood constructs) should be done.

Future research should also look into understanding how the type of chronic pain, the intensity of chronic pain, the location of one's pain, the extent of one's musculoskeletal mobility, demographics, and other health-related factors influence the conceptualization of this model. These self-reported factors were not included in the data analysis because they exceeded the scope of the current study which is the creation of a novel pain scale and the development of a better understanding of the dimensionality of pain catastrophizing.

The present study focused on dispositional measures of catastrophizing instead of situational measures (i.e. measures taken right after the admiration of a painful stimulus). Discrepancies between these measurement types have been found in the literature that suggest that situational measurements provide greater accuracy when assessing the amount of pain one is experiencing (Campbell, et al., 2010; Quartana, Campbell, & Edwards, 2009). Replication of this study using situational measures should be done in order to better understand this discrepancy.

Replication of this study with an additional nonchronic group would create a study dichotomy that may be used to confirm whether or not those with chronic pain are more likely to be catastrophizers (i.e. scoring a total of 30 or greater in the PCS).

Limitations

This study had several limitations. A sample size of 459 is not sufficiently large enough for a factor analysis of a 70-item measure (Osborne, 2014). In order for the results to have any merit and for the study to have achieved the gold standard for accuracy, the study must be replicated with a minimum of a 10:1 participant to item ratio and ideally a 20:1 participant to item ratio (Osborne, 2014).

Item selection was done on the basis of convenience through the use of several key search terms being inputted into an online database. This limits the scope of the study to what scales are readily available from specific databases. Furthermore, the lack of a theory-guided approach makes analyses more prone to subjective interpretation and personal bias.

The participant sample was pulled from the MTurk Marketplace. This sample has been found in past research to be more likely to report levels of distress that are uncommon in the general population, as well as, greater rates of substance abuse, depression, trauma, and general anxiety (Shapiro, et al., 2013). These factors confound the data and should be controlled for in future studies.

Chronic pain was broadly defined as pain lasting more than three months and the inclusion criteria reflected this. Chronic pain manifests itself through many unique etiologies and in many unique locations. This heterogeneity complicates interpretation of results. Furthermore, it has resulted in a lack of a standardized diagnostic procedure for chronic pain. Participant recruitment did not involve a diagnosis from a trained medical professional. Altogether, this makes screening for the condition difficult and creates skepticism towards the validity of the anonymously collected data.

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Appendix A

Item Pool

#	Item	Scale and Subscale
1	When I am in pain, I keep thinking about how badly I want the pain to stop.	PCS-Rumination
2	When I am in pain, I anxiously want the pain to go away.	PCS-Rumination
3	When I am in pain, I can't seem to keep it out of my mind.	PCS-Rumination
4	When I am in pain, I keep thinking about how much it hurts.	PCS-Rumination
5	When I am in pain, I wonder whether something serious may happen.	PCS-Magnification
6	When I am in pain, I become afraid that the pain may get worse.	PCS-Magnification
7	When I am in pain, I think of other painful experiences.	PCS-Magnification
8	When I am in pain, I feel I can't go on.	PCS-Helplessness
9	When I am in pain, it's terrible and I think it's never going to get any better.	PCS-Helplessness
10	When I am in pain, I worry all the time about whether the pain will end.	PCS-Helplessness
11	When I am in pain, it's awful and I feel that it overwhelms me.	PCS-Helplessness
12	When I am in pain, I feel I can't stand it anymore.	PCS-Helplessness
13	When I am in pain, there is nothing I can do to reduce the intensity of the pain.	PCS-Helplessness
14	I feel disoriented and confused when I hurt.	PASS-Cognitive Anxiety
15	I am bothered by unwanted thoughts when I'm in pain.	PASS-Cognitive Anxiety
16	My thoughts are agitated and keyed up as pain approaches.	PASS-Cognitive Anxiety
17	I worry when I am in pain.	PASS-Cognitive Anxiety
18	I think that pain is a signal that means I am damaging myself.	PASS-Fear
19	I dread feeling pain.	PASS-Fear
20	When pain comes on strong, I think that I might become paralyzed or totally disabled.	PASS-Fear
21	I think that if my pain gets too severe, it will never decrease.	PASS-Fear
22	I feel that I can not control the pain.	SSCS-Helplessness

23	I feel I cannot endure the pain anymore.	SSCS-Helplessness
24	I feel that the pain will not get better no matter what I do.	SSCS-Helplessness
25	If I think of when I will recover from my pain, I am at a loss.	SSCS-Helplessness
26	I mind even minor changes to bodily sensations.	SSCS-Body Sensations
27	I repeatedly confirm the degree of pain I am experiencing.	SSCS-Body Sensations
28	I think it will become a serious illness someday.	SSCS-Seriousness Concern
29	My pain limits me in everything that is important to me.	ICQ-Helplessness
30	My pain frequently makes me feel helpless.	ICQ-Helplessness
31	My pain makes me feel useless at times.	ICQ-Helplessness
32	My pain controls my life.	ICQ-Helplessness
33	When I stop and think about my pain, it seems to get worse.	CEQ-Desire to Withdraw
34	I am afraid of what people think about my pain.	CEQ-Self-Disappointment
35	I don't want to upset anyone by telling them I am in pain.	CEQ-Self-Disappointment
36	I feel guilty about having pain episodes.	CEQ-Self-Disappointment
37	I am angry with myself for being in pain.	CEQ-Self-Disappointment
38	I am disappointed with myself for having another bout of pain.	CEQ-Self-Disappointment
39	I am thinking, "Why me. Why do I always feel pain?"	CEQ-Helplessness
40	I guess all I can do is wait it out.	CEQ-Helplessness
41	I am worrying about my future plans and commitments.	CEQ-Concern
42	My pain makes me wonder if I'll have to cancel my plans.	CEQ-Concern
43	How am I going to concentrate with this awful pain?	CEQ-Concern
44	It's so hard to work with pain.	CEQ-Concern
45	My pain makes me worried about my family obligations.	CEQ-Concern
46	My pain makes me wish people would be more considerate.	CEQ-Concern
47	My pain makes me feel I need comfort from friends and family.	CEQ-Concern
48	I cannot stand pain.	PRSS-Catastrophizing
49	I cannot change the pain.	PRSS-Catastrophizing
50	I need medication for my pain.	PRSS-Catastrophizing

51	My pain will never stop.	PRSS-Catastrophizing
52	My pain makes me feel like I am a hopeless case.	PRSS-Catastrophizing
53	The pain gets to me.	PRSS-Catastrophizing
54	The pain drives me crazy.	PRSS-Catastrophizing
55	Because of my pain, other people have to do everything for me.	INTRP-Neg. Self-Statements
56	Because of my pain, I can no longer do anything.	INTRP-Neg. Self-Statements
57	My pain makes me think "I am worthless."	INTRP-Neg. Self-Statements
58	Because of my pain, my family has taken over all of my responsibilities.	INTRP-Neg. Self-Statements
59	Because of my pain, I am going to become an invalid.	INTRP-Neg. Self-Statements
60	Because of my pain, I won't be able to do anything for others.	INTRP-Neg. Self-Statements
61	Because of my pain, I will become a burden on my family.	INTRP-Neg. Self-Statements
62	I know if I do anything it will make my pain worse.	INTRP-Neg. Self-Statements
63	I believe I push through my pain.	PRS-Behavioral Perseverance
64	I believe I will accomplish my goals in spite of the pain.	PRS-Behavioral Perseverance
65	I can focus on positive thoughts to manage pain.	PRS-Cognitive/Affective Positivity
66	My pain will not affect my happiness.	PRS-Cognitive/Affective Positivity
67	I will be able to keep a hopeful attitude despite my pain.	PRS-Cognitive/Affective Positivity
68	I will be able to relax even though I am in pain.	PRS-Cognitive/Affective Positivity
69	I can still accomplish most of my goals in life, despite the pain.	PSEQ-2
70	I will live a normal lifestyle, despite the pain.	PSEQ-2

Appendix B

Negative Pain Cognitions Questionnaire

#	Item	Subscale	Original Scale and Subscale
1	When I am in pain, I keep thinking about how badly I want the pain to stop.	Catastrophizing	PCS-Rumination
2	When I am in pain, I anxiously want the pain to go away.	Catastrophizing	PCS-Rumination
3	When I am in pain, I can't seem to keep it out of my mind.	Catastrophizing	PCS-Rumination
6	When I am in pain, I become afraid that the pain may get worse.	Catastrophizing	PCS-Magnification
10	When I am in pain, I worry all the time about whether the pain will end.	Catastrophizing	PCS-Helplessness
11	When I am in pain, it's awful and I feel that it overwhelms me.	Catastrophizing	PCS-Helplessness
12	When I am in pain, I feel I can't stand it anymore.	Catastrophizing	PCS-Helplessness
15	I am bothered by unwanted thoughts when I'm in pain.	Catastrophizing	PASS-Cognitive Anxiety
16	My thoughts are agitated and keyed up as pain approaches.	Catastrophizing	PASS-Cognitive Anxiety
19	I dread feeling pain.	Catastrophizing	PASS-Fear
31	My pain makes me feel useless at times.	Catastrophizing	ICQ-Helplessness
39	I am thinking, "Why me. Why do I always feel pain?"	Catastrophizing	CEQ-Helplessness
43	How am I going to concentrate with this awful pain?	Catastrophizing	CEQ-Concern
54	The pain drives me crazy.	Catastrophizing	PRSS-Catastrophizing
29	My pain limits me in everything that is important to me.	Disability	ICQ-Helplessness
55	Because of my pain, other people have to do everything for me.	Disability	INTRP-Neg. Self-Statements
56	Because of my pain, I can no longer do anything.	Disability	INTRP-Neg. Self-Statements
58	Because of my pain, my family has taken over all of my responsibilities.	Disability	INTRP-Neg. Self-Statements
59	Because of my pain, I am going to become an invalid.	Disability	INTRP-Neg. Self-Statements
60	Because of my pain, I won't be able to do anything for others.	Disability	INTRP-Neg. Self-Statements

61	Because of my pain, I will become a burden on my family.	Disability	INTRP-Neg. Self-Statements
13	When I am in pain, there is nothing I can do to reduce the intensity of the pain.	Low Self-Efficacy	PCS-Helplessness
22	I feel that I cannot control the pain.	Low Self-Efficacy	SSCS-Helplessness
24	I feel that the pain will not get better no matter what I do.	Low Self-Efficacy	SSCS-Helplessness
49	I cannot change the pain.	Low Self-Efficacy	PRSS-Catastrophizing
51	My pain will never stop.	Low Self-Efficacy	PRSS-Catastrophizing
35	I don't want to upset anyone by telling them I am in pain.	Self-Directed Negative Affect	CEQ-Self-Disappointment
36	I feel guilty about having pain episodes.	Self-Directed Negative Affect	CEQ-Self-Disappointment
37	I am angry with myself for being in pain.	Self-Directed Negative Affect	CEQ-Self-Disappointment
38	I am disappointed with myself for having another bout of pain.	Self-Directed Negative Affect	CEQ-Self-Disappointment
57	My pain makes me think "I am worthless."	Self-Directed Negative Affect	INTRP-Neg. Self-Statements

Appendix C

Resilience Subscale

#	Item	Original Scale and Subscale
63	I believe I push through my pain.	PRS-Behavioral Perseverance
64	I believe I will accomplish my goals in spite of the pain.	PRS-Behavioral Perseverance
65	I can focus on positive thoughts to manage pain.	PRS-Cognitive/Affective Positivity
66	My pain will not affect my happiness.	PRS-Cognitive/Affective Positivity
67	I will be able to keep a hopeful attitude despite my pain.	PRS-Cognitive/Affective Positivity
69	I can still accomplish most of my goals in life, despite the pain.	PSEQ-2
70	I will live a normal lifestyle, despite the pain.	PSEQ-2